

Non-Time-Critical Removal Action Engineering Evaluation/Cost Analysis

Upper Granite Creek Watershed Mines, Wallowa-Whitman National Forest, Oregon

Prepared for

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This is a draft document and the information contained herein is subject to change. It should not be relied upon; consult the final document

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Acronyms and Abbreviations

ABA acid-base accounting
ABP acid-base potential

ARAR applicable or relevant and appropriate requirement

ARD acid rock drainage

CERCLA Comprehensive Environmental Response, Compensation, and Liability Act

CES Cascade Earth Sciences

COPCs contaminant of potential concern

cy cubic yards

EA Engineering, Science, and Technology, Inc

EC engineering control

EE/CA engineering evaluation/cost analysis

FS Forest Service Road (prefix)

IC institutional control

LiDAR light detection and ranging mg/kg milligram per kilogram mg/L milligram per liter

NCP National Oil and Hazardous Substances Pollution Contingency Plan

ODEQ Oregon Department of Environmental Quality

ppm parts per million

PRG preliminary removal goal
RAOs removal action objectives

RCRA Resource Conservation Recovery Act

RG removal goal

Site Upper Granite Creek Watershed Mines

SPLP synthetic precipitation leaching procedure

tCaCO3/kt tons of calcium carbonate to neutralize a kiloton of waste

TCLP toxicity characteristic leaching procedure

Terraphase Engineering Inc.
UCL upper confidence limit

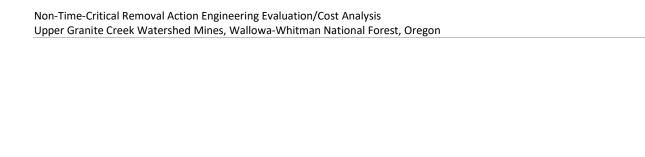
UCLM 95 percent upper confidence limit on the mean

USDA United States Department of Agriculture

USEPA United States Environmental Protection Agency

XRF x-ray fluorescence





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Executive Summary

Terraphase Engineering Inc. (Terraphase) has prepared an engineering evaluation/cost analysis (EE/CA) for the Upper Granite Creek Watershed Mines (the "Site"; Figure 1) in the Wallowa-Whitman National Forest. The Site consists of the following nine abandoned gold mines along Granite Creek between Forest Service Road (FS) 7345 and its headwaters:

- 1. Monumental Mine (divided into Upper-Upper 5. Golden Fraction Mine Monumental Mine, Upper Monumental Mine, 6. Central Mine and Lower Monumental Mine)
- 2. Cap Martin Mine
- 3. Tillicum Mine
- 4. Sheridan Mine

- 7. Granite Creek #5 Mine
- 8. Granite Creek #6 Mine
- 9. Granite Creek #7 Mine

The purpose of the EE/CA is to develop alternatives for the removal action, make comparative analysis between the alternatives (including cost), and recommend a preferred alternative based on the comparative analysis of the alternatives. The goal of the preferred alternative is to minimize or eliminate any release or threat of release of a hazardous substance into the environment or impact on public health and welfare.

Site characterization occurred between 2003 and 2024 and involved collection of soil, sediment, porewater, plant tissue, and surface water samples; the identification of ecological species; wetland delineation; surveying; test pit excavation; mapping; and x-ray fluorescence measurement. Human health and ecological risk assessments were prepared by Cascade Earth Sciences (CES) in 2006 (updated in 2011) based on the sample data, observed Site conditions, and ecological observations. The main driver for risk at the Site is arsenic-contaminated tailings and waste rock piles. The highest contaminant concentrations were detected in samples from Monumental Mine, particularly in tailings piles at the former mill and crusher. Surface water in adit seeps and ponds in proximity to the mines were above ecological screening criteria; however, surface water samples in Granite Creek were generally less than these criteria. Updated preliminary removal goals of 190 and 110 milligrams per kilogram (mg/kg) for arsenic in soil/waste rock and tailings, respectively, were calculated based on conservative assumptions regarding potential exposure of human health receptors at the Site and information obtained through additional sampling and analysis to determine the relative bioavailability of arsenic in these media at the Site. These preliminary removal goals are proposed as removal goals (RGs).

Four removal action alternatives were evaluated for effectiveness, implementability, and cost:

- Alternative 1 No Action: Under this alternative, no remedial action, monitoring, or maintenance would be performed.
- Alternative 2 On-site Containment: Under this alternative, waste rock and tailings above RGs would be graded and covered with clean soil sourced from the Site.
- Alternative 3- Excavation and On-site Disposal: Under this alternative, waste rock and tailings above RGs would be excavated and placed in a repository constructed on Site.



• Alternative 4- Excavation and Off-site Disposal: Under this alternative, waste rock and tailings above RGs would be excavated and hauled to an off-site sanitary landfill.

Taking into consideration the evaluation criteria presented in this EE/CA, the recommended removal action alternative for the Site is a combination of Alternatives 1, 2, 3, and 4. The Site mines, and the features at each mine, have individual attributes such that a single remedy would not be appropriate for the entire Site. The rationale for selecting an alternative for each mine is presented below.

Monumental Mine

The recommended removal action at Monumental Mine is a combination of Alternatives 1, 2, 3, and 4, as described below.

Upper-Upper Monumental Mine

Alternative 1 is recommended for waste rock piles at the Upper-Upper Monumental Mine with 95 percent upper confidence limit (UCL) on the mean (UCLM) below RGs.

Alternative 2 is recommended for waste rock piles with UCLMs above RGs. Piles can be moved using a bulldozer into trenches and covered with local clean borrow material. The cover material would be placed on the partially open shaft to prevent a trespasser or recreator from falling. Access to this area would require minimal road improvement.

Upper Monumental Mine

Alternative 2 is recommended for waste rock pile B. The shaft has sufficient capacity to accept the waste rock pile. Cover material can be supplied from the Upper-Upper Monumental Mine area and the unnamed road adjacent to the pile would require minimal improvement for equipment access.

A combination of Alternatives 2 and 3 is recommended for waste rock pile A. The steep slope of the waste rock pile will not likely allow recontouring of the entire pile without significant grubbing of the surrounding forest. It is recommended that the over-steepened portion of the pile be pushed with a bulldozer downslope to FS 7345 and taken to an on-site repository. Approximately half of the pile could then be spread and contoured to the existing topography. During the removal action, efforts would be made to maximize the volume of soil left in place, graded, and covered, and minimize the volume of soil transported to the on-site repository.

Alternative 4 is recommended for tailings piles A, B, and C. A vacuum truck should be used to remove the fine tailings without disturbing the historical structures and minimize creating dust in this particularly fine material with high arsenic concentration. The contents of the vacuum truck will be transferred to a highway-rated truck with appropriate hazardous waste placards and a lined, covered bin at a staging area near the intersection of FS 7345 and FS 73 for transport to a Subtitle C landfill. After removing tailings to the extent practicable, clean cover soil will be placed in the excavated areas to provide an exposure barrier from remnant tailings. No road improvements would be necessary except a vacuum truck with sufficient hose length could park on FS 7345. Tailings pile C could be accessed from the unnamed access road that transects Lower Monumental Mine.

The wetlands near the tailings piles B and C will be restored following the removal of hazardous substances in accordance with the 1994 United States Environmental Protection Agency guidance document *Considering Wetlands at CERCLA Sites*. If needed, clean organic fill may be imported from off Site for placement in the new wetland system. Wetland plants will be obtained either off Site or from a local borrow area pending United States Department of Agriculture Forest Service approval.

Lower Monumental Mine

Alternative 4 is recommended for tailings pile A. Similar to the Upper Monumental Mine, a vacuum truck could be used to remove the fine tailings without disturbing the historical crusher structure. The contents of the vacuum truck will be transferred to a highway-rated truck with appropriate hazardous waste placards and a lined, covered bin at a staging area near the intersection of FS 7345 and FS 73 for transport to a Subtitle C landfill. Some road improvement would be necessary to allow a vacuum truck to drive on the unnamed road. Removing tailings would help reduce the capacity for this material to leach chemicals of potential concern and migrate to Cap Martin Creek and nearby wetlands.

Alternative 2 is recommended for waste rock piles A and B. The area surrounding the waste rock piles is relatively flat and would support grading. The over-steepened northeastern portion of waste rock pile A could be regraded to the north—northwest, and across tailings pile A to the northeast, taking care not to bury or obscure the historically significant crusher. A portion of waste rock pile A could be placed in the open adit to prevent access to this physical hazard. Waste rock pile B could be placed in the area in front of adit 3 and the rest appropriately graded downslope. Cover material could be sourced from the area to the east of the unnamed access road or to the south of waste rock pile A. Capping the waste rock piles would be protective of human health, cost effective, and less difficult to implement than Alternatives 3 and 4.

Granite Creek Aquatic Station 03

Alternative 1 is recommended for Granite Creek Aquatic Station 03 waste rock pile A due to low arsenic concentrations indicative of background conditions.

Alternative 2 is recommended for Granite Creek Aquatic Station 03 waste rock pile B. Minimal road improvement would be necessary along FS 720 to allow for a bulldozer or excavator to regrade and pull the waste rock pile away from Granite Creek and cover it with material from waste rock pile A or another local cover source. Alternative 2 would be protective of human health, reduce risk to ecological receptors, be cost effective, and relatively easy to implement.

Cap Martin Mine

Alternative 1 is recommended for the Cap Martin Mine. Only waste rock pile C at this mine had a UCLM (243.5 mg/kg) above the arsenic RG of 190 mg/kg. At this waste rock pile, only three of the eight sample locations had concentrations above the arsenic RG (maximum concentration of 365.8 mg/kg). Cap Martin Mine is in a remote area of the Site, with difficult access through small trees and brush by foot and no access by road or trail. It is unlikely that a trespasser or recreator would discover Cap Martin Mine, and even more unlikely that they would spend time in the area of waste rock pile C with elevated



arsenic concentrations. Implementing Alternatives 2, 3, or 4 would necessitate constructing a new road down a steep and densely vegetated portion of national forest. These alternatives would be expensive and provide only marginal benefit for the protection of human health.

Sheridan Mine

Alternative 1 is recommended for the Sheridan Mine. All samples collected at this mine had arsenic concentrations well below the RG. The mine is in a remote portion of the Site and is difficult to access.

Granite Creek #7 Mine

Alternative 1 is recommended for Granite Creek #7 Mine. Of the seven analytical samples collected at this mine, only one exceeded the RG with a concentration of 220 mg/kg. Calculated UCLMs for the waste rock piles were below RGs. The mine is in a remote area of the Site that would be difficult to access.

Granite Creek #6 Mine

Alternative 1 is recommended for Granite Creek #6 Mine. Two samples collected from waste rock pile A exceeded RGs (maximum concentration 504 mg/kg). However, the waste rock pile is relatively small, and the mine is in a remote portion of the Site with difficult access. This mine was difficult to locate with a map and GPS device and offers no historically significant features that trespassers or recreators would be interested in. To implement Alternatives 2, 3, or 4, it would be necessary to construct a new road along Granite Creek that would likely cause unwanted turbidity and undercut the uphill slopes.

Tillicum Mine

Alternative 1 is recommended for Tillicum Mine. Only waste rock pile A had a calculated arsenic UCLM (357.7 mg/kg) above the RG of 190 mg/kg. This pile is downhill from FS 280, between the road and Granite Creek. Human health exposure to the waste rock pile is likely minimal as it would require descending a steep hill from the road. Soil downslope of waste rock pile A had similar arsenic concentrations to the pile, which indicates that erosion of the pile to Granite Creek is ongoing; however, pool and riffle samples collected in 2003 adjacent to the pile did not have measurable arsenic concentrations. The concentration of total arsenic in the 2024 Granite Creek surface water sample collected downstream of Tillicum Mine was slightly less than the upstream sample. These data suggest that even though material from the waste rock pile is eroding into Granite Creek, it is not having a significant effect on downstream water quality. Implementing Alternatives 2, 3, or 4 at Tillicum Mine would require improving approximately 0.75 miles of FS 280, including a portion across privately held land, which would be labor and capital intensive.

Granite Creek #5 Mine

Alternative 1 is recommended for the Granite Creek #5 Mine. The calculated arsenic UCLM for waste rock pile A is 293.2 mg/kg, which exceeds the RG. However, six of the eight x-ray fluorescence measurement or analytical sample locations had arsenic concentrations below the RG. Furthermore, the sample collected downslope of the waste rock pile, between the pile and Granite Creek, had an arsenic concentration less than half of the minimum concentration of waste rock pile A samples. The concentration of total arsenic in the 2024 Granite Creek surface water sample collected downstream of the Granite Creek #5 Mine was slightly less than the upstream sample, suggesting Granite Creek #5 Mine does not significantly contribute to contaminant loading in Granite Creek. Implementing Alternatives 2, 3, or 4 at the Granite Creek #5 Mine would require improving approximately 0.4 miles of FS 280, including a portion across privately held land.

Golden Fraction Mine

Alternative 1 is recommended for Golden Fraction Mine. Waste rock pile A had arsenic concentrations above the RG (calculated UCLM of 332 mg/kg). However, this waste rock pile is located high up a steep hillside from the most likely access point of a trespasser or recreator, and it is unlikely that there is an associated human health risk. This waste rock pile is relatively small and implementation of Alternatives 2, 3, or 4 would require constructing an access road across a very steep hillside, which may not be feasible. In 2011, CES collected a sample from the area of a trench within waste rock pile C that had an arsenic concentration of 1,340 mg/kg. Terraphase measured arsenic concentrations at four locations in this area and collected a sample from the trench and was unable to reproduce this result (maximum concentration 102 mg/kg when not including the CES sample). It is possible that this sample was collected from a different area or it represents an anomalous result unrepresentative of the bulk of the pile. In either case, this waste rock pile does not represent a significant human health risk and does not warrant removal action.

Central Mine

Alternative 2 is recommended for Central Mine waste rock pile A, which had a calculated arsenic UCLM of 239.5 mg/kg, slightly above the RG. This waste rock pile is easily accessible along FS 280, just west of its intersection with FS 280, which has parking at nearby FS 73. Waste rock pile A would be pulled up from the Granite Creek floodplain and placed in the open space at the adit and contoured into the adjacent hillside. Cover material is available downslope of FS 280, though it would need to be tested prior to application. Although there is higher likelihood of trespassers and recreators, no action is needed at waste rock piles B, C, or D as they had calculated UCLMs below the RG.

Recommended Removal Action Summary

The recommended removal action for the Site includes a combination of Alternatives 1, 2, 3, and 4, as summarized above. Combined estimated costs for the recommended removal action are \$1,218,259, as summarized in Table 10.





Introduction

In accordance with United States Department of Agriculture (USDA) Forest Service Contract BPA Call No. 1240BE24A0015/1240BD24F0080, Terraphase Engineering Inc. (Terraphase) has prepared this engineering evaluation/cost analysis (EE/CA) for the nine Upper Granite Creek Watershed Mines (the "Site"; Figure 1) in the Wallowa Whitman National Forest in accordance with:

- Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) cleanup authorities (42 USC § 9604[a] and 7 CFR § 2.60[a][39]) and Federal Executive Order 12580;1
- The provisions of National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 CFR § 300.415(b)(4)(i);² and
- The United States Environmental Protection Agency's (USEPA) Guidance on Conducting Non-Time-Critical Removal Actions under CERCLA (1993).

Cascade Earth Sciences (CES) prepared an EE/CA for the Site in 2011 based on data collected between July 2003 and September 2009 (CES 2011a). This EE/CA updates that report with additional field and laboratory data.

Site Mines 1.1

The Site consists of the following nine abandoned gold mines, most along Granite Creek between Forest Service Road (FS) 7345 and its headwaters, approximately 5 to 8 aerial miles north of Granite, Oregon (Figure 2):

- 1. Monumental Mine (divided into Upper-Upper 5. Golden Fraction Mine Monumental Mine, Upper Monumental Mine, 6. and Lower Monumental Mine)
- 2. Cap Martin Mine
- 3. Tillicum Mine
- 4. Sheridan Mine

- Central Mine
- 7. Granite Creek #5 Mine
- 8. Granite Creek #6 Mine
- 9. Granite Creek #7 Mine

The mines are managed by the USDA Forest Service under CERCLA authorities.

² "Removal action." 40 CFR § 300.415, https://www.ecfr.gov/current/title-40/chapter-I/subchapter-J/part-300/subpart-E/section-300.415.



^{1 &}quot;Response authorities," 42 USC § 9604, https://www.govinfo.gov/content/pkg/USCODE-2023title42/pdf/USCODE-2023-title42-chap103-subchapI-sec9604.pdf.

[&]quot;Chief, Forest Service." 7 CFR § 2.60, https://www.ecfr.gov/current/title-7/subtitle-A/part-2/subpart-J/section-2.60

[&]quot;Superfund implementation," Executive Order 12580, https://www.archives.gov/federalregister/codification/executive-order/12580.html.

1.2 EE/CA Purpose and Organizational Structure

The NCP authorizes and describes two processes for responding to releases: (1) a removal action process, and (2) a remedial action process (see 40 CFR §§ 300.400–300.440). Based on environmental investigations at the Site, USDA Forest Service determined that site conditions warranted additional response to address the release or threatened release of hazardous substances and that a non-time-critical removal action is appropriate at the Site as specified in 40 CFR § 300.415(b). The purpose of the EE/CA is to develop alternatives for the removal action; make comparative analysis between the alternatives, including cost; and recommend a preferred alternative based on the comparative analysis of the alternatives. The goal of the preferred alternative is to minimize or eliminate any release or threat of release of a hazardous substance into the environment or impact on public health and welfare.

The EE/CA evaluates risks that mine-related contamination poses to (primarily) human and (secondarily) ecological health, the extent that remedial action is necessary to mitigate identified risks, and the best course of action to pursue if remedial action is necessary.

This EE/CA report is organized by the following topical headings, which also represent the overall objectives of the EE/CA:

- Characterize the nature and extent of contamination at the Site (Section 2);
- Identify applicable or relevant and appropriate requirements (ARARs; Section 3);
- Develop removal action objectives (RAOs) and removal goals (RGs; Section 4);
- Identify and analyze potential removal action alternatives (Sections 5.1–5.4);
- Conduct a comparative evaluation of the removal action alternatives (Section 5.5); and
- Recommend a removal action alternative (Section 6).

2 Site Characterization

This section describes the local climate, nearest surface water, and regional geology and hydrogeology of the Site and surrounding area; setting, operational history, and previous investigations of the Site; chemicals of potential concern (COPCs); and a summary of the human health and ecological risk assessments.

2.1 Local Climate

The Wallowa-Whitman National Forest has an alpine climate with cool nights and generally sunny days in the summer and early fall. Average minimum and maximum temperatures range from a low of 11 to 31 degrees Fahrenheit in January to a high of 39 to 79 degrees Fahrenheit in July. Average precipitation

³ "Subpart E—Hazardous Substance Response," 40 CFR §§ 300.400–300.440, https://www.ecfr.gov/current/title-40/chapter-l/subchapter-J/part-300#subpart-E.

and snow depth are 24 and 168 inches, respectively. ⁴ There are likely differences in snowpack and temperature with elevation across the Site.

2.2 Surface Water

The Site mines, except Monumental Mine, are located along Granite Creek. Monumental Mine is located at the headwaters of Cap Martin Creek (previously identified as an unnamed tributary), which joins Granite Creek between the Sheridan and Granite Creek #6 and #7 Mines. Granite Creek empties into the North Fork John Day River approximately 13 miles downstream of Central Mine, the furthest downstream of the nine mines. The Granite Creek watershed encompasses 94,480 acres primarily in the boundaries of the Wallowa-Whitman National Forest (40,624 acres) and the Umatilla Nation Forest (49,539 acres), with the remainder held as private land (USDA Forest Service 2016). The runoff-streamflow regime is dominated by spring snowmelt with peaks occurring in May and June and water levels dropping in the summer (USDA Forest Service 2016). Several wetlands are present at and near the Site. Wetland delineation conducted at Monumental Mine as part of the 2011 EE/CA identified wetlands in the areas of the settling ponds, and downstream near Cap Martin Creek (CES 2011b). The wetland delineation report is included as Appendix A.

2.3 Geology and Hydrogeology

The Granite Creek Mines are located within the Elkhorn Mountains area of the Blue Mountains geomorphic province. The lode mines of the Granite Mining District lie along the southwestern edge of the Bald Mountain Batholith, a large granodiorite body with an outcrop area of more than 170 square miles. The principal lode mines occur in a northeast-trending belt of veins and mineralized shear zones about 2 miles wide and 5 miles long (Engineering, Science, and Technology, Inc. [EA] 2004). Within the district, the veins occur primarily in older Argillite of the Elkhorn Ridge Argillite. However, eight of the nine mines target veins within the Bald Mountain Batholith and only one (Central) occurs within the Elkhorn Ridge Argillite.

The Bald Mountain Batholith is of Lower Cretaceous and Upper Jurassic age. It primarily consists of granodiorite and tonalite, with small amounts of norite and quart monzonite (Ferns, Brooks, and Ducette 1982). Dikes and sills of similar compositions occur along the borders of the batholith.

Shallow groundwater at the Site discharges to seeps and springs, which contribute flow to Granite Creek. Shallow groundwater previously encountered at some of the mines likely does not form a laterally continuous aquifer in the study area due to the presence of igneous intrusions and shallow bedrock. Deep, regional groundwater is likely present in cracks and fissures within the intrusive rocks that may discharge along faults or fissures; however, no local study of deeper groundwater has been conducted.

⁴ Measured at the Granite, Oregon, weather station; https://wrcc.dri.edu/cgi-bin/cliMAIN.pl?or3430.



2.4 Mine Descriptions

The following subsections describe each mine, based on summaries provided in the previous EE/CA (CES 2011a) and field observations. All waste rock/tailings volumes and distances are considered approximate and are based on measurements completed in the field and their relationship to LiDAR-derived digital elevation model topographic contours. The mines are described from east to west, upstream to downstream of Granite Creek. The details on the figures associated with the mines are from field observations. During the investigation, features identified in the previous EE/CA were geolocated and the maps were updated accordingly so that the mapped features better represent features visible in the LiDAR imagery and observed in the field. Photographs of the mines are included in Appendix A of the Terraphase *Supplemental Site Investigation Report* (Terraphase 2024), which is included as Appendix B to this EE/CA report.

2.4.1 Monumental Mine

Monumental Mine is situated on moderate to steep hillsides near the headwaters of Cap Martin Creek. The largest of the nine mines, Monumental Mine is approximately 12 acres and is split into the following three areas (Figures 3-5):

- 1. Upper-Upper Monumental Mine
- 2. Upper Monumental Mine
- 3. Lower Monumental Mine

The mine consists of over 4,000 feet of underground workings reaching 700 feet below ground surface (EA 2004). The upper-upper mine area was not previously mapped or investigated.

2.4.1.1 Upper-Upper Monumental Mine

The upper-upper mine area consists of 9 shafts, 3 trenches, and 10 waste rock piles (Figure 3). Shafts 2 and 3 are partially open and present physical hazards to humans and terrestrial wildlife. A total of 500 cubic yards (cy) of waste material is scattered in numerous piles throughout the area, with piles ranging in size from 5 to 395 cy. Features resembling a shaft or trench identified by LiDAR but not observed during the field investigation are shown on Figure 3 as a "potential" shaft or trench.

2.4.1.2 Upper Monumental Mine

Upper Monumental Mine includes several distinct areas:

- The upper shaft area is located just downhill from an unnamed former roadway that connects to FS 7345 and consists of a partially open shaft and an associated 60 cy waste rock pile (WRB; Figure 4).
- The upper adit area has an open adit and associated 7,905 cy waste rock pile (WRA; Figure 4). A
 seep was observed flowing from the adit and infiltrating into the eastern section of the waste rock
 pile.

⁵ https://oceanservice.noaa.gov/facts/lidar.html

• The former mill area includes the remains of a 20-stamp, dry crusher mill, flotation table, chlorination plant, and stone conduit (chlorination flue). Though referenced in previous documents, the location of the former chlorination plant is unknown. A layer of pink-colored concentrations/tailings (TLA, 125 cy; Figure 4) extends 80 feet from the former flotation table to the edge of a steep slope above FS 7345 to the northwest.

A spring which forms the first observable water of Cap Martin Creek discharges below the upper waste rock area. The spring flows across FS 7345 and into a series of settling ponds, all of which are connected by surface water flow. The settling ponds have developed into a small wetland system. Two tailing piles (TLB and TLC, 305 and 10 cy, respectively; Figure 4) are present at and surrounding the settling ponds. A potential trench and waste rock pile are present below the lower settling pond. These features were observed in the field and in LiDAR imagery. X-ray fluorescence (XRF) measurements of these features did not show arsenic concentrations above background and no further evaluation of the potential trench and waste rock pile was conducted.

2.4.1.3 Lower Monumental Mine

Lower Monumental Mine is accessible via an unnamed road that spurs from FS 7345 and contains one open adit, one collapsed adit, two waste rock piles, a former crusher, and tailings associated with the former crusher. The open adit is adjacent to a large waste rock pile (WRA, 5,560 cy; Figure 5). The collapsed adit is adjacent to a smaller waste rock pile, approximately 170 cy (WRB). The crusher and tailings pile (TLA, 180 cy) are adjacent to the north of the WRA waste rock pile. The lower settling pond is south of the open adit. Water was observed seeping from the open adit through a constructed ditch to the lower settling pond. No outlet for the lower settling pond was observed but seeps were observed at the base of the waste rock pile A. A series of parallel cuts in the hillslope are present to the south of waste rock pile A. Collapsed cabins are adjacent to the open adit and downslope from the tailings pile and an intact cabin is present near the waste rock pile B.

2.4.2 Granite Creek Aquatic Station 03

Although not identified as a mine site, CES evaluated and recommended remedial action for waste rock adjacent to its Aquatic Station 03 (Figure 6). Terraphase mapped two waste rock piles in this area (WRA and WRB at 15 and 80 cy, respectively). Both piles are close to Granite Creek. No adits, shafts, or structure were observed in the immediate area of these waste rock piles. These waste rock piles are the furthest upstream features sampled along Granite Creek.

2.4.3 Cap Martin Mine

Cap Martin Mine, approximately 1,500 feet downstream of Granite Creek Aquatic Station 03, consists of six collapsed adits (Figure 7). Mining activity, including evidence of placer mining, occurred on both sides of Granite Creek. Collapsed cabins and one standing cabin are on the north side of Granite Creek. Two waste rock piles associated with adits are south of Granite Creek (WRA and WRB at 370 and 10 cy, respectively) and a single large waste rock pile (WRC, 735 cy) is north of Granite Creek, near the other four adits. Placer spoils were observed near an intermittent stream and along Granite Creek (Figure 7). A small wetland area was observed to the west of the placer spoils.



2.4.4 Sheridan Mine

Sheridan Mine is located 0.25 miles downstream of Cap Martin Mine on moderately steep slopes on the south side of Granite Creek (Figure 8). Mining targeted veinlets with pyrite, chalcopyrite, and tetrahedrite in a series of short adits (Ferns, Brooks, and Ducette 1982). The mine consists of four adits and three waste rock piles (WRA, WRB, and WRC at 65, 30, and 5 cy, respectively). A small wetland was observed to the west of waste rock pile B. Placer deposits are along the southern bank of Granite Creek and adjacent to a tributary west of the mine that flows into Granite Creek from the south. Previous mapping identified a collapsed cabin, though Terraphase was unable to locate this feature.

2.4.5 Granite Creek #6 Mine

Granite Creek #6 Mine is approximately 100 feet northeast of Sheridan Mine on the northeast side of Granite Creek (Figure 9). The mine consists of one open adit with an associated waste rock pile (WRA, 45 cy) and a "wet trench" with a larger pile of material likely generated from the creation of the trench (WTP, 140 cy). The open adit represents a potential physical hazard.

2.4.6 Granite Creek #7 Mine

Granite Creek #7 Mine is approximately 100 feet upstream (north) of Granite Creek #6 Mine on the north side of the confluence between Cap Martin Creek and Granite Creek. The mine consists of two collapsed adits and associated waste rock piles (WRA and WRB at 195 and 125 cy, respectively). There is a trench north of the adits that CES mapped as a "canal" (2011a; Figure 10).

2.4.7 Tillicum Mine

Tillicum Mine, 0.25 miles downstream of the Sheridan Mine on moderately steep slopes along the north bank of Granite Creek, is accessible by FS 280 (Figure 11). Underground workings were over 400 feet accessed from five or more adits across several narrow shear zones targeting small quartz veins (Brooks and others 1982). Two primary veins and associated adits are about 50 feet apart (EA 2004). These were the only adits observed (Figure 11). The upper adit is directly uphill of the lower adit. Waste rock piles are adjacent to both adits (WRB, 145 cy and WRC, 210 cy) and a third waste rock pile is between FS 280 and Granite Creek (WRA, 205 cy). Ruins are present below the upper adit and adjacent to WRC.

2.4.8 Granite Creek #5 Mine

Granite Creek #5 Mine is approximately 0.3 miles downstream of Tillicum Mine (Figure 12). Brooks et al. (1982) mapped a mine as "name unknown" in the approximate location of Granite Creek #5 Mine and stated it targeted a shear zone with small quartz veins. The mine consists of one collapsed adit, a waste rock pile that encompasses the ridges on either side of the adit entrance, a portion of FS 280, an area between FS 280 and Granite Creek (WRA, 285 cy), and a small waste rock pile that appeared distinct to the east of WRA (WRB, 10 cy). EA identified a seep emerging from the hillside approximately 150 feet east of the adit (EA 2004); however, Terraphase did not observe this feature. Based on its location, EA did not think that the seep was associated with the Granite Creek #5 Mine.

2.4.9 Golden Fraction Mine

Golden Fraction Mine is approximately 1,600 feet downstream of Granite Creek #5 Mine (Figure 13). Brooks et al. (1982) mapped a mine as "Eddy Group" in the approximate location of Golden Fraction Mine and stated it had five short adits targeting two parallel shear zones with quartz lenses and pyrite stringers in argillite, metagabbro, and quartz diorite. The mine has three collapsed adits, each with an associated waste rock pile (WRA, WRB, and WRD at 295, 145, and 1,105 cy, respectively) and a trench surrounded by waste rock (WRC, 295 cy). A cabin was previously mapped by EA but Terraphase could not locate it. The mine is accessed by FS 280, and a portion of WRD is over the road. A spring was observed at the lower adit that created a small marshy area uphill of FS 280.

2.4.10 Central Mine

Central Mine is located approximately 800 feet downstream of Golden Fraction Mine to the northwest of where Granite Creek flows under FS Road 73 (Figure 14). It is the only Site mine known to target the Permian Elkhorn Ridge Argillite (unless Golden Fraction Mine is the referenced "Eddy Group Mine"). The mine is described as targeting two parallel shear zones 90 feet apart and consisting of more than 500 feet of workings in three adits (Brooks et al. 1982). However, five collapsed adits, one potential collapsed adit, and four waste rock piles (WRA, WRB, WRC, and WRD at 80, 25, 105, and 25 cy, respectively) were observed during the 2024 Site visit. The mine is accessible from either FS 73 or FS 280, which separates Adit 1 from waste rock pile WRA. A trench was observed running east—west below FS 280.

2.5 Operational History

Mining in the Granite Creek area began as early as the 1860s and continued until World War II when it was curtailed. Monumental Mine was discovered in 1870 and operated until 1928, with at least 11 different claims targeting during this time span (EA 2004). Mining was primarily conducted by following quartz veins within granodiorite of the Cretaceous Bald Mountain Batholith, though the Central Mine targeted shear zones within Permian Elkhorn Ridge Argillite (Brooks et al 1982; Ferns, Brooks, and Ducette 1982). Ore minerals in the Monumental Mine included pyrite, arsenopyrite, sphalerite, galena, and tetrahedrite (Ferns, Brooks, and Ducette 1982). Hand dredging was common before the 1880s when it was replaced by lode mining using large-scale mining equipment and chemical extraction methods. Dredging began again in the 1920s using large-scale dredging equipment (EA 2004).

Initial dredge and placer mining was replaced in the late 1880s, when lode mining became the most profitable form of mining because of the advent of large-scale drilling and crushing equipment and chemical extraction methods to extract the gold from its alloys. Use of fluid amalgamation processes is evident at the Monumental Mine. In the 1920s, dredging for gold in the rivers again became profitable using large-scale dredging equipment (EA 2004). Numerous dredge tailings piles are still visible along these creeks. Hydraulic mining methods involved sluices and sorting the tailings by hand. Rows of hand-piled rocks remain along the shoreline and within Granite Creek at many of the Site mines. Limited historical gold production information for four of the nine named mines is provided below.



- Monumental Mine. Gold was discovered in 1870 by Harvey Robbins, Isaac Nail, and Isaac Klopp and the mine operated intermittently until 1928. Between 1875 and 1906, several new claims were established and several of the original claims were relocated. The mine consisted of two tunnels, two shafts, several raises, and a stoop that daylights to the surface near one of the shafts, all totaling approximately 4,000 feet (EA 2004).
 - In 1875, a ton of the ore, with a value of \$1,500, was shipped to San Francisco to attract investors. With the added capital, a 20-stamp mill was constructed on the mine site. The Monumental Gold and Silver Mining Company operated both the mine and the mill in the late 1880s. In 1902, the mill included a chlorination plant. The total output through 1928 has been estimated at \$100,000 (EA 2004).
- **Cap Martin Mine.** Gold was discovered by Cap Martin. The mine consisted of three adits totaling approximately 300 feet (Ferns, Brooks, and Ducette 1982).
- **Tillicum Mine.** Gold production was reported to be minimal, and development occurred in approximately 400 feet of five or more adits, two of which were the primary adits (Brooks et al. 1982; EA 2004)
- **Central Mine.** It is not known when the mine was established but production was reported to be very minimal, and development consisted of approximately 500 feet in three adits (Brooks et al. 1982).

2.6 Previous Investigations

Previous site assessment and risk evaluations performed for the Site are summarized in the following subsections.

2.6.1 Environmental Impact Statement - 2002

In 2002, the USDA Forest Service completed a *Draft Environmental Impact Statement, Granite Area Mining Projects*, which included the Upper Granite Creek Watershed. The report noted that the Columbia River bull trout and Mid-Columbia steelhead had been observed in the Granite Creek Watershed and were listed as threatened under the Federal Endangered Species Act. In addition, several of the streams within the watershed were on the state of Oregon 303(d) list of impaired waters, as described by the Clean Water Act.⁶

The USDA Forest Service also conducted *Abbreviated Preliminary Assessments* on both Monumental and Tillicum Mines using an XRF device to field analyze samples to determine whether the potential existed for a release of hazardous contaminants to the environment (2003a, 2003b). Summaries of these abbreviated preliminary assessments are provided below as presented in the EA's 2004 *Site Inspection* report.

⁶ https://www.epa.gov/tmdl

- **Monumental Mine.** Three samples from the waste rock piles and two from the tailings ponds were analyzed. The results indicated that arsenic, lead, and mercury exceeded USEPA Region 9 preliminary removal goals (PRGs).
- **Tillicum Mine.** One waste rock sample was collected and analyzed; results exceeded USEPA Region 9 PRGs for arsenic and lead.

2.6.2 Site Inspection - 2004

In 2003, EA conducted a site inspection at the Monumental, Cap Martin, Sheridan, Tillicum, and Central Mines to determine if waste material posed an immediate or potential threat to human health and the environment, and to collect data to assess the necessity of further action. Tasks performed during the inspection included background research and file review, on- and off-site reconnaissance, and collection and analysis of soil, waste rock, surface water, pore water, sediment, plant tissue, and benthic macroinvertebrate samples (EA 2004). Results of the site inspection indicated the following:

- Metals from the Site were not notably impacting surface water, pore water, or sediments in Granite Creek.
- Lead, manganese, arsenic, and selenium were detected at levels above the comparison criteria in surface water samples collected from the seeps and upper settling pond at Monumental Mine.
- There did not appear to be significant benthic habitat impairment or decreased benthic macroinvertebrate diversity and abundance along Granite Creek.
- Arsenic was identified above screening levels and background concentrations at the five mines
 evaluated. Antimony, cadmium, lead, mercury, silver, and zinc were detected above screening levels
 and background concentrations in samples from at least one mine.
- Bull trout (Salvelinus confluents), listed as threatened under the Endangered Species Act, were observed in small numbers throughout the study area. Two small trout (either west slope cutthroat or redband trout) were observed at locations along Granite Creek. Both species are federally listed as "species of concern" and identified as vulnerable by the Oregon Fish and Wildlife Commission.

EA recommended the completion of an EE/CA based on the results of the site inspection. Sample locations from the site inspection are included on Figures 3 through 14.

2.6.3 Risk Assessment - 2006

CES prepared a *Human Health and Ecological Risk Assessment* (Risk Assessment) in 2006 for the five mines assessed during the site investigation (Monumental, Cap Martin, Tillicum, Sheridan, and Central Mines). The following potential risks were described.

Human Health Risks:

- Current and future potential receptors were identified as hunters, hikers, and campers.
- Arsenic and lead were identified as the soil/waste rock, sediment, and surface water noncarcinogenic COPCs.



- No unacceptable non-carcinogenic health effects were anticipated under both the central tendency exposure and reasonable maximum exposure conditions.
- Arsenic was the only carcinogenic COPC identified at the mines.
- Carcinogenic risks were predicted from exposure to arsenic-impacted surface water and soil/waste rock under both the central tendency and the reasonable maximum exposure conditions at each of the mines.
- The Monumental Mine had the highest arsenic concentrations and represented the highest level of human health risk.
- No carcinogenic risks were predicted from exposure to sediment.

Ecological Risks:

- Ecological impacts were predicted for immobile species, primarily plants and terrestrial invertebrates, due to COPCs in soil and waste rock.
- Ecological impacts were also predicted for aquatic life and wildlife exposed to COPCs in surface water and pore water. However, the lack of background data in 2006 made it more difficult to predict the potential for impacts.
- Benthic invertebrates and wildlife appeared to have the potential to be impacted by total arsenic, cadmium, and zinc, which were present at elevated concentrations at nearly all sediment sample locations.
- The Monumental and Tillicum Mines had more locations with elevated COPC concentrations in soil/waste rock than the other mines and therefore represent the highest level of ecological risk.
- Ecological "hot spots" are generally defined as concentrations greater than 10 times the ecological risk-based screening concentration. Multiple ecological hot spots were identified at each mine.

A cleanup concentration of 143 milligrams/kilogram (mg/kg) for arsenic was calculated as part of the risk assessment. CES recommended an EE/CA be prepared, and a data gap investigation be conducted. Following the 2006 risk assessment, the USDA Forest Service added four additional mines to the Site (GC-5, GC-6, GC-7, and the Golden Fraction Mine).

2.6.4 Additional Abbreviated Preliminary Assessments - 2006

In August 2006, the USDA Forest Service conducted abbreviated preliminary assessments on the Golden Fraction, Central, Cap Martin, Granite Creek #5, Granite Creek #6, and Granite Creek #7 Mines (USDA Forest Service 2006a–2006f). The assessments included the collection of in situ soil samples using an XRF device; cataloging mine features, location, and access; and recommendations for further action. The Upper Central and Granite Creek #6 Mines were ranked low priority for further assessment (USDA Forest Service 2006b, 2006e). The Golden Fraction, Cap Martin, Granite Creek #5, and Granite Creek #7 Mines were ranked as high priority for further assessment (USDA Forest Service 2006a, 2006c, 2006d, 2006f).

2.6.5 EE/CA Data Gap Investigation - 2007

In June 2007, CES conducted a data gap investigation to fill the data gaps identified in its 2006 risk assessment. The objective of the investigation was to:

- Verify previously identified hazardous substances, mining features, and waste volumes at the Central, Sheridan, Tillicum, Cap Martin, and Monumental Mines;
- Inspect the new mines (Granite Creek #5, Granite Creek #6, Granite Creek #7, and the Golden Fraction Mines) and collect waste rock, soil, and water samples;
- Collect three background sediment, surface water, and pore water samples from Granite Creek, and four streambank/floodplain sediment samples;
- Collect background soil samples within the upper Granite Creek Watershed;
- Assess each mine for alternatives for the EE/CA (i.e., access, repository locations, etc.); and
- Develop human health and ecological risk assessment updates based on the new data collected.

2.6.6 Supplemental Data Gap Investigation at the Monumental Mine - 2009

In September 2009, CES completed an additional data gap investigation at Monumental Mine, which included the following activities:

- Adit and spring sampling to characterize the quality and flow rate for potential water diversion during and after the removal action;
- Additional topographic survey of waste rock piles, tailings, and pertinent features for accurate volume estimation;
- Detailed field screening of waste rock and tailings with an XRF to guide additional sampling and analysis activities;
- Collection of waste rock and tailings samples for laboratory analysis for total metals, synthetic
 precipitation leaching procedure (SPLP), and toxicity characteristic leaching procedure (TCLP)
 metals; and
- A wetland delineation of the upper and middle settling ponds for possible mitigation activities.

2.6.7 Wetland Delineation Report - 2011

The results of the 2009 wetland delineation were described in CES' 2011 Wetland Delineation Report. The report describes the delineation of one approximately 0.08-acre wetland at the Monumental Mine. Proposed remedial activity would potentially include the removal of tailings within the wetland and potential destruction of a 0.04-acre portion of the wetland. CES recommended that this potential wetland destruction be mitigated by restoration or creation of 0.04 to 0.06 acres of wetland to compensate for potential wetland removal. The wetland delineation was included as Appendix B to CES' 2011 EE/CA and is included as Appendix A to this report.



2.6.8 Human Health and Ecological Risk Assessment - 2011

CES conducted an update of its 2006 risk assessment to include additional data collected at the original five mines and data from Golden Fraction Mine and Granite Creek #5 through 7 Mines (CES 2011c). The 2011 risk assessment had similar conclusions to the 2006 assessment—notably that arsenic was the only COPC with human-health risk for ingestion and dermal contact above the standard of 1x10⁻⁶, and that arsenic, cadmium, and zinc had elevated concentrations in sediments that could be indicative of minerelated impact to ecological receptors. The 2011 risk assessment report was included as Appendix C to CES' 2011 EE/CA and is included as Appendix C to this report.

2.6.9 Non-Time-Critical Removal Action EE/CA - 2011

In 2011, CES prepared an EE/CA for completing a non-time-critical removal action related to hazardous substances at the Site. The EE/CA presented alternatives, made comparative analysis between the alternatives, and recommended a preferred alternative based upon the comparative analysis of the alternatives with the goal of "minimizing or eliminate any release or threat of release of a hazardous substance into the environment or impact on public health and welfare." The proposed removal action aimed to achieve cleanup of site-related hazardous substances to acceptable levels of risk to humans and the environment.

Four alternatives were evaluated and compared as potential removal actions:

- Alternative 1: No Action (\$0)
- Alternative 2: On-site Containment (\$499,000)
- Alternative 3: Excavation and On-site Containment/Disposal in Repository (\$903,000)
- Alternative 4: Excavation and Off-site Disposal (\$6,155,000)

A combination of Alternatives 1, 2, and 3 were recommended by CES as the most appropriate, effective, and cost-effective alternatives. The total cost to implement this recommended blended alternative was \$691,000. Most of the cost was related to removal action at Monumental Mine.

On-site waste rock contouring with the surrounding terrain, covering with unimpacted soil, and revegetation was recommended for the Golden Fraction (Middle)/Central Mines and Upper Granite Creek Near Station GC-03 due to elevated arsenic concentrations approaching or exceeding the calculated cleanup level, and accessibility of the Central Mine to the public.

No action was recommended for the Golden Fraction, Cap Martin, Sheridan, Tillicum, Granite Creek #5, Granite Creek #6, and Granite Creek #7 Mines due to concentrations of arsenic in waste rock piles at or well below the cleanup level, and limited access to the public.

2.6.10 Supplemental Sampling Investigation - 2024

In October 2024, Terraphase collected additional XRF and analytical data, as described in the *Supplemental Site Investigation Report* provided as Appendix B. Each mine feature was mapped (Figures 3 through 14) as part of the investigation. Waste rock pile volumes were recalculated based on updated mapping using a LiDAR-derived digital elevation model. PRGs of 190 and 110 mg/kg for waste rock and

tailings, respectively, were calculated for arsenic based on an updated human health risk calculation using the results of in-vitro bioavailability sampling. Ninety-five percent upper confidence limits (UCLs) on the mean (UCLMs) were calculated for each waste rock and tailings pile. Figures 3 through 14 shade each waste rock pile based on a comparison between calculated UCLMs and the updated arsenic PRG.

2.6.11 Previous Cleanup Response Actions

To date there have been no actions to control or treat site-related contaminants. The 2011 EE/CA was never formally accepted.

2.7 Chemicals of Potential Concern

Based on the environmental investigations conducted to date, COPCs for the Site are the metals antimony, arsenic, barium, cadmium, chromium, copper, iron, lead, manganese, mercury, selenium, silver, thallium, vanadium, and zinc. These metals exceed one or more screening criteria in at least one medium (soil, sediment, surface water; Tables 1 through 3). Arsenic is considered the main driver for human health risk (Section 2.8), and the primary COPC for the Site. The presence of metals above screening criteria is either due to naturally elevated background concentrations or the concentration of these metals during processing of mine-related waste rock and tailings. Background soil samples collected during investigations in 2003 and 2007 indicated concentrations of arsenic, barium, cadmium, chromium, copper, manganese, mercury, nickel, selenium, thallium, vanadium, and zinc above one or more screening criteria. Regional background concentrations for antimony, arsenic, barium, beryllium, cadmium, chromium, copper, lead, manganese, mercury, nickel, selenium, vanadium, and zinc also exceed one or more screening criteria (Oregon Department of Environmental Quality [ODEQ] 2019). The following subsections provide a description of the extent and potential transport mechanisms of COPCs in soil, sediment, surface water, pore water, groundwater, and air at the Site.

2.7.1 Soil

COPCs are present in soil above site-specific and regional background concentrations in waste rock piles, tailings piles, and in soil adjacent to the piles. COPCs that exceed local and regional background concentrations in one or more sample at each Site mine are as follows (Table 1):

- Monumental Mine: antimony, arsenic, cadmium, copper, lead, mercury, selenium, silver, and zinc
- Cap Martin Mine: antimony, arsenic, cadmium, lead, silver, and zinc
- Sheridan Mine: antimony, arsenic, and silver
- Granite Creek #6 Mine: arsenic
- Granite Creek #7 Mine: antimony, arsenic, cadmium, and silver
- Tillicum Mine: antimony, arsenic, cadmium, lead, selenium, silver, and zinc
- Granite Creek # 5 Mine: antimony, arsenic, cadmium, lead, silver, and zinc
- Golden Fraction Mine: antimony, arsenic, cadmium, lead, selenium, silver, and zinc
- Central Mine: antimony, arsenic, cadmium, lead, selenium, silver, and zinc



The highest concentrations of COPCs are in Monumental Mine waste rock and tailings piles. The highest detected concentration of arsenic (excluding XRF measurements) was 14,000 mg/kg in a sample from Upper Monumental Mine waste rock pile B, which is several orders of magnitude higher than the highest local background arsenic concentration (43.5 mg/kg).

Soil can be transported by erosion of the waste rock and tailings piles by precipitation or wind. Incidental transport can also occur by erosion caused by animals walking along the piles and by uprooting soil by the root systems of falling trees. Erosion is likely most pronounced via surface water runoff in periods of high precipitation and snowmelt. However, samples collected immediately downslope of waste rock piles in native soil generally had much lower arsenic concentrations than the associated waste rock pile. Samples collected by Terraphase, labeled "-DS," were collected within 10 feet of the edge of a waste rock pile with the same sample nomenclature. For example, sample UMM-WRA-1-DS (arsenic concentration 37.5 mg/kg) was collected within 10 feet of Upper Monumental Mine waste rock pile A, close to sample UMM-WRA-1 (arsenic concentration 1,300 mg/kg). This suggests that surficial erosion of the piles is relatively minor and that the piles are stable.⁷

COPCs can also leach from soil and enter shallow groundwater or surface water. Acid-base accounting (ABA) was analyzed on 28 waste rock, tailings, and soil samples. The acid-base potential (ABP) is the result of the acid neutralizing potential minus the acid generating potential. A negative ABP indicates that the acid generating potential is greater than the acid neutralizing potential; thus, the material has the potential to produce acid rock drainage (ARD). ABP's ranged from -20 (Lower Monumental Mine crusher) to 98 (Upper Monumental Mine waste rock pile) tons of calcium carbonate to neutralize a kiloton of waste (tCaCO3/Kt). Generally, ABP values below -20 tCaCO3/Kt indicate a strong potential for ARD and values above +20 tCaCO3/Kt indicate that material is unlikely to form ARD. Most of the sample results were between -20 and 20 tCaCO3/Kt, which indicates an uncertain result. The most negative ABP, and therefore the most likely sample to produce ARD, was collected at the Lower Monumental Mine tailings pile A, near the former crusher. Other samples collected from tailings piles also had negative ABP values. Samples collected from the Upper and Lower Monumental Mine tailings piles had the lowest pH (3.1–4.6), which is consistent with a higher propensity for ARD.

Thirty waste rock, tailings, and soil samples were submitted for TCLP and SPLP analyses for the eight Resource Conservation Recovery Act regulated constituents (arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver). There are no applicable standards for SPLP; however, the results can be compared to Resource Conservation Recovery Act TCLP disposal limits. No waste rock samples had TCLP or SPLP extracts exceeding the TCLP limits. However, samples collected from Upper Monumental Mine tailings pile A had TCLP and SPLP arsenic results with concentrations of 15.6 and 9.4 milligrams per liter (mg/L), respectively, and a sample collected from Upper Monumental Mine tailings pile B contained a

⁷ One notable exception is at Tillicum Mine's waste rock pile A (Figure 11), which is on a steep slope close to Granite Creek. The arsenic UCLM based on XRF measurements at sample location TL-WRA-1 was 175.2 parts per million (ppm; duplicate measurement UCLM for this sample was 182.5 ppm). Samples collected downslope of this sample location, closer to Granite Creek, had XRF-derived arsenic UCLMs of 185.7 (sample location TL-WRA-1-DS) and 187.2 (sample location TL-WRA-1-DS-2) ppm. Laboratory analytical arsenic concentration from sample location TL-WRA-1-DS-2 was 267 mg/kg, which is higher than the associated waste rock sample. The difference for this waste rock pile is likely the proximity to Granite Creek.

TCLP arsenic result at a concentration of 8.5 mg/L. The USEPA TCLP regulatory threshold for arsenic is 5.0 mg/L. The exceedances of TCLP thresholds for tailings but not waste rock are consistent with the ABA results, suggesting that tailings are more likely to contribute contaminant loading to surface water than waste rock.

2.7.2 Sediment

Contribution of COPCs from the Site in Granite Creek sediment were evaluated relative to sediment samples collected upstream (Table 2). Arsenic, lead, silver, and zinc concentrations increase from upstream to downstream sediment sample locations, which shows the cumulative effect of the Site mines. However, sediment COPC concentrations are much less than soil COPC concentrations. The highest sediment sample arsenic concentration collected by CES from Granite Creek upstream of the confluence with Lucas Gulch was 127 mg/kg. The highest arsenic concentration in sediment samples collected by Terraphase was 35.2 mg/kg in the furthest downstream sample. Samples collected from Lucas Gulch had arsenic concentrations up to 303 mg/kg; however, these concentrations reflect contribution from other sources (East Eddie group and Ajax Magnolia Mine Complex). A UCLM for arsenic of 27.1 mg/kg was calculated for Granite Creek sediment samples upstream of Lucas Gulch after removing the 127 mg/kg outlier. This value is similar to background soil arsenic concentrations.

Sediment with elevated COPCs is derived from down-slope erosion of waste rock piles and tailings from the Site mines. Once deposited as sediment, COPCs migrate with flowing surface water. Deposition of sediment is expected in areas protected by rocks and trees, and in sand bars and other stream depositional features in areas of lower velocity water. The low concentrations of arsenic in sediment supports the lack of significant erosion from and stability of the waste rock piles.

2.7.3 Surface Water

Similar to sediment, COPCs in surface water generally increase with distance from upstream to downstream of the Site (Table 3). Concentrations of antimony, arsenic, lead, and zinc are higher in downstream samples relative to upstream samples. However, nearly all Granite Creek surface water sample concentrations were below the most conservative screening levels. Samples collected from Lucas Gulch, further downstream from the Site, had detections of mercury above screening levels, though this is due to the contribution of other sources. Surface water quality is likely worse during high precipitation events and snowmelt, as these conditions would be expected to increase turbidity and COPCs within suspended solids.

Surface water samples have also been collected from adit seeps, springs, and ponds. Samples were collected at Monumental Mine (springs, adit seeps, settling ponds), Granite Creek #5 Mine (seep/spring), Golden Fraction Mine (adit seep), and Cap Martin Mine (adit seep). Table 3 summarizes the data and highlights concentrations exceeding ecological screening criteria. Concentrations of arsenic in surface water from these samples are between one and three orders of magnitude higher than concentrations in the furthest upstream Granite Creek samples. Samples from surface water features at Upper and Lower Monumental Mines have the highest COPC concentrations. The surface water bodies present in these areas drain through Cap Martin Gulch and enter Granite Creek between Sheridan and Granite Creek #6/#7 Mines. Arsenic concentrations in Granite Creek surface water have the largest



increase between samples upstream and downstream of the confluence of Cap Martin Creek and Granite Creek. This suggests that the highest contribution of contaminant loading to surface water is from Monumental Mine and the adit seeps and springs that flow across Monumental Mine waste rock piles and tailings. However, as discussed above, detections of COPCs in surface water samples within Granite Creek itself have been generally below ecological screening levels, suggesting that the relative contribution of flow from mine-related springs and seeps is not significant.

2.7.4 Groundwater

Shallow groundwater at the Site would be expected to discharge to Granite Creek via springs and seeps, and COPCs in groundwater would therefore be expected to be accounted for in surface water data. No drinking water wells are present at the Site. The closest well is more than 4 miles away in the town of Granite, Oregon, and is several hundred feet deep (CES 2011a). The drinking water pathway is considered incomplete, and the lack of groundwater data is not considered significant for the purposes of the EE/CA.

2.7.5 Air

No air samples were collected as part of environmental investigations at the Site. COPCs could be present in dust from waste rock piles and tailings, particularly if disturbed by humans or animals. However, no visible dust was observed during site investigation activities, and remedial action addressing COPCs in soil would address COPCs in dust; therefore, the lack of COPC data in air is not considered significant for the purposes of the EE/CA.

2.8 Risk Evaluation

As discussed in Section 2.7, human health and ecological risk assessments were completed for the Site in 2006 and updated in 2011 (CES 2006, 2011c). The 2011 risk assessment is included as Appendix C. The following subsections summarize the results of the risk assessment.

2.8.1 Human Health

The following human health exposure pathways were identified for the Site:

- Dermal contact of soil/waste rock
- Incidental ingestion of soil/waste rock
- Inhalation of soil/waste rock (dust)
- Dermal contact with sediment
- Incidental ingestion of sediment
- Dermal contact with surface water
- Incidental ingestion of surface water

These pathways were considered complete for hikers, campers, and hunters—the recreator or trespasser receptors (CES 2011c).

CES compared media-specific cumulative cancer risks and hazard indices to a cumulative cancer risk of 1×10^{-6} and noncancer HI of 1, respectively, to help determine whether remedial action is warranted for a particular media at a particular area of the Site. These risk management goals are equivalent to those used by ODEQ for risk assessment decision making (ODEQ 2020).

CES estimated that potential receptor exposure to arsenic in soil at the Site could result in noncancer hazard indices greater than 1. Similarly, CES estimated that potential receptor exposure to arsenic in soil at the Site could result in cumulative cancer risk greater than 1×10^{-6} .

CES conducted a hot spot evaluation and determined that no hot spots were present at the Site with consideration for human health exposure. Hot spots were identified by CES as those locations exhibiting cumulative cancer risks greater than 1x10⁻⁴ in accordance with ODEQ guidance (2010). Arsenic concentrations in soil greater than 14,330 mg/kg would result in cancer risk estimates greater than this threshold. Since the 2011 risk assessment update, Terraphase measured arsenic concentrations using XRF that exceeded this threshold at Monumental Mine (Appendix B, Table 1).

CES calculated a PRG for arsenic of 143 mg/kg. Terraphase developed updated PRGs in the 2024 *Sampling and Analysis Plan* for antimony, arsenic, beryllium, cadmium, cobalt, copper, mercury, nickel, selenium, silver, and vanadium (Table 1). Only arsenic concentrations exceeded Terraphase PRGs. Using relative bioavailability data generated via the 2024 sampling, Terraphase recalculated arsenic PRGs of 190 and 110 mg/kg for soil/waste rock and tailings, respectively (Appendix B).

2.8.2 Ecological

Ecological receptors at the Site include birds, mammals, plants, amphibians, reptiles, and invertebrates that inhabit upland terrestrial areas, the on-site wetland areas, and within or adjacent to Granite Creek and its tributaries. Cap Martin Creek supports a native population of redband trout. Middle Columbia River Steelhead have summer spawning and rearing habitat near the confluence of Granite Creek and Cap Martin Creek, and Bull Trout have been observed in Granite Creek as far upstream as the Cap Martin Mine (CES 2011a).

Plants roots may absorb contaminants from upland or wetland soil or surface water. Animals may be exposed to contaminants in shallow (surface) soils and surface water via direct contact and incidental or intentional ingestion. Animals may also consume mercury and lead that readily accumulate in the tissues of plants and animals.

COPCs with unacceptable risk ratios for ecological receptors included antimony, arsenic, iron, lead, manganese, mercury, silver, vanadium, and zinc for soil/waste rock; arsenic, cadmium, selenium, and zinc for sediment; and barium for surface water/pore water. Additional COPCs were retained for risk evaluation due to bioaccumulation potential, a lack of screening criteria to calculate risk ratios, or elevated reporting limits.

Based on COPCs with concentrations greater than 10 times the screening criteria or background concentrations, CES identified ecological hot spots in soil/waste rock at Monumental Mine, Cap Martin Mine, Golden Fraction Mine, Tillicum Mine, Granite Creek #7 Mine, and Granite Creek Aquatic Station 03; in surface water at Monumental Mine springs and settling ponds; at the Cap Martin Mine adit seep;



in Granite Creek water samples collected near the Sheridan, Tillicum, Central, and Cap Martin Mines; and in Granite Creek porewater near the Tillicum and Central Mines.

Predicted risk from soil/waste rock to ecological receptors were primarily due to arsenic but antimony, lead, mercury, silver, and zinc also contributed to total risk. Plants, immobile invertebrates, and individual birds or small mammals living on or adjacent to waste rock piles were considered at risk; however, population level impacts were not expected considering the relatively small footprint of waste rock piles compared to the home-ranges of identified species.

No PRGs were calculated based on ecological risk; however, remedial action taken to reduce human health risk will also reduce ecological risk.

3 Potential Applicable or Relevant and Appropriate Requirements

ARARs include standards, requirements, criteria, or limitations under federal or more stringent state environmental law (CERCLA § 121(d)(2)(A)) that should be considered at the Site. To be adopted as an ARAR, the requirement is either "applicable" to conditions at the Site or if not applicable the requirement is both "relevant" and "appropriate" based on Site conditions. Applicable requirements are defined by 40 CFR § 300.5 as those requirements "that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance found at a CERCLA site." That is, they are laws and regulations that would be enforceable at a particular site even if a CERCLA response action was not occurring. Relevant and appropriate requirements are defined as those requirements "that, while not 'applicable' to a hazardous substance, pollutant, contaminant, remedial action location, or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site that their uses are well suited to the particular site." In addition to being applicable or relevant and appropriate, ARARs must be substantive, rather than administrative, and promulgated. It is necessary to identify ARARs prior to evaluating and selecting a cleanup action since circumstances may arise where non-time-critical removal action is expected to be the first and final action at the Site and therefore, the selected removal action must satisfy all adopted ARARs.

ARARs are classified into the three following categories:

- **Chemical-specific** ARARs that address specific hazardous substances and are typically health or risk-based numerical values that cleanups must achieve.
- **Location-specific** ARARs that place restrictions on the concentration of hazardous substances or the conduct of activities solely because the response actions occur in the specific location.

⁸ https://www.epa.gov/superfund/applicable-or-relevant-and-appropriate-requirements-arars

⁹ "Definitions." 40 CFR § 300.5, https://www.ecfr.gov/current/title-40/chapter-I/subchapter-J/part-300/subpart-A/section-300.5.

• **Action-specific** ARARs are typically technology or activity-based requirements or limitations on actions taken with respect to specific hazardous substances.

Other factors "to be considered" are non-promulgated criteria, advisories, guidance, and proposed standards issued by federal or state governments. These factors are not enforceable and a response action is not required to attain them; however, these factors may be appropriate in shaping or guiding the development or implementation of a response action in certain circumstances; for example, where ARARs do not provide sufficient direction.

Tables 4 through 6 evaluate ARARs for applicability to the Site. Potential ARARs are grouped as federal or state of Oregon potential ARARs; no specific local potential ARARs were identified. Potential ARARs are identified by a statutory or regulatory citation, followed by a brief explanation of the potential ARAR, and whether the potential ARAR is (1) "potentially applicable," (2) "potentially relevant and appropriate," or (3) "to be considered." In accordance with § 121(e) of CERCLA, no permits are required for an on-site removal action. However, as discussed above, substantive requirements, which a permit might otherwise address, must be met to the extent practicable. Key ARARs are discussed below.

3.1.1 Chemical-Specific ARARs

ODEQ allows for the calculation of risk-based cleanup levels for human and ecological receptors. As discussed in Section 2.9, human health PRGs were calculated for the Site. However, although ecological risk assessments were completed, no ecological cleanup levels have been calculated, therefore the following ARARs are considered for the evaluation of ecological risk:

- National recommended water quality criteria (Section 304(a) of the Clean Water Act [33 USC § 1314])¹⁰
- Oregon water quality standards (OAR 340-41, Table 20)¹¹
- Federal freshwater sediment standards, threshold effects level and probably effects level, as outlined in the National Oceanic and Atmospheric Administration 2008 Screening Quick Reference Tables¹²

3.1.2 Action-Specific ARARs-

The solid waste disposal ARARs establish the performance standards for proper handling and disposal of solid waste; outline responsibilities of various entities and stakeholders; and outline requirements for solid waste handling facility location, design, construction, operation, and closure. All substantive requirements for closure and post-closure of non-municipal landfills (OAR 340-95) are potential ARARs,

¹² https://repository.library.noaa.gov/view/noaa/9327



¹⁰ "Information and guidelines," 33 USC § 1314, https://uscode.house.gov/USC-prelim-title33-section1314.

¹¹ "Water Quality Standards: Beneficial Uses, Policies, and Criteria for Oregon," OAR 340-41, https://secure.sos.state.or.us/oard/340-41.

particularly if a repository is constructed. 13 Additional requirements would be triggered if the repository were to store hazardous waste (ORS 466). 14 Hazardous waste transportation requirements are also potential ARARs.

3.1.3 Location-Specific ARARs

Portions of the Northwest Forest Plan are potentially key ARARs for assessing Site removal action alternatives. ¹⁵ The Northwest Forest Plan includes standards and guidelines that are potentially relevant and appropriate to actions at the Site, including activities within or that affect riparian management areas. These standards and guidelines control the design, construction, and use of temporary and permanent roads and other modifications within riparian reserves. In addition, the standards control solid waste and mine waste facilities within riparian reserves.

The following ecological ARARs are considered key in planning and executing the removal action:

- Endangered Species Act of 1973 (16 USC §§ 1531(h)-1543)¹⁶
- Section 404 of the Clean Water Act (33 CFR 330) and Executive Order Number 11990 Protection of Wetlands (40 CFR § 6.302(a) and Appendix A)¹⁷
- Executive Order Number 119988 Floodplain Management (40 CFR § 6.302(g) and Appendix A)
- Oregon Wildlife Diversity Program and Plant Protection (OAR 635- 100)¹⁸

Key potential historic and cultural ARARs, which may be applicable during removal action, at and around historic mine infrastructure are:

- National Historic Preservation Act (16 USC § 470)¹⁹
- Historic Site, Buildings, Objects, and Antiquities Act (16 USC §§ 461-467)²⁰

¹³ "Solid Waste: Land Disposal Sites Other Than Municipal Solid Waste Landfills," OAR 340-95, https://secure.sos.state.or.us/oard/340-95.

¹⁴ "Chapter 466—Hazardous Waste and Hazardous Materials II," OAR 466, https://www.oregonlegislature.gov/bills_laws/ors/ors466.html.

¹⁵ https://www.fs.usda.gov/detail/r5/landmanagement/planning/,

¹⁶ "Endangered Species," 16 USC §§ 1531(h)-1543, https://uscode.house.gov/title16/chapter35.

¹⁷ "Part 330--Nationwide Permit Program," 33 CFR 330, https://www.ecfr.gov/current/title-33/chapter-II/part-330 ""Responsible official requirements," 40 CFR § 6.302, https://www.ecfr.gov/current/title-33/chapter-II/part-330 "Subchapter-A/part-6/subpart-C/section-6.302.

¹⁸ "Wildlife Management Plans: Wildlife Diversity Plan," OAR 635-100, https://oregon.public.law/rules/oar chapter 635 division 100.

¹⁹ "Short title; Congressional finding and declaration of policy," 16 USC § 470, https://uscode.house.gov/USC-2007-title16-section470.

²⁰ "Chapter 1A—Historic Sites, Buildings, Objects, and Antiquities," 16 USC §§ 461-467, https://uscode.house.gov/USC-2000-title16-chapter1A.

Archeological and Historic Preservation Act (16 USC § 469)²¹

4 Removal Action Goals and Objectives

RAOs are specific goals for protection of human health and the environment that identify response actions to adequately address human health and ecological risks. RAOs for the Site are:

- Protection of human health by minimizing exposure and hazards to receptors.
- Reduction of possible mobilization of hazardous substances.
- Compliance with ARARs.

4.1 RG Selection

RGs are selected with consideration for the risk-based PRGs discussed in Section 2.9, ARAR-specific PRGs noted in Section 3, and background concentrations for naturally occurring COPCs. The calculated PRGs are considered the most appropriate RGs as they represent a more realistic exposure scenario than generic ARAR-specific PRGs and incorporate background metals concentrations in their calculation. PRGs are listed in Table 1. For arsenic, the PRGs of 190 and 110 mg/kg are selected as RGs for soil/waste rock and tailings, respectively. The difference between these media is the results of bioavailability testing and is likely due to differences in grain size and processing mechanism between waste rock and tailings. As arsenic is the only contributor for human health risk, and the primary driver for ecological risk, removal action that reduces exposure of arsenic to below the RGs will achieve the RAOs. As there are no surface water or sediment risks to human health, no RGs are considered for these media.

4.2 Scope of the Removal Action

The scope of the removal action is to remove or cover tailings or waste rock piles exceeding RGs to the extent practicable and to mitigate Site physical hazards.

4.3 Removal Action Schedule

It is highly recommended that the removal action be implemented within a few years of completion and approval of this EE/CA. If the removal action is done in phases, the most time-sensitive action would be removal of tailings piles from the Upper and Lower Monumental Mines as tailings are more bioavailable than waste rock. The tailings are in areas of historical significance and would be expected to attract more recreational visitors. The tailings are at or near Cap Martin Creek, which provides contaminant load to Granite Creek.

²¹ "Preservation of historical and archeological data threatened by dam construction or alterations of terrain," 16 USC § 469, https://uscode.house.gov/USC-1999-title16-section469.



5 Identification and Analysis of Removal Action Alternatives

The purpose of this section is to present the removal action alternatives proposed to achieve the RAOs identified in Section 4. The selected removal action must meet the RAOs and comply with ARARs. The identified potential remedial technologies and process options were preliminarily screened according to their overall applicability (technical implementability). The purpose of this screening effort is to evaluate the available technologies and process options and to eliminate those not applicable to the Site. The following potential remedial technologies were evaluated through a preliminary screening, as follows:

- **No Action.** No action leaves contaminated materials in their current condition and assumes no further remedial activities will occur. No monitoring is associated with this approach.
 - **Preliminary Screening Evaluation.** Consistent with the NCP and CERCLA guidance, a no action alternative is retained for further evaluation as a baseline for comparison to other remedial alternatives developed.
- Institutional Controls (ICs). ICs restrict access to or control the use of the Site (e.g., zoning, deed restrictions, environmental easements, or access restrictions). Enforcement of ICs can require periodic inspections and patrols, training for USDA Forest Service personnel required to access the restricted areas, maintaining physical barriers (e.g., signage, gates, and fencing), and potentially legal action against trespassers.
 - Preliminary Screening Evaluation. ICs at the Site could include land use controls or physical barriers. Establishing restricted legal use of the Site is not likely to achieve a reduction in human health risk without security or other enforcement to ensure the legal restrictions are adhered to. Given the remote nature of the Site, this is not feasible and trespassers would still be able to access the waste rock piles and other Site features with elevated COPCs. Adding physical barriers around areas with elevated COPCs could temporarily reduce exposure to trespassers but would require frequent maintenance against vandalism. Placing barriers over open holes and shafts could reduce the potential for falling in these features. None of these ICs would reduce the risk of COPCs to ecological receptors. Of the ICs, barricading open holes and shafts was retained as a common item.
- Engineering Controls (ECs). ECs refer to physical modifications or installations designed to mitigate or eliminate exposure to hazardous substances, reduce risks to human health and the environment, or manage contaminant migration. Containment is a type of EC used to reduce the mobility of and exposure to COPCs in soils. These goals are accomplished by creating a barrier that prevents direct exposure and transport of surface soil through erosion. ECs do not reduce the volume or toxicity of the hazardous material. Containment barriers could consist of imported topsoil, asphalt/concrete, local soil, geotextile fabrics, or an engineered clay cap.
 - Other potential engineering controls that could work in parallel with containment include regrading, installing piping to reroute surface water runoff, consolidating waste rock piles, revegetating after capping, and using waste rock to block access to physical hazards.

Preliminary Screening Evaluation. The primary risk drivers for arsenic are dermal contact and ingestion. If implemented appropriately, containment using a surface cap would reduce these risks and help achieve RAOs. Of the potential caps, using soil or rock obtained from unimpacted areas proximal to the Site mines or from a nearby quarry is the most feasible from a cost and implementability standpoint. On-site containment is retained for further evaluation. Other ECs are also retained, as suitable, for a particular mine site.

• Treatment. According to the Federal Remediation Technologies Roundtable Remediation Technologies Screening Matrix and Reference Guide 4.0, ²² potentially applicable treatment technologies for metals in soil include in-situ solidification/stabilization or ex-situ physical or chemical treatment. Available ex-situ physical/chemical treatment technologies for metals in soil include chemical extraction, chemical reduction/oxidation, separation, soil washing followed by precipitation, and solidification/stabilization. Another possible treatment technology would require off-site reprocessing of the waste rock at an operating mill or smelter.

Preliminary Screening Evaluation. The large quantity of soil above RGs, combined with the steep embankments, difficult access, and the absence of suitable areas to install treatment equipment, make in-situ and ex-situ treatment options less favorable and more costly compared to other available technologies; therefore, treatment technologies have not been retained for further evaluation.

• Excavation and Disposal in an On-site Repository. Excavation and disposal in an on-site repository would involve removing tailings and waste rock piles with concentration above RGs and placing the piles at a designated repository at or near the Site. Excavated areas are backfilled with clean soil, returned to original grade, if necessary, and revegetated or otherwise stabilized to prevent erosion. A repository would need to be prepared by grubbing and scraping vegetation, digging to a depth that would ensure a stable slope once filled, covering with clean soil, and revegetating. The presence of an on-site repository would require maintenance and inspection, and potential liability as it would retain the hazardous substances on forest service property in perpetuity.

Preliminary Screening Evaluation. Excavating soil above RGs is a feasible remedial strategy although site-specific conditions, such as the presence of steep slopes, existing structures and retaining walls, and sensitive ecological receptors at the Site would require special consideration to comply with ARARs. It would eliminate on-site exposure to COPCs and reduce contaminant loading to Cap Martin and Granite Creeks. Construction of an on-site repository is possible in the relatively flat area at the crest of the hill at Upper-Upper Monumental Mine. This option is retained for further evaluation.

• Excavation and Disposal in an Off-site Repository. Excavation and off-site disposal involve removal of contaminated soil and subsequent off-site disposal in a landfill licensed to accept the waste. Excavated areas are backfilled with clean soil, returned to original grade, if necessary, and revegetated or otherwise stabilized to prevent erosion. Excavated soil would be stockpiled at an on-site staging area for waste characterization or would be characterized in situ to facilitate direct loading of soil into trucks. Excavated soil would be transported off Site to an appropriate disposal

²² http://www.frtr.gov/matrix2/top_page.html



facility. Some soil failed the TCLP hazardous waste criteria, and it may be necessary to dispose this soil at a Subtitle C facility.

Preliminary Screening Evaluation. Excavation of soil at the Site is implementable although site-specific conditions, such as the presence of steep slopes, existing structures and retaining walls, and sensitive ecological receptors at the Site would require special consideration to comply with ARARs. Off-site disposal would have less long-term liability and would achieve RAOs. However, if disposal at a Subtitle C facility would be required for all waste rock and tailing piles, the cost could be prohibitive. Excavation and off-site disposal are retained for further evaluation.

Remedial alternatives were developed using the remedial technologies retained following the initial screening. Each alternative is described in the following subsections. Cost estimate details for each alternative are provided in Tables 7 through 9. The costs were estimated using order-of-magnitude unit cost provided by a local remedial contractor, as well as methodologies prescribed by USEPA in cost estimating guidance for CERCLA sites (USEPA 2000).

5.1 Alternative 1: No Action

Consistent with the NCP and CERCLA guidance, a no action alternative is considered as a baseline for comparison. Under this alternative, no remedial action, monitoring, or maintenance would be performed. This alternative would not include a mechanism to prevent future exposure to contaminants and would fail to achieve the RAOs for the Site. If no action is taken, arsenic and other COPCs would continue to pose an unacceptable risk to human and ecological receptors for tailings and waste rock piles above RGs. The Sheridan and Granite Creek #7 Mines do not have waste rock piles above RGs; therefore, no action is appropriate for these mines and they are not discussed in sections outlining other alternatives. No action may also be appropriate in cases in which the benefit of the removal action is outweighed by the environmental damage that the removal action would cause.

5.2 Alternative 2: On-site Containment and Other ECs

On-site containment would consist of covering tailings and waste rock piles exceeding RGs with a minimum of 1 foot of clean soil. The lower 6 inches would be machine compacted, and the upper 6 inches would be loosely applied to better promote root development. Prior to placement, piles with slopes greater than a three to one horizontal to vertical ratio would be regraded to the extent practicable. All covered waste material would be revegetated to the satisfaction of the USDA Forest Service. CES proposed revegetation using weed-free WoodStraw mulch, a seed mix based on USDA Forest Service consultation, and a fertilizer consisting of 16 percent total nitrogen, 16 percent available phosphoric acid, 16 percent total water-soluble potash, and 5 percent sulfur applied at the rate of 400 pounds per acre (CES 2011a). However, the final revegetation protocol should be specified in the remedial design documents. During regrading and application of soil cover, berms, channels, or ditches for conveying stormwater and snowmelt should be constructed at the upgradient side of the piles to reduce erosion. Individual grading and water conveyance ECs are described for each Site mine in the following subsections.

For Site mines at which a local source of suitable clean cover soil cannot be identified, cover soil can be obtained from the location of the on-site repository discussed in Alternative 3 (Section 5.3). CES completed test pits at the Upper Granite Creek Saddle, 1 mile east of Monumental Mine on FS 7345. The test pits found ash and loam in the upper 2.5 feet below ground surface, underlain by weathered granite. The presence of vegetation within the proposed borrow area suggested that it would allow for revegetation after use as cover soil (CES 2011a). A closer potential repository and cover soil borrow location is the area adjacent to and southeast of Upper-Upper Monumental Mine. This area has relatively shallow topography closer to the Site and is accessible by road; however, additional engineering evaluation would be necessary to assess the suitability of soils in this area during the remedial design.

Roads would require improvement to facilitate haul trucks and construction equipment, notably FS 7345 (for access to potential repository, Monumental Mine, Cap Martin Mine, and Granite Creek Aquatic Station 03 waste rock piles) and FS 280 (for access to Central, Golden Fraction, Granite Creek #5, and Tillicum Mines). Additional specific road improvements are discussed for each mine in the following subsections. After completion of the removal action, any temporary access roads would be decommissioned at USDA Forest Service's discretion to limit unauthorized vehicles. Decommissioning may consist of ripping the roads, revegetating, and recontouring for drainage, and blocking using large boulders, trees, or tank ditches.

During construction, water will be applied to prevent fugitive dust emissions. The remedial contractor could potentially withdraw water for this purpose from Site surface water features, with USDA Forest Service's permission.

5.2.1 Monumental Mine

The following subsections describe on-site containment at Monumental Mine areas.

5.2.1.1 Upper-Upper Monumental Mine

Waste rock piles A, D, and F at Upper-Upper Monumental Mine (395, 10, and 10 cy, respectively) exceed RGs. Waste rock piles B, C, and E (5, 5, and 5 cy, respectively) are below RGs, and waste rock piles G, H, I, and J (10, 25, 5, and 15 cy, respectively) have not been evaluated. Prior to implementation of the removal action, waste rock piles with no data should be assessed using an XRF device. Waste rock piles can be accessed via the unnamed roadway that connects to FS 7245 approximately 0.1 miles north of the area. The obstructions currently present at the road would need to be removed and the road graded to allow for a haul truck. Under Alternative 2, where practicable, piles can be spread to adjacent shafts and trenches, particularly those that are open or partially open and represent physical hazards. Any remaining waste rock should be graded and all waste rock covered using clean cover soil from the shallow topographic area to the southeast or from the borrow area at Granite Creek Saddle.



5.2.1.2 Upper Monumental Mine

All tailings and waste rock piles at Upper Monumental Mine exceed RGs. Under Alternative 2, Waste rock pile B (60 cy) can be pushed into the adjacent shaft, which will accommodate its volume, and graded to match surrounding topography after placement of cover material. Cover material could be obtained from the Upper-Upper Monumental Mine area or from the Granite Creek Saddle. Access to waste rock pile B would require improvement of approximately 0.25 miles of an unnamed road that splits from the Upper-Upper Monumental Mine's unnamed road close to FS 7345.

Waste rock pile A (7,905 cy) is the largest waste rock pile at the Site and is situated on a steep, heavily vegetated slope, which would make grading difficult. The thick forest adjacent to the pile would preclude the use of local cover material and require hauling from the Upper-Upper Monumental Mine area or from the Granite Creek Saddle. Grading at this pile would require the removal of several trees. A portion of waste rock pile A could be placed in the open adit to prevent passageway to this physical hazard and the rest graded and covered. The adit seep would be redirected around the side of the waste rock pile using a pipe or drainage ditch. The low flow of the seep would be expected to infiltrate into the native soil. Access to waste rock pile A would require improvement of approximately 0.25 miles of FS 025 as well as FS 7345.

On-site containment at the former mill site (tailings pile A, 125 cy) would require scraping the thin tailings into a well-graded pile and covering with local borrow material, potentially from material on the eastern side of the clearing that had much lower arsenic concentrations. Care would need to be taken to remove tailings from around the flotation table to maintain the integrity of this historical feature, which may necessitate the use of hand tools, vacuum devices, and engineering controls to avoid exposure to dust and fine particles. The work may be completed using a small excavator, which may be able to access the area from FS 025 or through one of the drainages from FS 7345.

Tailings pile B (305 cy) includes tailings at and surrounding the upper settling pond. Covering this material would necessitate redirecting the flow of Cap Martin Creek to the north and adding berms to ensure it did not recapture its existing drainage and remove the cover material. Grading would be required to allow for access downslope from FS 7345. Cover material may be identified in the immediate surrounding area or sourced from the Upper-Upper Monumental Mine area or from the Granite Creek Saddle.

Tailings pile C (10 cy) is at and surrounding the middle settling pond. Covering this material would necessitate redirecting the flow of Cap Martin Creek to the south and adding berms to ensure it did not erode the cover material. Access would be difficult but the small areal extent of the tailings pond could allow for the use of hand carried materials. Access is likely easiest from the unnamed roadway that leads to the Lower Monumental Mine.

5.2.1.3 Lower Monumental Mine

Lower Monumental Mine waste rock pile A (5,560 cubic yards) and tailings pile A are in a relatively flat area. Under Alternative 2, the over-steepened northeastern portion of waste rock pile A could be regraded to the north–northwest and across tailings pile A (180 cy) to the northeast, taking care not to bury or obscure the historically significant crusher. A portion of waste rock pile A could be placed in the

open adit to prevent passageway to this physical hazard. Waste rock pile B (170 cubic yards) could be placed in the area in front of adit 3 and the rest appropriately graded downslope. Cover material could be sourced from the area to the east of the unnamed access road or to the south of waste rock pile A. Accessing this area would require improvement of approximately 0.25 miles of the unnamed road.

The seep emanating from adit 1 would be redirected via a pipe under the unnamed access road to the lower settling pond. The flow of Cap Martin Creek from the lower settling pond would be directed via rock-lined drainage ditch around the lower waste rock pile so it does not contact or erode the regraded, covered pile. Details of the water management would be included in the remedial design documents.

Preliminary XRF measurements of the "potential waste rock pile" depicted on Figure 5 indicated arsenic concentrations similar to background; however, additional evaluation of this feature should be conducted during remedial design.

5.2.2 Granite Creek Aquatic Station 03

Waste rock pile A (15 cy) is below RGs and requires no action. Waste rock pile B (80 cy), approximately 70 feet upstream of the intersection between Granite Creek and FS 720, has an arsenic UCLM above the RG. Under Alternative 2, the pile would be graded away from Granite Creek to the northeast. Waste rock pile A, which had arsenic concentrations similar to Site background, could potentially be used as a local cover source or material could be sourced from the Upper-Upper Monumental Mine area or the Granite Creek Saddle. Removal action at the waste rock pile would necessitate the improvement of approximately 0.3 miles of FS 720, in addition to FS 7345.

5.2.3 Cap Martin Mine

Waste rock piles A and B (370 and 10 cy, respectively) are less than RGs and would require no action. Under Alternative 2, waste rock pile C (735 cy) would be regraded and covered with local borrow material. The depression that separates the east and western portions of waste rock pile C, where adits 4, 5, and 6 are located, could be filled with material from the northernmost portion of the western half of the pile that forms a steep mound. Most of the pile is vegetated and would require tree removal prior to containment. Cover material would be identified in the immediate area and likely require additional tree removal. Access to Cap Martin Mine would require the installation of a new road. Although closer to FS 7345, it would be easier to build a road on the less steep slopes to the north of FS 720. This would require improvement of approximately 0.75 miles of FS 720, as well creating an approximately 0.25-mile new road.

5.2.4 Granite Creek #6 Mine

The wet trench pile (140 cy) is below RGs and requires no action. Waste rock pile A (45 cy) is above PRGs and Alternative 2 would involve regrading the over-steepened portion into the open adit. The pile is extensively vegetated and would require grubbing and scraping prior to regrading and capping. Cover material could be from the adjacent and larger wet trench pile, which had arsenic concentrations at or below background. Access to the Granite Creek #6 Mine would require building a new road, 0.3 miles along Granite Creek from Tillicum Mine on FS 280. If a road is built to access Cap Martin Mine, it may be



easier to construct a road west along Granite Creek from Cap Martin Mine, although either scenario would require extensive regrading, grubbing, and scraping.

5.2.5 Tillicum Mine

Waste rock piles B and C (145 and 210 cy, respectively) are below RGs and would require no action. Waste rock pile A (205 cy), between FS 280 and Granite Creek, is above RGs. Under Alternative 2, waste rock pile A would be partially graded and pulled into the concave portion of the hillside downslope of adit 2. Most of the pile may fit within this area and the rest would be regraded to match the surrounding contours. No local cover material is available due to the steep slopes adjacent to the mine and Alternative 2 would likely require sourcing from the Upper-Upper Monumental Mine area, the Granite Creek Saddle, or other closer borrow area. Action at Tillicum Mine would require improvement of 0.75 miles of FS 280.

5.2.6 Granite Creek #5 Mine

Waste rock pile B (10 cy) is below RGs and would require no action. Waste rock pile A (285 cy) is above RGs. Under Alternative 2, waste rock pile A would be regraded to fill the collapsed adit. Waste rock downhill from FS 280 would be pulled away from Granite Creek and graded into the existing hillside. No local cover material is likely available due to the steep slopes adjacent to the mine and Alternative 2 would likely require sourcing from Upper Upper-Monumental Mine area or from the Granite Creek Saddle or other closer borrow area. Action at the Granite Creek #5 Mine would require improvement of 0.4 miles of FS 280.

5.2.7 Golden Fraction Mine

No action is necessary at waste rock piles B, C, or D (145, 295, and 1,105 cy, respectively) based on calculated UCLMs for these features. Under Alternative 2, waste rock pile A (295 cy) would be recontoured into the concave depression downslope of collapsed adit 3 and covered with clean borrow material. No immediately local cover material is likely available due to the steep slopes adjacent to the mine and this alternative would likely require sourcing from the Upper-Upper Monumental Mine area, from the Granite Creek Saddle, or other closer borrow area to be identified during remedial design. Access to this waste rock pile would be difficult due to the steep terrain and would likely require construction of a temporary road uphill to the pile from FS 280 as building a road from FS 7345 would likely put the road at risk of being undercut.

5.2.8 Central Mine

Waste rock piles B, C, and D (25, 105, and 25 cy, respectively) are less than RGs and would require no action. Under Alternative 2, material from waste rock pile A (80 cy) would be pulled up the slope away from Granite Creek into the concave topography at adit 1 and graded into the surrounding hillside. It is possible that a local source of cover material could be excavated from the hillside between FS 280 and Granite Creek. Waste rock pile A is densely vegetated and would require grubbing and scraping prior to regrading and cover. Access to this mine is from FS 280, close to where it meets FS 73, and would

require minimal improvement. In the previous EE/CA, CES suggested removing a transite pipe identified at the mine by EA that may contain asbestos as part of the removal action. If the pipe is encountered during construction, it should be excavated, tested for asbestos, and removed from the Site.

5.3 Alternative 3: Excavation and On-site Disposal

Under this alternative, all waste material exceeding the RGs of 190 and 110 mg/kg total arsenic for waste rock and tailings, respectively, would be excavated and disposed in an on-site repository. CES proposed a repository be constructed at the proposed cover soil borrow area at the Granite Creek Saddle (2011a). Another potential location for a repository would be near the Upper-Upper Monumental Mine to the southeast of the mapped area. The repository would be excavated to a sufficient depth to allow for placement of material and for creation of a cap. The aerial extent of the repository will be dependent upon the volume of soil placed in the repository. ABA and TCLP results suggest that tailings have the possibility to leach contaminants and waste rock does not. Once material is mixed, additional TCLP and ABA testing could be completed to facilitate decision making. The necessity of lining or otherwise preventing toxic leachate should be evaluated during the remedial design. The repository will be constructed such that it does not exceed a three to one horizontal to vertical slope ratio to prevent erosion. Material placed in the repository would be compacted in 6-inch lifts. The repository would be capped with 1 foot of clean excavated borrow material stockpiled during its construction. The bottom 6 inches of the cap would be compacted and the upper 6 inches placed loosely to help develop root formation. The cap would be vegetated to USDA Forest Service specifications. Similar to the contained piles, berms and channels will be constructed to prevent stormwater and precipitation run-on.

In either location, the repository would be constructed beyond accessible roadways and require partial road construction/improvement. After the repository is constructed, the access road would be blocked to prevent unauthorized access.

Details regarding waste rock piles necessitating action, waste rock volumes, roadway improvements, stormwater controls, and other necessary controls are consistent with protocols outlined in Alternative 2 per mine site. Tailings at the Upper and Lower Monumental Mines would be removed using a vacuum truck to minimize disturbance to historically significant structures due to the relative thin nature of these materials, their fine grain size, and their high arsenic concentrations. A vacuum truck parked on FS 7345 could remove tailings from Upper Monumental Mine tailings piles A and B, and a vacuum truck parked on the unnamed road accessing Lower Monumental Mine could remove Upper and Lower Monumental Mine tailings pile C and A, respectively.

Excavated material would be based on visual observations and XRF measurements. Laboratory analytical samples of the underlying material would be taken to verify material above RGs had been removed. After excavation, the exposed surfaces would be graded, covered with clean soil, and revegetated to match the surroundings.

5.4 Alternative 4: Excavation and Off-site Disposal

Under this alternative, all waste material exceeding the RGs of 190 and 110 mg/kg total arsenic for waste rock and tailings, respectively, would be excavated and disposed of off Site. Procedures for this alternative would be the same as Alternative 3; however, instead of requiring the creation of a repository, material would be loaded directly from the respective mine into haul trucks. Due to the TCLP results, tailings would need to be transported as hazardous waste to Chemical Waste Management of the Northwest in Arlington, Oregon, a Subtitle C facility. Waste rock could either be transported to the USDA Forest Service repository planned at FS 7350 or to the Baker City Landfill approximately 4 and 55 miles from the intersection between FS 73 and FS 7345, respectively. Material transported to a municipal landfill would be temporarily stockpiled at a staging area to the west of the intersection between FS 73 and FS 7345, and then transferred to trucks more suitable for highway travel.

5.5 Analysis of Selected Removal Action Alternatives

Pursuant to the NCP, each alternative described above was analyzed using the following evaluation criteria: effectiveness, implementability, and cost. The effectiveness of each alternative was evaluated by each alternative's protectiveness of human health and the environment; attainment of ARARs; reduction of toxicity, mobility, or volume through treatment; long-term effectiveness and permanence; and short-term effectiveness. The implementability criterion addresses the technical feasibility of implementing the response (including availability of services and materials), the administrative feasibility, and Oregon State and community acceptance. Projected costs were calculated using direct capital costs, indirect capital costs, and annual post-removal Site control costs. Consistent with guidance, the costs presented are estimated using current costs of labor and materials, and actual costs are expected to range from 30 percent below to 50 percent above the costs presented. The projected costs presented for the EE/CA removal action alternatives are estimates only for the sole purpose of comparing alternatives and should not be considered design-level cost estimates. Details that formed the basis for the removal action alternative cost projections are provided in Tables 7 through 9.

5.5.1 Effectiveness

The following subsections evaluate an alternative's ability to meet the RAOs as identified in Section 4; in particular, its ability to achieve the criteria of protectiveness of human health and the environment and to attain ARARs. Other factors that affect the overall protectiveness of a removal action include preference for treatment to reduce contaminant toxicity, mobility, or volume for principal threats, short-term effectiveness, and long-term effectiveness/permanence. Details regarding the effectiveness evaluation criteria are presented in the following subsections.

5.5.1.1 Overall Protection of Human Health and the Environment

Under Alternative 1, the Site would remain as it currently exists and no active efforts to minimize contaminated areas or migration pathways would be made. Therefore, COPCs in soil would continue to pose an unacceptable risk to human health and the environment.

Alternative 2 would cover all tailings and waste rock piles exceeding RGs with clean cover, which would be effective in preventing direct contact to human receptors and improve conditions for some ecological receptors. The alternative would also involve regrading, which would reduce erosion, and rerouting surface water features flowing through tailings and waste rock piles, which would reduce contaminant load to streams. However, leaving the piles in place with a permeable cap would still allow infiltration, leaching, and migration of COPCs to surface water bodies. This is particularly problematic for tailings, which have a higher propensity for ARD and leaching.

Alternative 3 would involve removing all soil above RGs and placing it in an on-site repository. This would provide a high level of protection to human health and the environment. Some environmental receptors (burrowing mammals and invertebrates, plants) would still have some exposure if living at the repository, though population level species would be expected to be protected. The repository would be constructed far from streams and contaminant load from leaching would be less than under Alternative 2.

Alternative 4 would involve removing all soil above RGs and transporting it offsite. This would provide a high level of protection to human health and the environment. Material with high toxicity and propensity for ARD and leaching would be transported to a Subtitle C landfill. The remaining soil would be transported to an off-site repository or landfill, which would be expected to provide the highest level of protection to human health and the environment.

5.5.1.2 Compliance with ARARs

Alternative 1 does not comply with ARARs.

Alternative 2 partially complies with ARARs. Leaving tailings in areas with the potential to leach into Cap Martin Creek is potentially against ARARs protective of ecological environments, including the Clean Water and Endangered Species Acts.

Alternatives 3 and 4 comply with ARARs.

5.5.1.3 Reduction of Toxicity, Mobility, or Volume through Treatment

None of the alternatives evaluated reduce the toxicity, mobility, or volume of contamination through treatment. The COPCs are not biodegradable and will continue to pose an unacceptable risk to human health and the environment, though Alternative 4 would place the material in a permitted landfill, which may have treatment requirements (solidification) prior to placement.

5.5.1.4 Short-Term Effectiveness

Alternative 1 has poor short-term effectiveness because potential risk from COPCs at the Site is not reduced. The length of time until protection is achieved is indefinite under this alternative.

Alternative 2 through 4 offer equal short-term effectiveness as each would be completed in a relatively short period of time (less than 2 years), and would minimize exposure to COPCs immediately after implementation.



Short-term air quality impacts to the immediate environment may occur during excavation of contaminated soil. These short-term risks could be mitigated through appropriate dust control procedures.

A small increase in short-term risk to human health would be encountered during the excavation and transport phase of this work due to the truck trips required. These impacts could be mitigated through a transportation plan for the waste materials.

Impacts associated with construction activities are considered short term and should not significantly impact human health.

5.5.1.5 Long-Term Effectiveness

Alternative 1 does not provide long-term effectiveness or a permanent remedy for COPCs at the Site.

Alternative 2 provides a high level of long-term effectiveness for waste rock piles, particularly if cap inspection and maintenance is conducted on a regular schedule. Alternative 2 has a moderate level of long-term effectiveness for tailings, which would be expected to continue to leach and impair surface water bodies.

Alternative 3 provides a high level of long-term effectiveness, provided the repository cap is inspected and maintained at a regular interval and that the remedial design includes a mechanism to reduce the ability of tailings placed in the repository to leach and adversely affect downstream surface water bodies.

Alternative 4 provides the highest level of long-term effectiveness in that it does not rely on inspection or maintenance and material removed would be off Site in perpetuity.

5.5.2 Implementability

This section provides an evaluation of the technical and administrative feasibility of implementing an alternative and the materials and services that would be required for its implementation.

5.5.2.1 Technical Feasibility

Technical Implementation Considerations

Alternative 1 is simple to implement, as no action is taken.

Alternatives 2, 3, and 4 are technically feasible, though implementation would be difficult due to the remote nature of the Site, the steep slopes surrounding some of the waste rock piles, the presence of vegetation, the lack of access roads, and the relatively short season in which actions can be implemented (i.e., between June snowmelt and October precipitation). All three alternatives would require a geotechnical engineer to provide feedback on necessary road improvements and the extent to which steep waste rock piles could be safely accessed. The technical feasibility of these options is higher at Site mines located on or near existing roadways and lower for Site mines without road access.

Alternative 2 would be simpler to implement if clean cover material were available close to a particular mine and pile, and more complicated to implement if the nearest cover material was sourced from the proposed upland area.

Implementation of Alternative 3 would require additional analysis of the need for impermeable lining at the bottom of the repository, as well as mechanisms for trapping and treating leachate, and would require additional logistics if needed.

Alternative 4 would require additional logistics to transfer waste material from off-road dumps to highway-approved dumps, which would likely require additional workforce to complete in a reasonable amount of time.

Availability of Services and Materials

No services or materials for Alternative 1 are required.

It is likely that a contractor and engineering design team would be available to implement Alternatives 2, 3, and 4. However, the remote nature of the Site could be logistically challenging and would likely reduce the work week to provide time to travel to and from the Site.

The capacity of an appropriately licensed off-site waste facility to accommodate the anticipated soil excavation volumes is anticipated if Alternative 4 is selected.

5.5.2.2 Administrative Feasibility

This section provides an evaluation of the activities needed for coordination with other offices and agencies. Under CERCLA, federal, state, and local permits are not required for on-site CERCLA response actions; however, the substantive requirements of all permits that would otherwise be required must be met (40 CFR § 300.400(e)). Construction of an on-site repository would need to follow the substantive requirements of OAR 340-95, which describes solid waste disposal sites other than municipal solid waste landfills. Additional requirements would be triggered if hazardous wastes were planned to be stored in the repository (ORS 466).

Community Acceptance

It is likely that the public would not support Alternative 1 for the entire Site as it provides no protection for human health or the environment. The public may support Alternative 1 for Site mines that are especially remote and which would cause environmental damage if a removal action were to be implemented.

The public would likely support Alternatives 2 through 4, depending on the extent of environmental degradation caused by the removal action. Community acceptance will be determined following the community review and comment period after completion of the EE/CA. These comments will be addressed prior to finalizing the EE/CA and issuance of the action memorandum.



5.5.3 Cost

Evaluation of costs consists of developing conservative, order-of-magnitude estimates based on the description of work items developed for each removal action alternative. A similar set of assumptions is used for the alternatives, so that the *relative* difference in cost between alternatives is represented.

Tables 7 through 9 detail costs for Alternatives 2 through 4. Estimated costs (net present value) are presented below:

5.6 Comparative Analysis of Removal Action Alternatives

The effectiveness of the retained alternatives was evaluated based on advantages in each of the evaluation criteria outlined in Section 5.3, as well as the removal action goals and objectives. The following table summarizes the comparison.

| | | Со | mparison of Alt | ternatives | | |
|------------------|--|---------------|-----------------------------|---|--|--|
| Criterion | Alterna | ntive | Alternative 1: No Action | Alternative 2: On- site Containment | Alternative 3: Excavation and On-site Disposal | Alternative 4: Excavation and Off-site Disposal |
| | | HH? | No | Yes | Yes | Yes |
| | Protective of: | Env? | No | Mostly – Leaching to Surface water bodies, species level risk at piles | Mostly; species level risk at repository | Yes |
| Effectiveness | Complies with | ARARs? | No | Yes- though leaching not 100% supportive of Clean Water and Endangered Species Acts | Yes | Yes |
| | Reduces Toxicit or Volume thro Treatment | • | No | No | No | No |
| | | Short Term | No | Yes | Yes | Yes |
| | Effectiveness Duration | Long Term | No | Yes, except possible leaching; requires inspection and maintenance of multiple caps | Yes; requires inspection and maintenance of repository. | Yes |
| Implementability | Feasibility | Tech. | High | Moderate - Implementation logistically and technically difficult, particularly at Site mines without existing road access | Moderate; implementation logistically and technically difficult, particularly at Site mines without existing road access | Moderate; implementation logistically and technically difficult, particularly at Site mines without existing road access |
| | | Admin | Low | High | Moderate (repository construction) | High |
| | Acceptance | Communit | Not expected | Yes | Yes | Yes |
| Cost | | | \$0 | \$1,125K | \$1,783K | 3,250K |

Note: Env = environment; HH = human health



6 Recommended Removal Action Alternative

Taking into consideration the evaluation criteria presented in this EE/CA, the recommended removal action alternative for the Site is a combination of Alternatives 1, 2, 3, and 4. The Site mines, and the features at each mine, have individual attributes such that a single remedy would not be appropriate for the entire Site. The rationale for selecting an alternative for each mine is presented in this section.

6.1 Monumental Mine

The recommended removal action at Monumental Mine is a combination of Alternatives 1, 2, 3, and 4, as described below.

6.1.1 Upper-Upper Monumental Mine

Alternative 1 is recommended for waste rock piles at the Upper-Upper Monumental Mine with UCLMs below RGs.

Alternative 2 is recommended for waste rock piles with UCLMs above RGs. Piles can be moved using a bulldozer into trenches and covered with local clean borrow material. The cover material would be placed on the partially open shaft to prevent a trespasser or recreator from falling. Access to this area would require minimal road improvement.

6.1.2 Upper Monumental Mine

Alternative 2 is recommended for waste rock pile B. The shaft has sufficient capacity to accept the waste rock pile. Cover material can be supplied from the Upper-Upper Monumental Mine area and the unnamed road adjacent to the pile would require minimal improvement for equipment access.

A combination of Alternatives 2 and 3 is recommended for waste rock pile A. The steep slope of the waste rock pile will not likely allow recontouring of the entire pile without significant grubbing of the surrounding forest. It is recommended that the over-steepened portion of the pile be pushed with a bulldozer downslope to FS 7345 and taken to an on-site repository. Approximately half of the pile could then be spread and contoured to the existing topography. During the removal action, efforts would be made to maximize the volume of soil left in place, graded, and covered, and minimize the volume of soil transported to the on-site repository

Alternative 4 is recommended for tailings piles A, B, and C. A vacuum truck should be used to remove the fine tailings without disturbing the historical structures and minimize creating dust in this particularly fine material with high arsenic concentration. The contents of the vacuum truck will be transferred to a highway-rated truck with appropriate hazardous waste placards and a lined, covered bin at a staging area near the intersection of FS 7345 and FS 73 for transport to a Subtitle C landfill. After removing tailings, to the extent practicable, clean cover soil will be placed in the excavated areas to provide an exposure barrier from remnant tailings. No road improvements would be necessary except

for accessing the repository, as a vacuum truck with sufficient hose length could park on FS 7345. Tailings pile C could be accessed from the unnamed access road that transects Lower Monumental Mine.

The wetlands near the tailings piles B and C will be restored following the removal of hazardous substances in accordance with the 1994 USEPA guidance document *Considering Wetlands at CERCLA Sites*. If needed, clean organic fill may be imported from off Site for placement in the new wetland system. Wetland plants will be obtained either off Site or from a local borrow area pending USDA Forest Service approval.

6.1.3 Lower Monumental Mine

Alternative 4 is recommended for tailings pile A. Similar to the Upper Monumental Mine, a vacuum truck could be utilized to remove the fine tailings without disturbing the historical crusher structure. The contents of the vacuum truck will be transferred to a highway-rated truck with appropriate hazardous waste placards and a lined, covered bin at a staging area near the intersection of FS 7345 and FS 73 for transport to a Subtitle C landfill. Some road improvement would be necessary to allow a vacuum truck to drive on the unnamed road. Removing tailings would help reduce the capacity for this material to leach COPCs and migrate to Cap Martin Creek and nearby wetlands.

Alternative 2 is recommended for waste rock piles A and B. The area surrounding the waste rock piles is relatively flat and would support grading. The over-steepened northeastern portion of waste rock pile A could be regraded to the north—northwest and across tailings pile A to the northeast, taking care not to bury or obscure the historically significant crusher. A portion of waste rock pile A could be placed in the open adit to prevent passageway to this physical hazard. Waste rock pile B could be placed in the area in front of adit 3 and the rest appropriately graded downslope. Cover material could be sourced from the area to the east of the unnamed access road or to the south of waste rock pile A. Capping the waste rock piles would be protective of human health, cost effective, and less difficult to implement than Alternatives 3 and 4. Construction of water diversion features would be conducted as outlined in Section 5.2.1.3.

6.2 Granite Creek Aquatic Station 03

Alternative 1 is recommended for Granite Creek Aquatic Station 03 waste rock pile A due to low arsenic concentrations indicative of background conditions.

Alternative 2 is recommended for Granite Creek Aquatic Station 03 waste rock pile B. Minimal road improvement would be necessary along FS 720 to allow for a bulldozer or excavator to regrade and pull the waste rock pile away from Granite Creek and cover it with material from waste rock pile A or other local cover source. Alternative 2 would be protective of human health, reduce risk to ecological receptors, be cost effective, and relatively easy to implement.

6.3 Cap Martin Mine

Alternative 1 is recommended for the Cap Martin Mine. Only waste rock pile C at this mine had a UCLM (243.5 mg/kg) above the arsenic RG of 190 mg/kg. At this waste rock pile, only three of eight sample locations had concentrations above the arsenic RG (maximum concentration of 365.8 mg/kg). Cap Martin Mine is in a remote area of the Site, with difficult access through small trees and brush by foot and no access by road or trail. It is unlikely that a trespasser or recreator would discover Cap Martin Mine, and even more unlikely that they would spend time in the area of waste rock pile C with elevated arsenic concentrations. Implementing Alternatives 2, 3, or 4 would necessitate constructing a new road down a steep and densely vegetated portion of national forest. These alternatives would be expensive and provide only marginal benefit for the protection of human health.

6.4 Sheridan Mine

Alternative 1 is recommended for the Sheridan Mine. All samples collected at this mine had arsenic concentrations well below the RG. The mine is in a remote portion of the Site and is difficult to access.

6.5 Granite Creek #7 Mine

Alternative 1 is recommended for Granite Creek #7 Mine. Of the seven analytical samples collected at this mine, only one exceeded the RG with a concentration of 220 mg/kg. Calculated UCLMs for the waste rock piles were below RGs. The mine is in a remote area of the Site that would be difficult to access.

6.6 Granite Creek #6 Mine

Alternative 1 is recommended for Granite Creek #6 Mine. Two samples collected from waste rock pile A exceeded RGs (maximum concentration 504 mg/kg). However, the waste rock pile is relatively small, and the mine is in a remote portion of the Site with difficult access. This mine was difficult to locate with a map and GPS device and offers no historically significant features that trespassers or recreators would be interested in. To implement Alternatives 2, 3, or 4, it would be necessary to construct a new road along Granite Creek that would likely cause unwanted turbidity and undercut the uphill slopes.

6.7 Tillicum Mine

Alternative 1 is recommended for the Tillicum Mine. Only waste rock pile A had a calculated arsenic UCLM (357.7 mg/kg) above the RG of 190 mg/kg. This pile is downhill from FS 280, between the road and Granite Creek. Human health exposure to the waste rock pile is likely minimal as it would require descending a steep hill from the road. Soil downslope of waste rock pile A had similar arsenic concentrations to the pile, which indicates that erosion of the pile to Granite Creek is ongoing; however, pool and riffle samples collected in 2003 adjacent to the pile did not have measurable arsenic concentrations. The concentration of total arsenic in the 2024 Granite Creek surface water sample collected downstream of Tillicum Mine was slightly less than the upstream sample. These data suggest that even though material from the waste rock pile is eroding into Granite Creek, it is not having a

significant effect on downstream water quality. Implementing Alternatives 2, 3, or 4 at Tillicum Mine would require improving approximately 0.75 miles of FS 280, including a portion across privately held land, which would be labor and capital intensive.

6.8 Granite Creek #5 Mine

Alternative 1 is recommended for the Granite Creek #5 Mine. Calculated arsenic UCLM for waste rock pile A is 293.2 mg/kg, which exceeds the RG. However, six of the eight XRF measurement or analytical sample locations had arsenic concentrations below the RG. Furthermore, the sample collected downslope of the waste rock pile, between the pile and Granite Creek, had an arsenic concentration less than half of the minimum concentration of waste rock pile A samples. The concentration of total arsenic in the 2024 Granite Creek surface water sample collected downstream of the Granite Creek #5 Mine was slightly less than the upstream sample, suggesting Granite Creek #5 Mine does not significantly contribute to contaminant loading in Granite Creek. Implementing Alternatives 2, 3, or 4 at the Granite Creek #5 Mine would require improving approximately 0.4 miles of FS 280, including a portion across privately held land.

6.9 Golden Fraction Mine

Alternative 1 is recommended for Golden Fraction Mine. Waste rock pile A had arsenic concentrations above the RG (calculated UCLM of 332 mg/kg). However, this waste rock pile is located high up a steep hillside from the most likely access point of a trespasser or recreator, and it is unlikely that there is an associated human health risk. This waste rock pile is relatively small and implementation of Alternatives 2, 3, or 4 would require constructing an access road across a very steep hillside, which may not be feasible. In 2011, CES collected a sample from the area of a trench within waste rock pile C that had an arsenic concentration of 1,340 mg/kg. Terraphase measured arsenic concentrations at four locations in this area and collected a sample from the trench and was unable to reproduce this result (maximum concentration 102 mg/kg when not including the CES sample). It is possible that this sample was collected from a different area or it represents an anomalous result unrepresentative of the bulk of the pile. In either case, this waste rock pile does not represent a significant human health risk and does not warrant remedial action.

6.10 Central Mine

Alternative 2 is recommended for Central Mine waste rock pile A, which had a calculated arsenic UCLM of 239.5 mg/kg, slightly above the RG. This waste rock pile is easily accessible along FS 280, just west of its intersection with FS 280, which has parking at nearby FS 73. Waste rock pile A would be pulled up from the Granite Creek floodplain and placed in the open space at the adit and contoured into the adjacent hillside. Cover material is available downslope of FS 280, though it would need to be tested prior to application. Although there is higher likelihood of trespassers and recreators, no action is needed at waste rock piles B, C, or D as they had calculated UCLMs below the RG.



6.11 Summary of Recommended Removal Action Alternative

The following table provides a summary of the recommended removal action alternative by Site mine. This information, including the total waste rock volume associated with each alternative, is also provided as Table 11.

| Re | ecommended Removal Action A | Alternatives |
|--|--|--|
| Mine | Feature | Recommended Removal Action Alternative |
| | Waste rock piles A, D, and F (395, 10, and 10 cy) | Alternative 2 |
| Upper-Upper Monumental Mine | Waste rock piles B, C, and E (5, 5, and 5 cy) | Alternative 1 |
| | Waste rock piles G, H, I and J (10, 25, 5, and 15 cy) | To be determined (requires characterization) |
| | Waste rock pile A (7,905 cy) | Alternatives 2 and 3 |
| Upper Monumental Mine | Waste rock pile B (60 cy) | Alternative 2 |
| | Tailings piles A, B, and C (125, 305, and 10 cy) | Alternative 4 |
| Lower Monumental Mine | Waste rock piles A and B (5,560 and 170 cy) | Alternative 2 |
| | Tailings pile A (180 cy) | Alternative 4 |
| Constitution Constitution Charlier Constitution Constitut | Waste rock pile A (15 cy) | Alternative 1 |
| Granite Creek Aquatic Station 03 | Waste rock pile B (80 cy) | Alternative 2 |
| Cap Martin Mine | All features | Alternative 1 |
| Sheridan Mine | All features | Alternative 1 |
| Granite Creek #7 Mine | All features | Alternative 1 |
| Granite Creek #6 Mine | All features | Alternative 1 |
| Tillicum Mine | All features | Alternative 1 |
| Granite Creek # 5 Mine | All features | Alternative 1 |
| Golden Fraction Mine | All features | Alternative 1 |
| | Waste rock pile A (80 cy) | Alternative 2 |
| Central Mine | Waste rock piles B, C, and D (25, 105, and 25 cy) | Alternative 1 |

6.12 Recommended Removal Action Cost

The recommended removal action includes a combination of Alternatives 1, 2, 3, and 4 as summarized above. Combined estimated costs for the recommended removal action are \$1,218,259, as summarized in Table 10.

7 References

- Brooks, Howard C., M.L. Ferns, and E.D. Mullen. 1982. *Geology and Gold Deposits Map of the Granite Quadrangle, Grant County, Oregon, 1982*.
- Cascade Earth Sciences (CES). 2006. *Human Health and Ecological Risk Assessment, Granite Creek Mines, Wallowa-Whitman National Forest*. Cascade Earth Sciences. Spokane, Washington.
- ——. 2007. Field Operation Plan, Data Gap Investigation of the Upper Granite Creek Watershed, Grant County, Oregon. Cascade Earth Sciences. Spokane, Washington.
- ——. 2009. Scope of Work and Cost Estimate Data Gap Investigation: Monumental Mine. Cascade Earth Sciences. Spokane, Washington.
- ———. 2011a. Non-Time-Critical Removal Action, Engineering Evaluation/ Cost Analysis, Upper Granite Creek, Grant County, Oregon, Wallowa-Whitman National Forest. May.
- ———. 2011b. Wetland Delineation Report, Monumental Mine Data Gap Assessment, Grant County, Oregon. May.
- ———. 2011c. Human Health and Ecological Risk Assessment, Upper Granite Creek Mines, Wallowa-Whitman National Forest. May.
- EA Engineering, Science, and Technology, Inc. (EA). 2004. *Site Inspection, Granite Creek Mines, Wallowa-Whitman National Forest, Oregon*. January.
- Ferns, M.L, H.C Brooks, and J. Ducette. 1982. *Geology and Mineral Resources Map of the Mt. Ireland Quadrangle, Baker and Grant Counties, Oregon*.
- Oregon Department of Environmental Quality. 2010. Human Health Risk Assessment Guidance. October.
- Oregon Department of Environmental Quality. 2019. Clean Fill Determinations. February.
- Terraphase Engineering Inc. (Terraphase). 2024. *Sampling and Analysis Plan, Upper Granite Creek Watershed Mines, Wallowa-Whitman National Forest, Oregon.* September 20.
- United States Department of Agriculture (USDA) Forest Service. 2002. DRAFT Environmental Impact Statement, Granite Area Mining Projects. June
- ——— 2003a. Abbreviated Preliminary Assessment, Monumental. February
- --- 2003b. Abbreviated Preliminary Assessment, Tillicum February
- ——— 2006a. Abbreviated Preliminary Assessment, Golden Fraction. August.
- ———. 2006b. Abbreviated Preliminary Assessment, Upper Central Mine. August.



——. 2006c. Abbreviated Preliminary Assessment, Cap Martin Complex. August.
——. 2006c. Abbreviated Preliminary Assessment, Granite Creek Mine #5. August.
——. 2006d. Abbreviated Preliminary Assessment, Granite Creek Mine #6. August.
——. 2006c. Abbreviated Preliminary Assessment, Granite Creek Mine #7. August.
——. 2016. Final Environmental Impact Statement, Granite Creek Watershed Mining Project. March.
United States Environmental Protection Agency (USEPA). 1993. Guidance on Conducting Non-Time-Critical Removal Actions Under CERCLA. Washington, DC: Office of Solid Waste and Emergency Response. PB93-963402. EPA 540-R-63-057. August.
——. 1994. Considering Wetlands at CERCLA Sites. May.

———. 2000. A Guide to Developing and Documenting Cost Estimates During the Feasibility Study. July.

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Table 1
Summary of Soil Analytical Results
Non-Time-Critical Removal Action Engineering Evaluation/Cost Analysis
Upper Granite Creek Watershed Mines
Wallowa-Whitman National Forest, Oregon

| | | | Collection | | | | | | | | Me | tals | | | | | | |
|------------|------------|---------------------|--------------------|------------------------|----------|-------------------|-------------------|------------|------------|----------|----------------|--------------|----------|----------|----------|----------|----------------|-------------|
| | | | Depth | Sample | | | | Arsenic, | Arsenic, | | | | | Chromium | | | | |
| AOI | Company | Location | (ft bgs) | Date | Aluminum | Antimony | Arsenic | IVBA | Total IVBA | Barium | Beryllium | Cadmium | Calcium | (total) | Cobalt | Copper | Iron | Lead |
| | PR | G for SAP | | | | 4895 | 82 | | | | 24468 | 9113 | | | 3681 | 489424 | | |
| | Tai | lings PRG | | | | | 110 | | | | | | | | | | | |
| | Waste | Rock/Soil PRG | | | | | 190 | | | | | | | | | | | |
| ODEC | Q Blue Mou | ntain Region Clear | n Fill | | | 1.3 | 14 | | | 950 | 2.6 | 0.69 | | 190 | | 120 | | 21 |
| | | Plant Direct Toxic | | | | 11 | 18 | | | 110 | 2.5 | 32 | | | 13 | 70 | | 120 |
| ODE | Q Eco RBC | Inverts Direct Toxi | city | | | 78 | 6.8 | | | 330 | 40 | 140 | | | | 80 | | 1700 |
| | ODEQ | Eco RBC Bird | | | | | 15 | | | 630 | | 0.29 | | 23 | 76 | 14 | | 11 |
| | ODEQ Ec | o RBC Mammal | | | | 0.27 | 19 | | | 1800 | 21 | 0.27 | | 34 | 230 | 42 | | 56 |
| (| ODEQ Excav | ation Worker RCB | | | | | 420 | | | | 19000 | 9700 | | | | 390000 | | 800 |
| | | BG-SSS-19 | 0.5 | 7/19/2003 | 24400 | 0.84 J | 4.5 | NA | NA | 288 | 1.2 | 0.43 J | 1830 | 31.3 | 11.3 | 30.7 | 24600 | 8.4 |
| | EA | BG-SSS-34 | 0.5 | 7/15/2003 | 26400 | ND (0.38) | 3.4 | NA | NA | 187 | 0.72 | 0.35 J | 1130 | 5.7 | 5.5 | 8.9 | 10800 | 3.8 |
| | LA | BG-SSS-35 | 0.5 | 7/15/2003 | 31200 | ND (0.4) | 5.5 | NA | NA | 268 | 1 | 0.54 | 2110 | 6.2 | 6.7 | 15.4 | 12400 | 5.9 |
| | | BG-SSS-36 | 0.5 | 7/15/2003 | 19400 | ND (0.33) | 11.4 | NA | NA | 319 | 0.55 | ND (0.026) | 2080 | 27.4 | 10.2 | 11 | 17700 | 6.3 |
| | | BGS-01 | 0.5 - 1 | 6/26/2007 | NA | ND (0.2) | 6.2 | NA | NA | NA | 0.6 J | 1.1 | NA | 12 | NA | 8 | 22900 | 8.04 |
| Background | | BGS-02 | 0.5 - 1 | 6/26/2007 | NA | ND (0.2) | 7.8 | NA | NA | NA | 0.6 J | 1.45 | NA | 7 | NA | 10 | 13600 | 5.98 |
| | | BGS-03 | 0.5 - 1 | 6/26/2007 | NA | 0.2 J | 5.4 | NA | NA | NA | 0.4 J | 0.39 | NA | 11 | NA | 8 | 20300 | 4.58 |
| | CES | BGS-04 | 0.5 - 1 | 6/26/2007 | NA | ND (0.2) | 9 | NA | NA | NA | 0.8 J | 2.03 | NA | 15 | NA | 24 | 16800 | 7.62 |
| | | BGS-05 | 0.5 - 1 | 6/26/2007 | NA | 0.3 J | 11.8 | NA | NA | NA | 0.9 J | 1.85 | NA | 7 | NA | 31 | 13400 | 7.92 |
| | | BGS-06 | 0.5 - 1 | 6/27/2007 | NA | 0.2 J | 15.3 | NA | NA | NA | 0.4 J | 0.51 | NA | 15 | NA | 5 | 29800 | 4.86 |
| | | BGS-07 BGS-08 | 0.5 - 1 0.5 - 1 | 6/27/2007 6/27/2007 | NA NA | ND (0.2) 0.3 J | 5 43.5 | NA NA | NA NA | NA NA | 0.6 J 0.4 J | 1.01 1.11 | NA NA | 12 70 | NA NA | 30 67 | 13600 35300 | 5.93 7.3 |
| | | TA-SUS-22 | 1.5 | 7/15/2003 | 12500 | 0.68 J | 6.3 | NA NA | NA NA | 155 | 0.4 J | ND (0.03) | 1940 | 5.2 | 8 8 | 3.3 | 16300 | 2.8 |
| | | WP-SUS-20 | 4 | 7/15/2003 | 15600 | 0.88 J | 10.1 | NA NA | NA NA | 180 | 0.383 | ND (0.03) | 2850 | 8.4 | 9.1 | 5.5 | 19700 | 3.6 |
| | EA | WP-SUS-21 | 2.5 | 7/15/2003 | 10400 | 2 J | 198 | NA NA | NA | 177 | 0.48 | 14.1 | 6320 | 5.5 | 7.4 | 43.5 | 20700 | 44.1 |
| | | WP-SUS-39 | 2 | 7/15/2003 | 14900 | 0.61 J | 17.5 | NA NA | NA | 167 | 0.44 | ND (0.025) | 905 | 9.7 | 9.6 | 11 | 19600 | 4.2 |
| | | CM-WR1-1 | 0.5 | 6/21/2007 | NA | 0.3 J | 19.6 | NA | NA | NA | ND (0.2) | 0.17 J | NA | 11 | NA | 4 J | 20500 | 5.71 |
| Cap Martin | | CM-WR2-1 | 0.5 | 6/21/2007 | NA | ND (0.2) | 9.7 | NA | NA | NA | ND (0.2) | 0.33 | NA | 9 | NA | 3 J | 15500 | 4.26 |
| | CES | CM-WR2-2 | 0.5 | 6/21/2007 | NA | ND (0.2) | 26.5 | NA | NA | NA | ND (0.2) | 0.2 J | NA | 11 | NA | 4 J | 12400 | 4.68 |
| | | CM-WR3-1 | 0.5 | 6/21/2007 | NA | 0.9 J | <u>131</u> | NA | NA | NA | 0.7 J | 0.27 J | NA | 3 J | NA | 3 | 16800 | 12.9 |
| | | CM-WR4-1 | 0.5 | 6/21/2007 | NA | ND (1) | <u>257</u> | NA | NA | NA | 0.3 J | 8.48 | NA | 6 | NA | 12 | 28800 | 105 |
| | TEI | CM-WRC-4 | 0.5 - 1 | 10/3/2024 | NA | NA | <u>292 (0.42)</u> | 33.1 (1.9) | 650 (4.9) | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | TA-SUS-33 | 1.5 | 7/10/2003 | 11100 | 1.3 J | 27.4 | NA | NA | 124 | 0.2 J | 0.36 J | 1380 | 9.8 | 7.2 | 12.6 | 16900 | 9.9 |
| | EA | WP-SSS-31 | 0.5 | 7/10/2003 | 11100 | 5.9 J | <u>295</u> | NA | NA | 223 | 0.28 J | 3.4 | 2110 | 10.4 | 8.5 | 56.2 | 31400 | 358 |
| | | WP-SUS-31 | 4.5 | 7/10/2003 | 10900 | 2.3 J | <u>150</u> | NA | NA | 179 | 0.29 J | 2.2 | 2270 | 8.4 | 8.1 | 30.6 | 26500 | 53 |
| Central | | WP-SUS-32 | 4 | 7/10/2003 | 17600 | 1.8 J | <u>106</u> | NA | NA | 225 | 0.3 J | 1.1 | 1900 | 13.3 | 9.9 | 16.3 | 28200 | 22.9 |
| | | CEM-WRA-2 | 0.5 - 1 | 10/5/2024 | NA | NA | <u>299 (8.3)</u> | 44.5 (2) | 794 (5) | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | TEI | CEM-WRA-4-DS | 0.5 - 1 | 10/2/2024 | NA | NA | 32.6 (0.4) | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | CEM-WRB-1 | 0.5 - 1 | 10/5/2024 | NA | NA | <u>151 (8.6)</u> | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | CEM-WRC-1 | 0.5 - 1 | 10/5/2024 | NA | NA | <u>110 (8)</u> | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |

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Table 1
Summary of Soil Analytical Results
Non-Time-Critical Removal Action Engineering Evaluation/Cost Analysis
Upper Granite Creek Watershed Mines
Wallowa-Whitman National Forest, Oregon

| | | | Collection | | | | | | | | Me | tals | | | | | | |
|-------------------------|-----------|---------------------|------------|-----------|----------|----------|------------------|------------|------------|--------|-----------|---------|---------|----------|--------|--------|-------|------|
| | | | Depth | Sample | | | | Arsenic, | Arsenic, | | | | | Chromium | | | | 1 |
| AOI | Company | Location | (ft bgs) | Date | Aluminum | Antimony | Arsenic | IVBA | Total IVBA | Barium | Beryllium | Cadmium | Calcium | (total) | Cobalt | Copper | Iron | Lead |
| | PR | G for SAP | , , | | | 4895 | 82 | | | | 24468 | 9113 | | | 3681 | 489424 | | |
| | Tai | lings PRG | | | | | 110 | | | | | | | | | | | |
| | Waste | Rock/Soil PRG | | | | | 190 | | | | | | | | | | | |
| ODEQ | Blue Mou | ntain Region Clea | n Fill | | | 1.3 | 14 | | | 950 | 2.6 | 0.69 | | 190 | | 120 | | 21 |
| ODE | Q Eco RBC | Plant Direct Toxic | ity | | | 11 | 18 | | | 110 | 2.5 | 32 | | | 13 | 70 | | 120 |
| ODEC | Q Eco RBC | Inverts Direct Toxi | city | | | 78 | 6.8 | | | 330 | 40 | 140 | | | | 80 | | 1700 |
| | ODEQ | Eco RBC Bird | | | | | 15 | | | 630 | | 0.29 | | 23 | 76 | 14 | | 11 |
| | ODEQ Ec | o RBC Mammal | | | | 0.27 | 19 | | | 1800 | 21 | 0.27 | | 34 | 230 | 42 | | 56 |
| 0 | DEQ Excav | ation Worker RCB | 3 | | | | 420 | | | - | 19000 | 9700 | | | | 390000 | | 800 |
| | | GF-WR-01 | 1 | 6/25/2007 | NA | 0.6 J | 28.7 | NA | NA | NA | 0.3 J | 1 | NA | 20 | NA | 12 | 26300 | 14.8 |
| | CES | GF-WR-2 | 0.5 | 6/25/2007 | NA | 30 J | <u>1340</u> | NA | NA | NA | ND (0.2) | 1.36 | NA | 6 | NA | 114 | 97300 | 2430 |
| | CLS | GF-WR2-1 | 0.5 | 6/21/2007 | NA | 3.1 | <u>141</u> | NA | NA | NA | 0.3 J | 4.07 | NA | 12 | NA | 22 | 30500 | 143 |
| Golden Fraction | | GF-WR-3 | 0.5 | 6/25/2007 | NA | 1.5 | <u>89</u> | NA | NA | NA | 0.3 J | 0.85 | NA | 18 | NA | 15 | 35600 | 4.89 |
| Golden Haction | | GF-DR-1 | 0.5 - 1 | 10/5/2024 | NA | NA | 58.3 (8.4) | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | TEI | GF-WRA-1 | 0.5 - 1 | 10/5/2024 | NA | NA | <u>332 (7.8)</u> | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | 161 | GF-WRD-4-DS | 0.5 - 1 | 10/5/2024 | NA | NA | 55.2 (8.5) | 12.3 (2) | 137 (4.9) | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | GF-WRD-6 | 0.5 - 1 | 10/5/2024 | NA | NA | 66.6 (7.9) | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | CES | GC5-WR-01 | 0.5 | 6/26/2007 | NA | 1.4 | <u>155</u> | NA | NA | NA | 0.3 J | 3.35 | NA | 13 | NA | 34 | 27300 | 35.8 |
| | 020 | GC5-WR-02 | 0.5 | 6/26/2007 | NA | 2.4 | <u>170</u> | NA | NA | NA | 0.4 J | 4.77 | NA | 18 | NA | 61 | 30600 | 88.5 |
| Granite Creek #5 | | GC5-WRA-3 | 0.5 - 1 | 10/4/2024 | NA | NA | <u>421 (8)</u> | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | TEI | GC5-WRA-4 | 0.5 - 1 | 10/4/2024 | NA | NA | <u>160 (7.8)</u> | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | GC5-WRA-4-DS | 0.5 - 1 | 10/4/2024 | NA | NA | 81.3 (7.9) | 10.4 (1.9) | 221 (5) | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | GC6-WR-01 | 0.5 | 6/24/2007 | NA | ND (0.2) | 9.3 | NA | NA | NA | ND (0.2) | 0.21 | NA | 9 | NA | 14 | 20700 | 1.49 |
| | CES | GC6-WR-02 | 0.5 | 6/24/2007 | NA | ND (0.2) | 6.6 | NA | NA | NA | 0.3 J | 0.24 | NA | 10 | NA | 6 | 21400 | 3.37 |
| Granite Creek #6 | | GC6-WR-03 | 0.5 | 6/24/2007 | NA | ND (0.2) | 1.7 | NA | NA | NA | ND (0.2) | 0.29 J | NA | ND (1) | NA | 4 J | 2650 | 0.85 |
| | TEI | GC6-WRA-1 | 0.5 - 1 | 10/4/2024 | NA | NA | <u>257 (8.5)</u> | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | GC6-WRA-2 | 0.5 - 1 | 10/4/2024 | NA | NA | <u>504 (8.5)</u> | 29.3 (2) | 759 (4.9) | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | GC7-WR-01 | 0.5 | 6/24/2007 | NA | 19 | <u>185</u> | NA | NA | NA | 0.4 J | 1.84 | NA | 6 | NA | 120 | 22600 | 81.7 |
| | CES | GC7-WR-02 | 0.5 | 6/24/2007 | NA | 2.5 | <u>142</u> | NA | NA | NA | 0.6 J | 0.5 | NA | 7 | NA | 17 | 28500 | 19 |
| Granite Creek 7 | | GC7-WR-03 | 0.5 | 6/24/2007 | NA | 7.6 | <u>220</u> | NA | NA | NA | 0.6 J | 0.76 | NA | 3 | NA | 66 | 25100 | 17.1 |
| | | GC7-WR-04 | 0.5 | 6/24/2007 | NA | 0.4 J | 22.9 | NA | NA | NA | 0.3 J | 0.27 J | NA | 9 | NA | 9 | 22500 | 4.94 |
| | TEI | GC7-WRA-3 | 0.5 - 1 | 10/4/2024 | NA | NA | 26.9 (8.5) | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | GC7-WRB-1 | 0.5 - 1 | 10/4/2024 | NA | NA | 7.43 (0.43) | NA | NA | NA | NA | NA | NA | NA - | NA | NA | NA | NA |
| Granite Creek Aq. St. 3 | CES | GC3-WR-01 | 0.5 | 6/24/2007 | NA | 7.2 | <u>337</u> | NA | NA | NA | 0.3 J | 7.97 | NA | 7 | NA | 57 | 29900 | 152 |

Table 1
Summary of Soil Analytical Results
Non-Time-Critical Removal Action Engineering Evaluation/Cost Analysis
Upper Granite Creek Watershed Mines
Wallowa-Whitman National Forest, Oregon

| | | | Collection | | | | | | | | Me | tals | | | | | | |
|-------------|-----------|------------------------|------------|------------------------|----------------|--------------|-------------------|------------|------------|------------|--------------|--------------------|--------------|------------|-------------|--------------|----------------|--------------|
| | | | Depth | Sample | | | | Arsenic, | Arsenic, | | | | | Chromium | | | | |
| AOI | Company | Location | (ft bgs) | Date | Aluminum | Antimony | Arsenic | IVBA | Total IVBA | Barium | Beryllium | Cadmium | Calcium | (total) | Cobalt | Copper | Iron | Lead |
| | PR | G for SAP | , , | | | 4895 | 82 | | | | 24468 | 9113 | | | 3681 | 489424 | | |
| | Та | ilings PRG | | | | | 110 | | | | | | | | | | | |
| | Waste | Rock/Soil PRG | | | | | 190 | | | | | | | | | | | |
| ODE | | ıntain Region Cleai | n Fill | | | 1.3 | 14 | | | 950 | 2.6 | 0.69 | | 190 | | 120 | | 21 |
| | | Plant Direct Toxic | | | | 11 | 18 | | | 110 | 2.5 | 32 | | | 13 | 70 | | 120 |
| | | Inverts Direct Toxi | | | | 78 | 6.8 | | | 330 | 40 | 140 | | | | 80 | | 1700 |
| | | Eco RBC Bird | • | | | | 15 | | | 630 | | 0.29 | | 23 | 76 | 14 | | 11 |
| | | o RBC Mammal | | | | 0.27 | 19 | | | 1800 | 21 | 0.27 | | 34 | 230 | 42 | | 56 |
| | ODEQ Exca | vation Worker RCB | | | | | 420 | | | | 19000 | 9700 | | | | 390000 | | 800 |
| | | ML-SSS-38 | 0.5 | 7/9/2003 | 1110 | 78.3 | <u>4470</u> | NA | NA | 51.7 | 0.033 J | 0.22 J | 308 J | 2.3 | 0.6 J | 26.6 | 16500 | 856 |
| | EA | WP-SSS-15 | 0.5 | 7/9/2003 | 3740 | 5 J | <u>573</u> | NA | NA | 149 | 0.25 J | 1.4 | 5570 | 3.5 | 6.4 | 14.6 | 18900 | 12.4 |
| | | WP-SUS-15 | 4 | 7/9/2003 | 4800 | 5.3 J | <u>544</u> | NA | NA | 176 | 0.25 J | 1.1 | 7180 | 4.4 | 6.6 | 18.2 | 20900 | 25 |
| | | MMDGA-T-46 | 3.5 | 9/30/2009 | NA | NA | <u>3340</u> | NA | NA | NA | NA | NA | NA | NA | NA | 152 | NA | 627 |
| | | MMDGA-WR-18 | 3.5 | 9/29/2009 | NA | NA | <u>2700</u> | NA | NA | NA | NA | NA | NA | NA | NA | 45 | NA | 589 |
| | | MMDGA-WR-19 | 3 | 9/29/2009 | NA | NA | <u>223</u> | NA | NA | NA | NA | NA | NA | NA | NA | 9.4 | NA | 16.1 |
| | CES | MMDGA-WR-20 | 3 | 9/29/2009 | NA | NA | <u>4610</u> | NA | NA | NA | NA | NA | NA | NA | NA | 220 | NA | 3210 |
| | CLS | MMDGA-WR-21 | | 9/29/2009 | NA | NA | <u>258</u> | NA | NA | NA | NA | NA | NA | NA | NA | 13.9 | NA | 12 |
| Lwr Mon'tl | | MMDGA-WR-24 | | 9/29/2009 | NA | NA | <u>8150</u> | NA | NA | NA | NA | NA | NA | NA | NA | 48 | NA | 712 |
| LWI WIOH CI | | MMDGA-WR-25 | | 9/29/2009 | NA | NA | <u>9360</u> | NA | NA | NA | NA | NA | NA | NA | NA | 60.5 | NA | 453 |
| | | MMDGA-WR-26 | | 9/29/2009 | NA | NA | <u>5690</u> | NA | NA | NA | NA | NA | NA | NA | NA | 135 | NA | 578 |
| | | LMM-WRA-3 | | 10/3/2024 | NA | NA | <u>125 (0.44)</u> | 16.6 (2) | 328 (4.9) | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | LMM-WRA-3-DS | 0.5 - 1 | 10/3/2024 | NA | NA | 21.6 (0.44) | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | LMM-WRA-4 | 0.5 - 1 | 10/3/2024 | NA | NA | <u>2290 (8.8)</u> | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | TEI | | 0.5 - 1 | 10/3/2024 | NA | NA | <u>2570 (8.5)</u> | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | LMM-WRB-1 | 0.5 - 1 | 10/3/2024 | NA | NA | 1090 (0.42) | NA NA | NA | NA | NA NA | NA NA | NA | NA NA | NA | NA NA | NA | NA |
| | | LNANA WADD 2 DC | | 10/3/2024 | NA | NA | <u>802 (0.42)</u> | NA NA | NA NA | NA NA | NA NA | NA NA | NA | NA NA | NA | NA NA | NA NA | NA NA |
| | | LMM-WRB-3-DS | 0.5 - 1 | 10/3/2024 | NA 17500 | NA 0.04 I | 29.1 (0.41) | NA NA | NA NA | NA 260 | NA O.F.F | NA ND (0.027) | NA 1030 | NA 8.6 | NA 10.5 | NA 10.2 | NA 20600 | NA 10.4 |
| | EA | TA-SUS-25 WP-SUS-23 | | 7/14/2003 7/14/2003 | 17500 11900 | 0.94 J 6 | 26 81.8 | NA NA | NA NA | 269 188 | 0.55 0.48 | ND (0.027) 0.63 | 1930 2920 | 8.6 6.7 | 10.5 8.6 | 10.2 30.5 | 20600 20100 | 10.4 15.6 |
| Sheridan | CES | SM-WR2-1 | | 6/21/2007 | NA | ND (0.2) | 16.8 | NA NA | NA NA | NA | ND (0.2) | 0.83 0.23 J | NA | 9 | NA | 30.3 7 | 20700 | 11.1 |
| Sheriaan | CLS | SH-WRB-2 | 0.5 - 1 | 10/4/2024 | NA | NA | 80.8 (0.39) | NA NA | NA NA | NA | NA | NA | NA NA | NA NA | NA NA | , NA | NA | NA NA |
| | TEI | SH-WRC-1 | 0.5 - 1 | 10/4/2024 | NA | NA | 14.4 (0.44) | NA | NA NA | NA | NA | NA | NA | NA | NA | NA NA | NA | NA |
| | | TA-SSS-30 | | 7/12/2003 | 11600 | 1.6 J | 58.6 | NA | NA | 201 | 0.2 J | 6.2 | 3480 | 8.8 | 8.8 | 10.4 | 22900 | 40.9 |
| | | WP-SSS-27 | 0.8 | 7/12/2003 | 9660 | 2.4 J | 88 | NA | NA | 177 | 0.2 J | 3.4 | 2600 | 5.9 | 8.2 | 27.5 | 20000 | 375 |
| | EA | WP-SSS-28 | | 7/12/2003 | 3550 | 1.3 J | 183 | NA | NA | 32.8 | 0.43 J | 2.8 | 26500 | 1.4 | 4.7 | 14.4 | 19300 | 52.2 |
| | | WP-SUS-26 | | 7/12/2003 | 8350 | 1.7 J | <u>156</u> | NA | NA | 138 | 0.29 J | 7.5 | 3120 | 4.3 | 6.7 | 32.3 | 23800 | 120 |
| Tillicum | | WP-SUS-27 | | 7/12/2003 | 11700 | 1.8 J | 35.7 | NA | NA | 206 | 0.21 J | 1.9 | 1830 | 6.8 | 8.2 | 15.2 | 21300 | 27.8 |
| | CES | TILL-WR-01 | | 6/26/2007 | NA | 5.5 | <u>371</u> | NA | NA | NA | 0.7 J | 15.6 | NA | 2 J | NA | 27 | 24600 | 184 |
| | | TL-WRA-1-DS-2 | | 10/4/2024 | NA | NA | <u>267 (0.44)</u> | 14.4 (1.9) | 550 (4.9) | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | TEI | TL-WRA-3 | | 10/4/2024 | NA | NA | <u>454 (0.42)</u> | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | TL-WRB-4 | 0.5 - 1 | 10/4/2024 | NA | NA | <u>194 (0.42)</u> | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |

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Non-Time-Critical Removal Action Engineering Evaluation/Cost Analysis
Upper Granite Creek Watershed Mines
Wallowa-Whitman National Forest, Oregon

| | | 1 | Collection | | | | | | | | Me | tals | | | | | | |
|----------------|-----------|---------------------------|--------------------|------------------------|----------|----------|---------------------------|-----------|------------|----------|-----------|------------|----------|----------|----------|----------|----------|------------|
| | | | Depth | Sample | | | | Arsenic, | Arsenic, | | | | | Chromium | | | | |
| AOI | Company | Location | (ft bgs) | Date | Aluminum | Antimony | Arsenic | IVBA | Total IVBA | Barium | Beryllium | Cadmium | Calcium | (total) | Cobalt | Copper | Iron | Lead |
| 7.0. | | G for SAP | (10.080) | Dute | | 4895 | 82 | | | | 24468 | 9113 | | | 3681 | 489424 | | |
| | | ilings PRG | | | | | 110 | | | | | | | | | | | |
| | | Rock/Soil PRG | | | | | 190 | | | | | | | | | | | |
| ODE | | ıntain Region Clear | n Fill | | | 1.3 | 14 | | | 950 | 2.6 | 0.69 | | 190 | | 120 | | 21 |
| | | Plant Direct Toxic | | | | 11 | 18 | | | 110 | 2.5 | 32 | | | 13 | 70 | | 120 |
| | • | Inverts Direct Toxic | | | | 78 | 6.8 | | | 330 | 40 | 140 | | | | 80 | | 1700 |
| OD. | | Eco RBC Bird | City | | | | 15 | | | 630 | | 0.29 | | 23 | 76 | 14 | | 11 |
| | | o RBC Mammal | | | | 0.27 | 19 | | | 1800 | 21 | 0.27 | | 34 | 230 | 42 | | 56 |
| | | vation Worker RCB | | | | | 420 | | | | 19000 | 9700 | | | | 390000 | | 800 |
| • | DDLQ LXCa | ML-SSS-12 | 0.7 | 7/9/2003 | 13300 | 4 J | 73 | NA | NA | 322 | 0.32 J | 0.65 | 3050 | 8.4 | 10.4 | 14.2 | 32000 | 27.5 |
| | | ML-SSS-12 ML-SSS-16 | 0.7 | 7/10/2003 | 6180 | 368 | 7500 | NA NA | NA NA | 129 | 0.32 J | 8.1 | 1610 | 7.7 | 1.6 J | 80 | 16300 | 1350 |
| | | WP-SSS-13 | 1 | 7/9/2003 | 4220 | 11.6 | <u>860</u> | NA NA | NA NA | 189 | 0.23 J | ND (0.064) | 523 J | 3.6 | 3.6 J | 12.5 | 21500 | 31.3 |
| | EA | WP-SSS-14 | 0.7 | 7/10/2003 | 3190 | 2.5 J | 616 | NA NA | NA NA | 69.8 | 0.087 J | 8.5 | 5980 | 2.3 | 5 J | 7.4 | 13600 | 15 |
| | | WP-SSS-17 | 1 | 7/9/2003 | 10600 | 241 | <u>11400</u> | NA | NA NA | 73.2 | 0.20 J | 23.4 | 3610 | 2.1 | 2.7 J | 698 | 16300 | 2120 |
| | | WP-SUS-14 | 3.5 | 7/10/2003 | 4680 | 5.8 J | 355 | NA | NA NA | 166 | 0.23 J | 0.52 | 10100 | 3.3 | 6.4 | 8 | 18800 | 36.9 |
| | | MMDGA-T-13 | 1 | 9/29/2009 | NA | NA | 10200 | NA | NA | NA | NA | NA | NA | NA | NA | 58.4 | NA | 1200 |
| | | MMDGA-T-34 | 0.25 | 9/30/2009 | NA | NA | 1900 | NA | NA | NA | NA | NA | NA | NA | NA | 119 | NA | 478 |
| | | MMDGA-T-34 | 2 | 9/30/2009 | NA | NA | 9610 | NA | NA | NA | NA | NA | NA | NA | NA | 440 | NA | 2340 |
| | | MMDGA-T-35 | 1 | 9/30/2009 | NA | NA | 4770 | NA | NA | NA | NA | NA | NA | NA | NA | 247 | NA | 1240 |
| | | MMDGA-T-37 | 0.25 | 9/30/2009 | NA | NA | 1360 | NA | NA | NA | NA | NA | NA | NA | NA | 128 | NA | 334 |
| | CES | MMDGA-T-40 | 2 | 9/30/2009 | NA | NA | <u>6310</u> | NA | NA | NA | NA | NA | NA | NA | NA | 460 | NA | 1140 |
| | CES | MMDGA-T-41 | 2 | 9/30/2009 | NA | NA | <u>8750</u> | NA | NA | NA | NA | NA | NA | NA | NA | 700 | NA | 1680 |
| | | MMDGA-T-9 | 1 | 9/29/2009 | NA | NA | <u>2440</u> | NA | NA | NA | NA | NA | NA | NA | NA | 75.3 | NA | 549 |
| Upr Mon'tl | | MMDGA-WR-2 | 4 | 9/28/2009 | NA | NA | <u>164</u> | NA | NA | NA | NA | NA | NA | NA | NA | 15.2 | NA | 11.3 |
| | | MMDGA-WR-28 | 0.5 | 9/29/2009 | NA | NA | <u>740</u> | NA | NA | NA | NA | NA | NA | NA | NA | 8.1 | NA | 10.4 |
| | | MMDGA-WR-3 | 4 | 9/28/2009 | NA | NA | <u>2240</u> | NA | NA | NA | NA | NA | NA | NA | NA | 70.6 | NA | 479 |
| | | MMDGA-WR-5 | 1 | 9/28/2009 | NA | NA | <u>2920</u> | NA | NA | NA | NA | NA | NA | NA | NA | 51.1 | NA | 231 |
| | | UMM-TLA-6 | 0.5 - 1 | 10/2/2024 | NA | NA | <u>3270 (8.1)</u> | 1350 (2) | 5560 (4.9) | NA | NA | NA | NA | NA | NA | NA | NA | 589 (0.81) |
| | | UMM-TLB-1 | 0.5 - 1 | 10/2/2024 | NA | NA | <u>6130 (11)</u> | 1840 (2) | 4420 (4.9) | NA | NA | NA | NA | NA | NA | NA | NA | 1710 (1.1) |
| | | UMM-TLB-4 | 0.5 - 1 | 10/2/2024 | NA | NA | <u>1540 (8)</u> | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | UMM-TLC-1 | 0.5 - 1 | 10/2/2024 | NA | NA | <u>5290 (9.9)</u> | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | UMM-TLC-2 | 0.5 - 1 | 10/2/2024 | NA | NA | <u>4980 (10)</u> | NA (a) | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | TEI | UMM-WRA-1 | 0.5 - 1 | 10/2/2024 | NA | NA | <u>1300 (8.4)</u> | 12.7 (2) | 1590 (4.9) | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | UMM-WRA-1-DS | 0.5 - 1 | 10/2/2024 | NA | NA | 37.5 (0.41) | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | UMM-WRA-3 | | 10/2/2024 | NA NA | NA | 1210 (0.45) | | NA NA | NA | NA NA | NA NA | NA | NA NA | NA NA | NA NA | NA | NA |
| | | UMM-WRB-1 | 0.5 - 1 | 10/2/2024 | NA NA | NA | 14000 (41) | NA | NA | NA | NA NA | NA NA | NA | NA NA | NA NA | NA | NA | 5210 (4.1) |
| | | UMM-WRB-2 UMM-WRB-2-DS | 0.5 - 1 0.5 - 1 | 10/2/2024 10/2/2024 | NA NA | NA NA | 1800 (8.2) 79.2 (0.45) | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA |
| | + | UUMM-WRA-2 | 0.5 - 1 | 10/2/2024 | NA NA | NA NA | 1940 (8.8) | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA |
| | | JOIVIIVI-VVRA-Z | | 10/2/2024 | NA NA | NA NA | 1710 (9.1) | 176 (1.9) | 3440 (4.9) | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA |
| | | UUMM-WRA-3 | | 10/2/2024 | NA NA | NA NA | 1470 (8) | 162 (2) | 3280 (5) | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA |
| Upr Upr Mon'tl | TEI | UUMM-WRA-3-DS | | 10/2/2024 | NA NA | NA NA | 16 (0.44) | NA | NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA |
| | | UUMM-WRD-1 | 0.5 - 1 | 10/2/2024 | NA | NA | 269 (0.45) | NA | NA | NA | NA | NA NA | NA | NA NA | NA | NA | NA | NA |
| | | UUMM-WRF-1 | | 10/2/2024 | NA | NA | <u>715 (0.44)</u> | NA | NA | NA | NA | NA NA | NA | NA | NA | NA | NA | NA |
| | | OCIVIIVI VVIII 'I | 0.5 1 | 10/2/2024 | 147 | 14/7 | <u>/ 4 / (0.77)</u> | INA | 14/7 | 147 | | 14/7 | 14/7 | IVA | 14/7 | 1477 | 11/7 | 11/7 |

Table 1
Summary of Soil Analytical Results
Non-Time-Critical Removal Action Engineering Evaluation/Cost Analysis
Upper Granite Creek Watershed Mines
Wallowa-Whitman National Forest, Oregon

| | | | Collection | | | | | | | | Metals | | | | | | |
|------------|------------|-----------------------|------------|------------------------|------------|-------------|------------|------------|-----------------|------------|------------|---------------|----------------|------------|-----------------|------------|----------|
| | | | Depth | Sample | | Lead. Total | | | | | | | | | | | |
| AOI | Company | Location | (ft bgs) | Date | Lead, IVBA | IVBA | Magnesium | Manganese | Mercury | Nickel | Potassium | Selenium | Silver | Sodium | Thallium | Vanadium | Zinc |
| 7.5. | , | G for SAP | (10 083) | Dute | | | | | 2153 | 244668 | | 61175 | 61145 | | | 61218 | |
| | | lings PRG | | | | | | | | | | | | | | | |
| | | Rock/Soil PRG | | | | | | | | | | | | | | | |
| ODE | | Intain Region Clear | n Fill | | | | | 1800 | 1.4 | 92 | | 0.93 | 0.51 | | | 400 | 160 |
| | • | Plant Direct Toxic | | | | | | 220 | 34 | 38 | | 0.52 | 560 | | 0.05 | 60 | 160 |
| | - | Inverts Direct Toxi | | | | | | 450 | 0.05 | 280 | | 4.1 | | | | | 120 |
| | | Eco RBC Bird | city | | | | | 1300 | 0.013 | 20 | | 0.71 | 2.6 | | 4.5 | 4.7 | 46 |
| | | o RBC Mammal | | | | | | 1400 | 1.7 | 10 | | 0.63 | 14 | | 0.42 | 280 | 79 |
| | | vation Worker RCB | \ | | | | | 230000 | 2900 | 190000 | | | 49000 | | | | |
| | JDEQ EXCUT | BG-SSS-19 | 0.5 | 7/19/2003 | NA | NA | 2630 | 837 | 0.14 | 23.4 | 1570 | 0.76 | 0.26 J | 806 | 0.97 | 47.8 | 105 |
| | | BG-SSS-34 | 0.5 | 7/15/2003 | NA | NA | 880 | 429 | 0.032 J | 5.2 | 848 | 0.61 | 0.28 J | 1220 | ND (0.28) | 24.9 | 50.2 |
| | EA | BG-SSS-35 | 0.5 | 7/15/2003 | NA | NA | 1560 | 156 | 0.035 J | 5.6 | 1140 | 0.42 J | 0.62 J | 1450 | ND (0.29) | 26.5 | 43.2 |
| | | BG-SSS-36 | 0.5 | 7/15/2003 | NA | NA | 4930 | 610 | 0.027 J | 23.4 | 3920 | 0.24 J | 0.48 J | 1180 | ND (0.24) | 47.2 | 61.3 |
| | | BGS-01 | 0.5 - 1 | 6/26/2007 | NA | NA | NA | 716 | 0.06 J | 7 | NA | 0.37 | 0.29 | NA | NA | NA | 71 |
| Background | | BGS-02 | 0.5 - 1 | 6/26/2007 | NA | NA | NA | 668 | ND (0.04) | 6 | NA | 0.28 J | 0.51 | NA | NA | NA | 61 |
| Background | | BGS-03 | 0.5 - 1 | 6/26/2007 | NA | NA | NA | 644 | 0.05 J | 8 | NA | 0.15 J | 0.2 | NA | NA | NA | 71 |
| | CES | BGS-04 | | 6/26/2007 | NA | NA | NA | 848 | 0.06 J | 23 | NA | 0.36 | 0.63 | NA | NA | NA | 126 |
| | CLS | BGS-05 | | 6/26/2007 | NA | NA | NA | 319 | 0.06 J | 10 | NA | 0.77 | 0.58 | NA | NA | NA | 44 |
| | | BGS-06 | | 6/27/2007 | NA | NA | NA | 644 | ND (0.04) | 7 | NA | 0.24 J | 0.32 | NA | NA | NA | 88 |
| | | BGS-07 | | 6/27/2007 | NA | NA | NA | 606 | 0.07 J | 13 | NA | 0.39 | 0.23 | NA | NA | NA | 60 |
| | | BGS-08 | | 6/27/2007 | NA | NA | NA | 1060 | 0.08 J | 70 | NA | 0.38 | 0.53 | NA | NA | NA | 145 |
| | | TA-SUS-22 | 1.5 | 7/15/2003 | NA | NA | 5180 | 408 | 0.058 | 3.8 J | 3720 | 0.24 J | 0.28 J | 982 | ND (0.28) | 40.6 | 41.8 |
| | EA | WP-SUS-20 | 4 | 7/15/2003 | NA | NA | 5320 | 270 | 0.026 J | 4.3 | 4080 | ND (0.31) | 0.63 J | 1100 | ND (0.25) | 52.2 | 48.6 |
| | | WP-SUS-21 | 2.5 | 7/15/2003 | NA | NA | 2980 | 504 | 0.3 | 4.1 | 3240 | 0.4 J | 4.2 | 122 J | 0.45 J | 33.9 | 495 |
| | | WP-SUS-39 CM-WR1-1 | 0.5 | 7/15/2003 6/21/2007 | NA NA | NA NA | 4560 NA | 321 312 | 0.064 0.06 J | 4.8 3 J | 3560 NA | 0.4 J 0.3 | 0.79 J 0.14 | 1060 NA | ND (0.23) NA | 52.2 NA | 50.5 |
| Cap Martin | | CM-WR1-1 CM-WR2-1 | 0.5 | 6/21/2007 | NA NA | NA NA | NA NA | 234 | ND (0.04) | 3 J | NA NA | 0.3 0.23 J | 0.14 0.08 J | NA NA | NA NA | NA NA | 39 34 |
| | CES | CM-WR2-2 | 0.5 | 6/21/2007 | NA NA | NA NA | NA NA | 198 | 0.07 J | 4 J | NA NA | 0.23 J | 0.083 | NA NA | NA NA | NA NA | 25 |
| | CLS | CM-WR3-1 | 0.5 | 6/21/2007 | NA NA | NA | NA NA | 69.4 | 0.07 J | 2.J | NA NA | 0.58 | 0.13 | NA NA | NA NA | NA NA | 50 |
| | | CM-WR4-1 | 0.5 | 6/21/2007 | NA NA | NA | NA | 657 | 0.06 J | 5 J | NA | 0.46 | 1.42 | NA | NA | NA | 330 |
| | TEI | CM-WRC-4 | 0.5 - 1 | 10/3/2024 | | 10.3 (0.49) | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | TA-SUS-33 | 1.5 | 7/10/2003 | NA | NA | 4650 | 378 | 0.12 | 6.9 | 2750 | 0.52 | ND (0.21) | 805 | 0.34 J | 44.2 | 63.2 |
| | | WP-SSS-31 | 0.5 | 7/10/2003 | NA | NA | 4860 | 1260 | 0.27 | 9.6 | 2840 | 1.6 | 2.7 | 787 | 3.3 | 96.1 | 203 |
| | EA | WP-SUS-31 | 4.5 | 7/10/2003 | NA | NA | 3450 | 833 | 0.19 | 8 | 1770 | 1 | 1.9 | 425 J | 2.5 | 59.4 | 137 |
| Control | | WP-SUS-32 | 4 | 7/10/2003 | NA | NA | 6300 | 697 | 0.12 | 9.7 | 4030 | 1 | 0.28 J | 1040 | 1.3 | 73.7 | 96.2 |
| Central | | CEM-WRA-2 | 0.5 - 1 | 10/5/2024 | 21.9 (0.2) | 78.5 (0.5) | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | TEI | CEM-WRA-4-DS | 0.5 - 1 | 10/2/2024 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | l 'EI | CEM-WRB-1 | 0.5 - 1 | 10/5/2024 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | CEM-WRC-1 | 0.5 - 1 | 10/5/2024 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |

Table 1
Summary of Soil Analytical Results
Non-Time-Critical Removal Action Engineering Evaluation/Cost Analysis
Upper Granite Creek Watershed Mines
Wallowa-Whitman National Forest, Oregon

| | | | Collection | | | | | | | | Metals | | | | | | |
|-------------------------|-----------|---------------------|------------|-----------|-------------|-------------|-----------|-----------|------------|--------|-----------|----------|--------|--------|----------|----------|------|
| | | | Depth | Sample | | Lead, Total | | | | | | | | | | | |
| AOI | Company | Location | (ft bgs) | Date | Lead. IVBA | IVBA | Magnesium | Manganese | Mercury | Nickel | Potassium | Selenium | Silver | Sodium | Thallium | Vanadium | Zinc |
| | <u> </u> | G for SAP | (10.080) | | | | | | 2153 | 244668 | | 61175 | 61145 | | | 61218 | |
| | | lings PRG | | | | | | | | | | | | | | | |
| | | Rock/Soil PRG | | | | | | | | | | | | | | | |
| ODEO | Blue Mou | ntain Region Clea | n Fill | | | | | 1800 | 1.4 | 92 | | 0.93 | 0.51 | | | 400 | 160 |
| | | Plant Direct Toxic | | | | | | 220 | 34 | 38 | | 0.52 | 560 | | 0.05 | 60 | 160 |
| | | Inverts Direct Toxi | | | | | | 450 | 0.05 | 280 | | 4.1 | | | | | 120 |
| | ODEQ | Eco RBC Bird | • | | | | | 1300 | 0.013 | 20 | | 0.71 | 2.6 | | 4.5 | 4.7 | 46 |
| | ODEQ Ec | o RBC Mammal | | | | | | 1400 | 1.7 | 10 | | 0.63 | 14 | | 0.42 | 280 | 79 |
| 0 | DEQ Excav | ation Worker RCB | | | | | | 230000 | 2900 | 190000 | | | 49000 | | | | |
| | | GF-WR-01 | 1 | 6/25/2007 | NA | NA | NA | 692 | NDH (0.04) | 6 | NA | 0.23 J | 0.58 | NA | NA | NA | 191 |
| | CES | GF-WR-2 | 0.5 | 6/25/2007 | NA | NA | NA | 97.5 | 2.61 | 1 | NA | 3.26 | 52 | NA | NA | NA | 305 |
| | CES | GF-WR2-1 | 0.5 | 6/21/2007 | NA | NA | NA | 718 | 0.19 J | 7 | NA | 0.39 | 7.95 | NA | NA | NA | 201 |
| Golden Fraction | | GF-WR-3 | 0.5 | 6/25/2007 | NA | NA | NA | 544 | NDH (0.04) | 8 | NA | 0.34 | 0.64 | NA | NA | NA | 94 |
| Golden Fraction | | GF-DR-1 | 0.5 - 1 | 10/5/2024 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | TEI | GF-WRA-1 | 0.5 - 1 | 10/5/2024 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | 1 1 1 | GF-WRD-4-DS | 0.5 - 1 | 10/5/2024 | 8.94 (0.2) | 25.6 (0.49) | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | GF-WRD-6 | 0.5 - 1 | 10/5/2024 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | CES | GC5-WR-01 | 0.5 | 6/26/2007 | NA | NA | NA | 821 | 0.08 JH | 8 | NA | 0.4 | 1.2 | NA | NA | NA | 221 |
| | CLS | GC5-WR-02 | 0.5 | 6/26/2007 | NA | NA | NA | 929 | 0.07 JH | 8 | NA | 0.55 | 5.05 | NA | NA | NA | 250 |
| Granite Creek #5 | | GC5-WRA-3 | 0.5 - 1 | 10/4/2024 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | TEI | GC5-WRA-4 | 0.5 - 1 | 10/4/2024 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | GC5-WRA-4-DS | 0.5 - 1 | 10/4/2024 | 26.4 (0.19) | 70.4 (0.5) | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | GC6-WR-01 | 0.5 | 6/24/2007 | NA | NA | NA | 497 | 1.21 H | 4 J | NA | 0.25 J | 0.08 J | NA | NA | NA | 59 |
| | CES | GC6-WR-02 | 0.5 | 6/24/2007 | NA | NA | NA | 367 | 0.09 JH | 4 J | NA | 0.26 J | 0.09 J | NA | NA | NA | 62 |
| Granite Creek #6 | | GC6-WR-03 | 0.5 | 6/24/2007 | NA | NA | NA | 25.3 | NDH (0.05) | ND (1) | NA | 0.17 J | 0.08 J | NA | NA | NA | 4 J |
| | TEI | GC6-WRA-1 | 0.5 - 1 | 10/4/2024 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | 1.51 | GC6-WRA-2 | 0.5 - 1 | 10/4/2024 | 150 (0.2) | 360 (0.49) | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | GC7-WR-01 | 0.5 | 6/24/2007 | NA | NA | NA | 661 | 0.24 H | 5 J | NA | 0.35 | 20.4 | NA | NA | NA | 134 |
| | CES | GC7-WR-02 | 0.5 | 6/24/2007 | NA | NA | NA | 593 | 0.24 | 5 | NA | 0.4 | 1.79 | NA | NA | NA | 84 |
| Granite Creek 7 | | GC7-WR-03 | 0.5 | 6/24/2007 | NA | NA | NA | 608 | 0.42 | 0.4 | NA | 0.45 | 4.08 | NA | NA | NA | 83 |
| Granite Creek / | | GC7-WR-04 | 0.5 | 6/24/2007 | NA | NA | NA | 443 | NDH (0.04) | 4 J | NA | 0.26 | 0.34 | NA | NA | NA | 61 |
| | TEI | GC7-WRA-3 | 0.5 - 1 | 10/4/2024 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | GC7-WRB-1 | 0.5 - 1 | 10/4/2024 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Granite Creek Aq. St. 3 | CES | GC3-WR-01 | 0.5 | 6/24/2007 | NA | NA | NA | 1070 | 0.29 H | 4 J | NA | 0.27 J | 19.1 | NA | NA | NA | 377 |

Table 1
Summary of Soil Analytical Results
Non-Time-Critical Removal Action Engineering Evaluation/Cost Analysis
Upper Granite Creek Watershed Mines
Wallowa-Whitman National Forest, Oregon

| | | | Collection | | | | | | | | Metals | | | | | | |
|------------|-----------|------------------------|----------------|------------------------|------------|-------------|--------------|------------|-------------------|------------|--------------|----------------|---------------|-----------------|-----------------|--------------|------------|
| | | | Depth | Sample | | Lead, Total | | | | | | | | | | | |
| AOI | Company | Location | (ft bgs) | Date | Lead, IVBA | IVBA | | Manganese | Mercury | Nickel | Potassium | Selenium | Silver | Sodium | Thallium | Vanadium | Zinc |
| AOI | | G for SAP | (it bgs) | Date | | | | | 2153 | 244668 | | 61175 | 61145 | | | 61218 | |
| | | ilings PRG | | | | | | | | | | | | | | | |
| | | Rock/Soil PRG | | | | | | | | | | | | | | | |
| ODE | | | . F:II | | | | | 1800 | 1.4 | 92 | | 0.93 | 0.51 | | | 400 | 160 |
| | | untain Region Clear | | | | | | - | | _ | | | | | | | |
| | | C Plant Direct Toxic | • | | | | | 220 | 34 | 38 | | 0.52 | 560 | | 0.05 | 60 | 160 |
| ODE | | Inverts Direct Toxi | city | | | | | 450 | 0.05 | 280 | | 4.1 | | | | | 120 |
| | | Eco RBC Bird | | | | | | 1300 | 0.013 | 20 | | 0.71 | 2.6 | | 4.5 | 4.7 | 46 |
| | | o RBC Mammal | | | | | | 1400 | 1.7 | 10 | | 0.63 | 14 | | 0.42 | 280 | 79 |
| | ODEQ Exca | vation Worker RCB | | T. | | | | 230000 | 2900 | 190000 | | | 49000 | | | | |
| | | ML-SSS-38 | 0.5 | 7/9/2003 | NA | NA | 212 J | 30.9 | 0.37 | 2.2 J | 836 | 0.86 | 48 | 193 J | ND (0.46) | 5.1 J | 65 |
| | EA | WP-SSS-15 | 0.5 | 7/9/2003 | NA | NA | 3690 | 757 | 0.14 | 4.8 | 2010 | 0.9 | 7.1 | 385 J | 1.5 | 24.7 | 107 |
| | | WP-SUS-15 | 4 | 7/9/2003 | NA | NA | 4940 | 776 | 0.33 | 6 | 2730 | 0.99 | 6.4 | 478 | 1.8 | 30.3 | 130 |
| | | MMDGA-T-46 | 3.5 | 9/30/2009 | NA | NA | NA | 208 | 95 | NA | NA | NA | 54.9 | NA | NA | NA | 1500 |
| | | MMDGA-WR-18 | 3.5 | 9/29/2009 | NA | NA | NA | 51.1 | 0.42 | NA | NA | NA | 48.8 | NA | NA | NA | 152 |
| | | MMDGA-WR-19 | 3 | 9/29/2009 | NA | NA | NA | 277 | 0.17 J | NA | NA | NA | 1.14 | NA | NA | NA | 63 |
| | CES | MMDGA-WR-20 | 3 | 9/29/2009 | NA | NA | NA | 185 | 1.28 | NA | NA | NA | 343 | NA | NA | NA | 1140 |
| | | MMDGA-WR-21 | 1 | 9/29/2009 | NA | NA | NA | 784 | 0.36 | NA | NA | NA | 2.6 | NA | NA | NA | 132 |
| Lwr Mon'tl | | MMDGA-WR-24 | 0.5 | 9/29/2009 | NA | NA | NA | 342 | 2.99 | NA | NA | NA | 21.9 | NA | NA | NA | 78 |
| | | MMDGA-WR-25 | 0.5 | 9/29/2009 | NA | NA | NA | 207 | 0.53 | NA | NA | NA | 9.47 | NA | NA | NA | 69 |
| | | MMDGA-WR-26 | 0.5 | 9/29/2009 | NA | NA | NA | 713 | 0.84 | NA | NA | NA | 40 | NA | NA | NA | 2030 |
| | | LMM-WRA-3 | 0.5 - 1 | 10/3/2024 | 10.8 (0.2) | 32 (0.49) | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | LMM-WRA-3-DS | 0.5 - 1 | 10/3/2024 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | LMM-WRA-4 | 0.5 - 1 | 10/3/2024 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | TEI | | 0.5 - 1 | 10/3/2024 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | LMM-WRB-1 | 0.5 - 1 | 10/3/2024 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | 1141414155 2 50 | 0.5 - 1 | 10/3/2024 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | LMM-WRB-3-DS | 0.5 - 1 | 10/3/2024 | NA | NA | NA COALO | NA | NA | NA 5.3 | NA 1000 | NA 0.24 i | NA | NA 1222 | NA ND (0.26) | NA 50.5 | NA |
| | EA | TA-SUS-25 | 1.5 | 7/14/2003 | NA NA | NA | 6310 | 444 | 0.048 | 5.3 | 4900 | 0.24 J | 1.4 | 1330 | ND (0.26) | 58.5 | 66.9 |
| Charidan | CEC | WP-SUS-23 | 3.5 | 7/14/2003 | NA NA | NA | 5200 | 782 | 0.36 | 5.2 | 3320 | 0.48 | 32.5 | 676 | 0.76 J | 50.8 | 87.8 |
| Sheridan | CES | SM-WR2-1 SH-WRB-2 | 0.5 0.5 - 1 | 6/21/2007 10/4/2024 | NA NA | NA NA | NA NA | 278 NA | 0.15 J NA | 5 J NA | NA NA | 0.25 J NA | 0.16 NA | NA NA | NA NA | NA NA | 67 NA |
| | TEI | SH-WRB-2 SH-WRC-1 | | 10/4/2024 | | NA NA | NA NA | NA NA | | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA |
| | + | | 0.5 - 1 0.4 | 7/12/2003 | NA NA | | | | NA 0.12 | | NA 2400 | | | 927 | | | |
| | | TA-SSS-30 | 0.4 | 7/12/2003 | NA NA | NA NA | 6290 4330 | 579 556 | 0.12 0.38 | 5.7 4.3 | 3490 2610 | 0.45 J 0.84 | 0.29 J 1.8 | 590 | 0.98 J 1.8 | 51.6 36.5 | 297 322 |
| | EA | WP-SSS-27 | | 7/12/2003 | NA NA | NA NA | 4330 1740 | | | 4.3 | | 0.84 | | | 1.8 | 36.5 11.7 | |
| | EA | WP-SSS-28 WP-SUS-26 | 0.8 | 7/12/2003 | NA NA | NA NA | 3220 | 890 660 | 0.21 | 3.9 J | 1410 1980 | | 1.2 2.2 | 38.5 J 271 J | 2.3 | 34.5 | 183 356 |
| Tillicum | | WP-SUS-26 WP-SUS-27 | 4.5 | 7/12/2003 | NA NA | NA NA | 5880 | 603 | 0.1 0.029 J | 5.2 | 3820 | 0.95 | ND (0.24) | 947 | 1.6 | 51.8 | |
| Timicum | CES | TILL-WR-01 | 0 | 6/26/2007 | NA NA | NA NA | NA | 1020 | 0.029 J 0.46 H | 4 J | 3820 NA | 0.95 | 3.34 | NA | NA | NA | 157 525 |
| | CLS | TL-WRA-1-DS-2 | 0.5 - 1 | | | 218 (0.49) | NA NA | NA | NA | NA | NA NA | NA | 3.34 NA | NA NA | NA NA | NA NA | NA |
| | TEI | TL-WRA-3 | 0.5 - 1 | 10/4/2024 | NA | NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA |
| | ''' | TL-WRB-4 | 0.5 - 1 | 10/4/2024 | | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA |
| | | IL-VVKB-4 | 0.5 - 1 | 10/4/2024 | AVI | NA | INA | INA | NA | INA | NA | INA | IVA | INA | INA | NA | INA |

Table 1
Summary of Soil Analytical Results
Non-Time-Critical Removal Action Engineering Evaluation/Cost Analysis
Upper Granite Creek Watershed Mines
Wallowa-Whitman National Forest, Oregon

| | | | Collection | | | | | | | | Metals | | | | | | |
|----------------|----------|--------------------------|------------|------------------------|-------------------------|---------------------------|-----------|------------|---------------|----------|-----------|----------|--------------|-----------|----------|----------|----------|
| | | | Depth | Sample | | Lead, Total | | | | | | | | | | | |
| AOI | Company | Location | (ft bgs) | Date | Lead, IVBA | IVBA | Magnesium | Manganese | Mercury | Nickel | Potassium | Selenium | Silver | Sodium | Thallium | Vanadium | Zinc |
| | <u> </u> | G for SAP | (11.000) | | | | | | 2153 | 244668 | | 61175 | 61145 | | | 61218 | |
| | | ilings PRG | | | | | | | | | | | | | | | |
| | | Rock/Soil PRG | | | | | | | | | | | | | | | |
| ODEO | | untain Region Clear | n Fill | | | | | 1800 | 1.4 | 92 | | 0.93 | 0.51 | | | 400 | 160 |
| | | C Plant Direct Toxic | | | | | | 220 | 34 | 38 | | 0.52 | 560 | | 0.05 | 60 | 160 |
| | | Inverts Direct Toxi | • | | | | | 450 | 0.05 | 280 | | 4.1 | | | | | 120 |
| | • | Eco RBC Bird | | | | | | 1300 | 0.013 | 200 | | 0.71 | 2.6 | | 4.5 | 4.7 | 46 |
| | | o RBC Mammal | | | | | | 1400 | 1.7 | 10 | | 0.63 | 14 | | 0.42 | 280 | 79 |
| 0 | - | vation Worker RCB | | | | | | 230000 | 2900 | 190000 | | | 49000 | | | | |
| | | ML-SSS-12 | 0.7 | 7/9/2003 | NA | NA | 5730 | 730 | 56 | 7.3 | 4270 | 1.1 | 1.8 | 1080 | 2.5 | 66.2 | 211 |
| | | ML-SSS-16 | 0.5 | 7/10/2003 | NA | NA | 678 | 100 | 3.1 | 2.5 J | 2550 | 1.6 | 156 | 370 J | 1.1 J | 15.6 | 432 |
| | | WP-SSS-13 | 1 | 7/9/2003 | NA | NA | 2270 | 115 | 0.5 | 2.6 J | 2950 | 0.83 | 21.2 | 557 | 0.57 J | 26.1 | 55 |
| | EA | WP-SSS-14 | 0.7 | 7/10/2003 | NA | NA | 2450 | 691 | 0.51 | 4.7 | 1650 | 0.7 | 1.5 | ND (23.6) | 1.2 | 15 | 857 |
| | | WP-SSS-17 | 1 | 7/9/2003 | NA | NA | 3200 | 321 | 784 | 3.2 J | 3480 | 0.75 | 319 | 3240 | 1.6 | 14.9 | 2410 |
| | | WP-SUS-14 | 3.5 | 7/10/2003 | NA | NA | 4100 | 511 | 0.61 | 4.6 | 2920 | 0.61 | 11.6 | 516 | 1.7 | 25.4 | 107 |
| | | MMDGA-T-13 | 1 | 9/29/2009 | NA | NA | NA | 381 | 8 | NA | NA | NA | 35 | NA | NA | NA | 674 |
| | | MMDGA-T-34 | 0.25 | 9/30/2009 | NA | NA | NA | 398 | 190 | NA | NA | NA | 85 | NA | NA | NA | 816 |
| | | MMDGA-T-34 | 2 | 9/30/2009 | NA | NA | NA | 400 | 770 | NA | NA | NA | 229 | NA | NA | NA | 3490 |
| | | MMDGA-T-35 | 1 | 9/30/2009 | NA | NA | NA | 281 | 270 | NA | NA | NA | 144 | NA | NA | NA | 1760 |
| | | MMDGA-T-37 | 0.25 | 9/30/2009 | NA | NA | NA | 781 | 101 | NA | NA | NA | 51.1 | NA | NA | NA | 764 |
| | CES | MMDGA-T-40 | 2 | 9/30/2009 | NA | NA | NA | 565 | 254 | NA | NA | NA | 214 | NA | NA | NA | 3030 |
| | | MMDGA-T-41 | 2 | 9/30/2009 | NA | NA | NA | 575 | 222 | NA | NA | NA | 303 | NA | NA | NA | 4900 |
| | | MMDGA-T-9 | 1 | 9/29/2009 | NA | NA | NA | 246 | 12 | NA | NA | NA | 80.1 | NA | NA | NA | 294 |
| Upr Mon'tl | | MMDGA-WR-2 | 4 | 9/28/2009 | NA | NA | NA | 1200 | 0.88 | NA | NA | NA | 0.82 | NA | NA | NA | 116 |
| | | MMDGA-WR-28 | 0.5 | 9/29/2009 | NA | NA | NA | 197 | 0.15 J | NA | NA | NA | 2.58 | NA | NA | NA | 52 |
| | | MMDGA-WR-3 MMDGA-WR-5 | 4 | 9/28/2009 9/28/2009 | NA NA | NA NA | NA NA | 865 313 | 1.09 0.4 | NA NA | NA NA | NA NA | 48.1 39.8 | NA NA | NA NA | NA NA | 248 |
| | - | | 0.5 - 1 | 10/2/2024 | | | NA NA | NA | 9.23 (0.19) | NA NA | NA NA | NA NA | 39.8 NA | NA NA | NA NA | NA NA | NA |
| | | UMM-TLA-6 UMM-TLB-1 | 0.5 - 1 | 10/2/2024 | 69.2 (0.2) 241 (0.2) | 1110 (0.49) 840 (0.49) | NA NA | NA NA | 387 (11) | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA |
| | | UMM-TLB-4 | 0.5 - 1 | 10/2/2024 | NA | NA | NA NA | NA NA | NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA |
| | | UMM-TLC-1 | 0.5 - 1 | 10/2/2024 | NA NA | NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA |
| | | UMM-TLC-2 | 0.5 - 1 | 10/2/2024 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | TEI | UMM-WRA-1 | 0.5 - 1 | 10/2/2024 | 66 (0.2) | 249 (0.49) | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | UMM-WRA-1-DS | 0.5 - 1 | 10/2/2024 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | UMM-WRA-3 | 0.5 - 1 | 10/2/2024 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | UMM-WRB-1 | 0.5 - 1 | 10/2/2024 | NA | NA | NA | NA | 0.663 (0.098) | NA | NA | NA | NA | NA | NA | NA | NA |
| | | UMM-WRB-2 | 0.5 - 1 | 10/2/2024 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | UMM-WRB-2-DS | 0.5 - 1 | 10/2/2024 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | UUMM-WRA-2 | 0.5 - 1 | 10/2/2024 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | UUMM-WRA-3 | 0.5 - 1 | 10/2/2024 | | 340 (0.49) | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Upr Upr Mon'tl | TEI | | 0.5 - 1 | 10/2/2024 | | 340 (0.5) | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| , . | | UUMM-WRA-3-DS | | 10/2/2024 | NA | NA | NA | NA | NA | NA | NA | NA | NA NA | NA | NA | NA | NA |
| | | UUMM-WRD-1 | 0.5 - 1 | 10/2/2024 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA NA | NA |
| | | UUMM-WRF-1 | 0.5 - 1 | 10/2/2024 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |

Table 1

Summary of Soil Notes Analytical Results

Non-Time-Critical Removal Action Engineering Evaluation/Cost Analysis

Upper Granite Creek Watershed Mines

Wallowa-Whitman National Forest, Oregon

| | | | Collection | | | | | | | | Me | tals | | | | | | |
|-----|--------------|------------------------|------------|--------|----------|----------|---------|----------|------------|--------|-----------|---------|---------|----------|--------|--------|------|------|
| | | | Depth | Sample | | | | Arsenic, | Arsenic, | | | | | Chromium | | | | |
| AOI | Company | Location | (ft bgs) | Date | Aluminum | Antimony | Arsenic | IVBA | Total IVBA | Barium | Beryllium | Cadmium | Calcium | (total) | Cobalt | Copper | Iron | Lead |
| | P | RG for SAP | | | | 4895 | 82 | | | | 24468 | 9113 | | | 3681 | 489424 | | |
| | Т | ailings PRG | | | | | 110 | | | | | | - | | - | | - | |
| | Waste | Rock/Soil PRG | | | | | 190 | | | | | | 1 | | - | | 1 | |
| | ODEQ Blue Mo | ountain Region Clear | Fill | | | 1.3 | 14 | | | 950 | 2.6 | 0.69 | 1 | 190 | 1 | 120 | 1 | 21 |
| | ODEQ Eco RE | C Plant Direct Toxic | ity | | | 11 | 18 | | | 110 | 2.5 | 32 | - | | 13 | 70 | - | 120 |
| | ODEQ Eco RB | C Inverts Direct Toxio | city | | | 78 | 6.8 | | | 330 | 40 | 140 | | | | 80 | - | 1700 |
| | ODE | Q Eco RBC Bird | | | | | 15 | | | 630 | | 0.29 | - | 23 | 76 | 14 | - | 11 |
| | ODEQ I | co RBC Mammal | | | | 0.27 | 19 | | | 1800 | 21 | 0.27 | | 34 | 230 | 42 | | 56 |
| | ODEQ Exc | avation Worker RCB | | | | | 420 | | | | 19000 | 9700 | | | | 390000 | | 800 |

Note:

- 1. All concentrations reported in mg/kg (ppm); detection limits in parentheses.
- 2. ODEQ does not provide a Eco Soil RBC for aluminum, but states that it is toxic if soil has a pH < 5.5.
- 3. Iron is a narrative criterion.
- 4. Underlined concentrations exceed the PRG for SAP.
- 5. Double underlined concentrations for results from Tailings exceed the Tailings PRG.
- 6. Double underlined concentrations for results from Waste Rock/Soil exceed the Waste Rock/Soil PRG.
- 7. Italicized concentrations exceed the ODEQ Blue Mountain Region Clean Fill.
- 8. Grey shaded concentrations exceed one or more of the ODEQ Eco RBC (i.e., plant, inverts, bird, or mammal).
- 9. Boldfaced concentrations exceed the ODEQ Excavation Worker RCB.
- CES Cascade Earth Scienes
- EA EA Engineering, Science, and Technology, Inc.
- Eco Ecological
- J Estimated Concentration
- H Storage and Preservation Times were Not Met
- Mon'tl Monumental
- ND Not Detected
- NA Not Analyzed
- ODEQ Oregon Department of Environmental Quality
- PRG Preliminary Remediation Goal
- RBC Risk-Based Concentration
- SAP Sampling and Analysis Plan
- St Station
- TEI Terraphase Engineering Inc.

Table 2
Summary of Sediment Analytical Results
Non-Time-Critical Removal Action Engineering Evaluation/Cost Analysis
Upper Granite Creek Watershed Mines
Wallowa-Whitman National Forest, Oregon

| | | | | | | | | | Me | tals | | | | | |
|-----------------|--------------|------------------------|------------------------|--------------|--------------------------------|-----------------------------------|--------------|------------------|-------------------------------|--------------|---------------------------|----------------|----------------|----------------|-------------------------------------|
| | | | Sample | | | | | | | | Chromium | | | | |
| AOI | Company | Location | Date | Aluminum | Antimony | Arsenic | Barium | Beryllium | Cadmium | Calcium | (total) | Cobalt | Copper | Iron | Lead |
| | PRG fo | r SAP | | | 4895 | 82 | | 24468 | 9113 | | | 3681 | 489424 | | |
| | Tailing | s PRG | | | | 110 | | | | | | | | | |
| ODEQ B | lue Mounta | in Region Clean | Fill | | 1.3 | 14 | 950 | 2.6 | 0.69 | | 190 | | 120 | | 21 |
| | ODEQ Eco | RBC FW | | | 3 | 6 | | | 0.6 | | 37 | | 36 | | 35 |
| USEPA R4 Eco | SV FW Non- | Narcotic Mode | of Action | 25000 | 2 | 9.8 | 20 | | 1 | | 43.4 | 50 | 31.6 | 20000 | 35.8 |
| USEPA R4 Eco SV | FW Aquatic I | Non-Narcotic Mo | de of Action | | | | | | | | | | | | |
| USEPA R4 Eco SV | FW Wildlife | | | | | | | | | | | | | | |
| | | ST-PSD-03 | 7/15/2003 | 4360 | 1.2 J | 13.8 | 76.3 | 0.32 J | ND (0.053) | 2050 | 45.6 | 6.4 | 2.5 | 40000 | 4.4 |
| | | ST-PSD-04 ST-PSD-05 | 7/15/2003 7/14/2003 | 6260 6670 | 1.5 J ND (0.39) | 19.5 18.7 | 127 126 | 0.38 J 0.27 J | ND (0.053) ND (0.062) | 1650 1820 | 5.2 7 | 6.3 5.7 | 3.1 2.4 J | 11600 14500 | 4.9 6.4 |
| | | ST-PSD-05 | 7/14/2003 | 9210 | ND (0.33) | 18.6 | 170 | 0.27 J | ND (0.065) | 2130 | 8.1 | 8.2 | 3 | 18800 | 4.9 |
| | | ST-PSD-07 | 7/12/2003 | 6980 | ND (0.36) | 21.9 | 127 | 0.3 J | ND (0.057) | 2040 | 11.5 | 5.7 | 10.6 | 19100 | 5.3 |
| | | ST-PSD-08 | 7/12/2003 | 11700 | ND (0.55) | 25.9 | 217 | 0.47 J | ND (0.086) | 2990 | 10.7 | 9.6 | 7.8 | 24600 | 6.7 |
| | | ST-PSD-09 | 7/11/2003 | 3990 | ND (0.42) | 9.6 | 52.3 | 0.11 J | 0.069 J | 1240 | 2.3 | 1.9 J | 1.5 J | 5650 | 2.2 |
| | | ST-PSD-10 | 7/10/2003 | 6680 | 0.74 J | 22.5 | 109 | 0.29 J | 0.12 J | 1710 | 9 | 5.1 J | 12.2 | 16100 | 8 |
| | | ST-PSD-53 | 7/19/2003 | 10200 | 2 J | <u>130</u> | 139 | 0.24 J | 0.96 | 2180 | 10.4 | 6.9 | 18.1 | 21600 | 38.2 |
| | EA | ST-PSD-54 | 7/17/2003 | 8910 | 5.1 J | <u>303</u> | 144 | 0.26 J | 2.8 | 2740 | 10.9 | 6.5 | 28 | 18900 | 148 |
| | | ST-RSD-03 ST-RSD-04 | 7/15/2003 7/15/2003 | 3820 5940 | ND (0.4) ND (0.41) | 17.4 44.2 | 68.2 92.5 | 0.2 J 0.23 J | ND (0.062) 0.074 J | 1430 2070 | 12.9 6.1 | 3.7 J 4.7 J | 1.3 J 2.1 J | 15400 12400 | 4.1 6.3 |
| | | ST-RSD-04 | 7/13/2003 | 6030 | ND (0.41) | 23 | 105 | 0.23 J 0.24 J | ND (0.063) | 1950 | 9.7 | 4.7 J | 2.13 | 15200 | 3.8 |
| | | ST-RSD-06 | 7/14/2003 | 4640 | 0.92 J | 9.3 | 92.1 | 0.32 J | ND (0.059) | 1900 | 24.9 | 6 | 2.4 J | 29900 | 4.4 |
| | | ST-RSD-07 | 7/12/2003 | 9650 | ND (0.42) | 19.3 | 174 | 0.39 J | ND (0.066) | 2330 | 10.1 | 8 | 3.5 | 22000 | 4.3 |
| | | ST-RSD-08 | 7/12/2003 | 8350 | ND (0.4) | 14.8 | 158 | 0.39 J | ND (0.063) | 2310 | 15.3 | 8.2 | 7.7 | 25300 | 5.7 |
| | | ST-RSD-09 | 7/11/2003 | 6190 | 0.56 J | 57.9 | 101 | 0.27 J | 0.62 | 1820 | 10 | 5.2 | 7.7 | 16900 | 52.4 |
| Granite Creek | | ST-RSD-10 | 7/10/2003 | 6850 | 1 J | 29 | 116 | 0.36 J | ND (0.068) | 2300 | 24.3 | 7.9 | 8.9 | 33700 | 9.5 |
| | | ST-RSD-53 | 7/19/2003 | 9670 | 2.3 J | <u>126</u> | 127 | 0.25 J | 1.2 | 2230 | 9.9 | 6.2 | 18.6 | 19000 | 44.3 |
| | | ST-RSD-54 GC-ABS-01 | 7/17/2003 6/26/2007 | 7770 NA | 5.1 <i>J</i> 1.2 | <u>246</u> 27.9 | 126 NA | 0.21 J 0.2 J | 1.8 0.44 | 1750 NA | 8.3 25 | 6.4 NA | 30 4 J | 18300 36000 | 121 12.5 |
| | | GC-ABS-01 | 6/26/2007 | NA NA | 1.2 | <u>127</u> | NA NA | ND (0.2) | 0.44 | NA NA | 12 | NA NA | 7 | 26600 | 45.3 |
| | | GC-ABS-03 | 6/26/2007 | NA | 0.7 J | 25 | NA | ND (0.2) | 0.85 | NA | 42 | NA NA | 3 J | 54600 | 15.1 |
| | CES | GC-ABS-04 | 6/27/2007 | NA | 1.7 | 67.4 | NA | 0.3 J | 1.49 | NA | 18 | NA | 10 | 29400 | 45.8 |
| | | GC-SS-01 | 6/25/2007 | NA | ND (0.2) | 7.5 | NA | 0.3 J | 0.22 J | NA | 9 | NA | 3 J | 9320 | 1.89 |
| | | GC-SS-02 | 6/25/2007 | NA | 0.3 J | 6.3 | NA | 0.6 J | 0.12 J | NA | 9 | NA | 2 J | 13700 | 2.04 |
| | | GC-SS-03 | 6/25/2007 | NA | 0.3 J | 36.5 | NA | 0.8 J | 0.17 J | NA | 10 | NA | 3 J | 16600 | 2.63 |
| | | CS-SD-1 | 10/5/2024 | NA | 0.26 (0.13) | 5.8 (1.3) | NA | NA | 0.234 (0.053) | NA | 7.81 (0.53) | NA | NA | NA | 4.12 (0.13) |
| | | CS-SD-2 | 10/3/2024 | NA | 0.038 J (0.054) | | NA | NA NA | 0.038 (0.022) | NA | 2.49 (0.22) | NA | NA NA | NA | 0.927 (0.054) |
| | | CS-SD-3 CS-SD-4 | 10/3/2024 10/3/2024 | NA NA | 0.069 (0.063) 0.892 (0.058) | 11.7 (0.63) 32.7 (0.58) | NA NA | NA NA | 0.062 (0.025) 1.09 (0.023) | NA NA | 4.9 (0.25) 9.05 (0.23) | NA NA | NA NA | NA NA | 1.53 (0.063) 25.6 (0.058) |
| | TEI | CS-SD-4 CS-SD-5 | 10/3/2024 | NA NA | 0.892 (0.038) | 14.1 (0.51) | NA | NA NA | 0.169 (0.023) | NA | 5.03 (0.23) | NA NA | NA NA | NA NA | 2.79 (0.051) |
| | | CS-SD-6 | 10/4/2024 | NA | 0.147 (0.045) | 16.6 (0.45) | NA | NA NA | 0.146 (0.018) | NA | 4.76 (0.18) | NA | NA NA | NA | 2.74 (0.045) |
| | | CS-SD-7 | 10/4/2024 | NA | 0.355 (0.048) | 24.2 (0.48) | NA | NA | 0.538 (0.019) | NA | 10.6 (0.19) | NA | NA | NA | 12.1 (0.048) |
| | | CS-SD-7 (DUP) | 10/4/2024 | NA | 0.334 (0.054) | 24.3 (0.54) | NA | NA | 0.446 (0.022) | NA | 9.1 (0.22) | NA | NA | NA | 12.8 (0.054) |
| | | CS-SD-8 | 10/5/2024 | NA | 0.406 (0.058) | 35.2 (0.58) | NA | NA | 0.316 (0.023) | NA | 9.13 (0.23) | NA | NA | NA | 10.7 (0.058) |

Table 2
Summary of Sediment Analytical Results
Non-Time-Critical Removal Action Engineering Evaluation/Cost Analysis
Upper Granite Creek Watershed Mines
Wallowa-Whitman National Forest, Oregon

| | | | | Metis | | | | | | | | | | |
|---|---------|------------------------|------------------------|--------------|------------|--------------------------------|----------------|--------------|------------------|-----------------------------|------------------------|------------------------|--------------|---------------------------------|
| | | | Sample | | | | | | | | | | | |
| AOI | Company | Location | Date | Magnesium | Manganese | Mercury | Nickel | Potassium | Selenium | Silver | Sodium | Thallium | Vanadium | Zinc |
| PRG for SAP | | | | | | 2153 | 244668 | | 61175 | 61145 | | | 61218 | |
| Tailings PRG | | | | | | | | | | | | | | |
| ODEQ Blue Mountain Region Clean Fill | | | | | 1800 | 1.4 | 92 | | 0.93 | 0.51 | | | 400 | 160 |
| ODEQ Eco RBC FW | | | | | 1100 | 0.2 | 18 | | | 4.5 | | | | 123 |
| USEPA R4 Eco SV FW Non-Narcotic Mode of Action | | | | | 460 | | 22.7 | | 0.72 | 1 | | | | 121 |
| USEPA R4 Eco SV FW Aquatic Non-Narcotic Mode of Action | | | | | | 0.18 | | | | | | | | |
| USEPA R4 Eco SV FW Wildlife Non-Narcotic Mode of Action | | | | | | 0.17 | | | 0.8 | | | | | |
| | EA | ST-PSD-03 ST-PSD-04 | 7/15/2003 7/15/2003 | 1520 3330 | 162 159 | ND (0.019) ND (0.02) | 5.5 4.3 | 950 2020 | 0.88 0.34 J | 0.22 J 0.58 J | ND (41.6) ND (41.9) | 1.8 ND (0.25) | 154 28.5 | 23 43.7 |
| | | ST-PSD-04 | 7/13/2003 | 3530 | 187 | ND (0.02) | 4.5 3.2 J | 2190 | 0.5 J | 0.58 J 0.64 J | ND (41.9) ND (48.9) | ND (0.23) ND (0.29) | 36.6 | 41.9 |
| | | ST-PSD-06 | 7/14/2003 | 5550 | 343 | 0.027 J | 4.4 | 3000 | 0.57 | 0.54 J | ND (50.9) | 0.5 J | 45.3 | 63.3 |
| | | ST-PSD-07 | 7/12/2003 | 3080 | 202 | 0.087 | 3.6 J | 2100 | 0.4 J | 0.83 J | ND (44.8) | 0.3 J | 57.5 | 62.6 |
| Granite Creek | | ST-PSD-08 | 7/12/2003 | 6100 | 342 | 0.12 | 5.7 J | 3870 | 0.73 | 0.63 J | ND (68) | 0.44 J | 61.9 | 94.2 |
| | | ST-PSD-09 | 7/11/2003 | 1370 | 100 | ND (0.019) | 1.1 J | 762 | 0.29 J | ND (0.1) | 230 J | ND (0.31) | 13 | 20.7 |
| | | ST-PSD-10 | 7/10/2003 | 2840 | 177 | 0.07 | 3.2 J | 2000 | 0.63 | 0.49 J | 79.7 J | ND (0.33) | 46 | 50.2 |
| | | ST-PSD-53 | 7/19/2003 | 4790 | 364 | 0.11 | 6.2 | 2840 | 0.44 J | 1.8 | ND (45.2) | 0.69 J | 52.1 | 150 |
| | | ST-PSD-54 | 7/17/2003 | 3460 | 611 | 0.32 | 7.6 | 2400 | 0.8 | 7.9 | 70.2 J | ND (0.67) | 43 | 186 |
| | | ST-RSD-03 | 7/15/2003 | 1600 | 171 | ND (0.019) | 2.2 J | 1070 | 0.43 J | ND (0.094) | 96.8 J | ND (0.29) | 50.2 | 21.8 |
| | | ST-RSD-04 ST-RSD-05 | 7/15/2003 7/14/2003 | 3390 2600 | 203 169 | ND (0.021) ND (0.023) | 2.7 J 3.1 J | 1320 1630 | 0.35 J 0.41 J | 0.86 J ND (0.094) | 120 J 76 J | ND (0.31) ND (0.29) | 29.5 45.9 | 34 38.7 |
| | | ST-RSD-05 | 7/14/2003 | 2220 | 156 | 0.037 J | 4.3 | 1420 | 0.413 | 0.24 J | ND (46.8) | 1.1 | 113 | 35.6 |
| | | ST-RSD-07 | 7/12/2003 | 5160 | 277 | 0.05 | 4.4 | 3500 | 0.37 J | 1.9 | ND (52.2) | 0.59 J | 58.5 | 57.7 |
| | | ST-RSD-08 | 7/12/2003 | 5210 | 283 | 0.058 | 4.8 | 3330 | 0.34 J | 0.73 J | ND (49.8) | 0.69 J | 76.2 | 58.1 |
| | | ST-RSD-09 | 7/11/2003 | 3130 | 177 | 0.031 J | 3.2 J | 1920 | 0.4 J | 1 | ND (44.1) | 0.51 J | 51.2 | 75.1 |
| | | ST-RSD-10 | 7/10/2003 | 3490 | 193 | 0.034 J | 5.2 | 2410 | 0.58 | 0.92 J | ND (53.2) | 1.4 | 117 | 64.9 |
| | | ST-RSD-53 | 7/19/2003 | 4030 | 360 | 0.12 | 6.5 | 2550 | 0.42 J | 4.9 | 45.9 | 0.73 J | 45.9 | 148 |
| | | ST-RSD-54 | 7/17/2003 | 3380 | 560 | 0.12 | 7.3 | 2340 | 0.63 | 6.3 | 79.5 J | 0.76 J | 38.3 | 151 |
| | | GC-ABS-01 | 6/26/2007 | NA | 243 | 0.23 | 3 J | NA | 0.28 J | 1.15 | NA | NA | NA | 77 |
| | | GC-ABS-02 | 6/26/2007 | NA | 376 | 0.12 J | 4 J | NA NA | 0.28 J | 3.27 0.68 | NA | NA NA | NA | 99 |
| | CES | GC-ABS-03 GC-ABS-04 | 6/26/2007 6/27/2007 | NA NA | 320 414 | 0.09 J ND (0.05) | 3 J 5 | NA NA | 0.38 0.64 | 2.4 | NA NA | NA NA | NA NA | 84 120 |
| | | GC-SS-01 | 6/25/2007 | NA NA | 165 | 0.07 J | | NA NA | 0.31 | 0.12 | NA NA | NA NA | NA NA | 25 |
| | | GC-SS-02 | 6/25/2007 | NA NA | 213 | ND (0.04) | ND (1) | NA NA | 0.09 J | 0.05 J | NA NA | NA NA | NA NA | 36 |
| | | GC-SS-03 | 6/25/2007 | NA | 298 | 0.1 JH | ND (1) | NA | 0.15 J | 0.13 | NA | NA | NA | 36 |
| | TEI | CS-SD-1 | 10/5/2024 | NA | NA | 0.031 J (0.053) | | NA | NA | 0.282 (0.053) | NA | NA | NA | 45 (1.3) |
| | | CS-SD-2 | 10/3/2024 | NA | NA | ND (0.024) | NA | NA | NA | 0.043 (0.022) | NA | NA | NA | 16.9 (0.54) |
| | | CS-SD-3 | 10/3/2024 | NA | NA | 0.923 (0.027) | NA | NA | NA | 0.112 (0.025) | NA | NA | NA | 29.7 (0.63) |
| | | CS-SD-4 | 10/3/2024 | NA | NA | 0.011 J (0.029) | | NA | NA | 0.961 (0.023) | NA | NA | NA | 47.2 (0.58) |
| | | CS-SD-5 | 10/4/2024 | NA | NA | 0.056 (0.025) | NA | NA | NA NA | 0.582 (0.02) | NA | NA | NA | 32.7 (0.51) |
| | | CS-SD-6 | 10/4/2024 | NA NA | NA NA | 0.033 (0.021) | NA NA | NA NA | NA NA | 0.2 (0.018) | NA NA | NA NA | NA NA | 37.1 (0.45) |
| | | CS-SD-7 (DUP) | 10/4/2024 10/4/2024 | NA NA | NA NA | 0.097 (0.023) 0.099 (0.024) | NA NA | NA NA | NA NA | 1.1 (0.019) 1.62 (0.022) | NA NA | NA NA | NA NA | 168 (0.48) 102 (0.54) |
| | | CS-SD-7 (DOP) | 10/4/2024 | NA NA | NA NA | 0.099 (0.024) | NA NA | NA NA | NA NA | 1.02 (0.022) | NA NA | NA NA | NA NA | 102 (0.54) |
| | ı | C3-3D-0 | 10/3/2024 | INA | INA | 0.030 (0.020) | INA | INA | IVA | 1.20 (0.023) | IVA | INA | INA | 103 (0.36) |

Summary of Sediment Notes Analytical Results

Non-Time-Critical Removal Action Engineering Evaluation/Cost Analysis

Upper Granite Creek Watershed Mines

Wallowa-Whitman National Forest, Oregon

| | | | | | Metals | | | | | | | | | | |
|----------------|--|-----------------|----------------|----------|----------|---------|--------|-----------|---------|---------|---------------------|--------|--------|-------|------|
| AOI | Company | Location | Sample Date | Aluminum | Antimony | Arsenic | Barium | Beryllium | Cadmium | Calcium | Chromium (total) | Cobalt | Copper | Iron | Lead |
| PRG for SAP | | | 4895 | 82 | | 24468 | 9113 | | | 3681 | 489424 | | | | |
| | Tailings PRG | | | | | 110 | | | | | | | | | |
| ODEQ E | Blue Mountai | n Region Clean | Fill | | 1.3 | 14 | 950 | 2.6 | 0.69 | | 190 | | 120 | | 21 |
| | ODEQ Eco | RBC FW | | | 3 | 6 | | | 0.6 | | 37 | | 36 | | 35 |
| USEPA R4 Eco | USEPA R4 Eco SV FW Non-Narcotic Mode of Action | | of Action | 25000 | 2 | 9.8 | 20 | | 1 | | 43.4 | 50 | 31.6 | 20000 | 35.8 |
| USEPA R4 Eco S | USEPA R4 Eco SV FW Aquatic Non-Narcotic Mode of Action | | | | | | | | | | | | | | |
| USEPA R4 Eco S | V FW Wildlife N | Non-Narcotic Mo | de of Action | | | | | | | | | | | | |

Note:

- 1. All concentrations reported in mg/kg (ppm); detection limits in parentheses.
- 2. Underlined concentrations exceed the PRG for SAP.
- 3. Double underlined concentrations exceed the Tailings PRG.
- 4. Boldfaced concentrations exceed the ODEQ Blue Mountain Region Clean Fill.
- 5. Italicized concentrations exceed the ODEQ Eco RBC FW.
- 6. Grey shaded concentrations exceed the USEPA R4 Eco SV FW Non-Narcotic Mode of Action.
- 7. Blue shaded concentrations exceed the USEPA R4 Eco SV FW Aquatic Non-Narcotic Mode of Action.
- 8. Red colored concentrations exceed the USEPA R4 Eco SV FW Wildlife Non-Narcotic Mode of Action.
- CES = Cascade Earth Scienes
- EA = EA Engineering, Science, and Technology, Inc.
- Eco = Ecological
- FW = Freshwater
- ND = Not Detected
- NA = Not Analyzed
 J = Estimated Concentration
- ODEQ = Oregon Department of Environmental Quality
- PRG = Preliminary Remediation Goal
- RBC = Risk-Based Concentration
- SAP = Sampling and Analysis Plan
- SV = Screening Value
- TEI = Terraphase Engineering Inc.

USEPA R4 = United States Environmental Protection Agency Region 4

Table 3
Summary of Surface Water Analytical Results
Non-Time-Critical Removal Action Engineering Evaluation/Cost Analysis
Upper Granite Creek Watershed Mines
Wallowa-Whitman National Forest, Oregon

| | | | | Physical Properties | | | | | Metals | | | | |
|------------------|--------------|------------------|-----------|---------------------|-------------|----------------------|--------------------|----------|----------------------|-------------|--------------------|---------------|-------------|
| | | | Sample | | | | | | | | | | |
| AOI | Company | Location | Date | Hardness (total) | Aluminum | Antimony | Arsenic | Barium | Cadmium | Calcium | Chromium (total) | Copper | Iron |
| Eco RBC | FW Aquation | Chronic Exposure | | | 0.32 | 0.19 | 0.15 | 0.22 | 0.000094 | 120 | 11 | 0.0014 | 1 |
| Eco RB | C FW Aquati | c Acute Exposure | | | 0.69 | 0.9 | 0.34 | 2 | 0.00049 | | 16 | 0.0023 | |
| Eco RBC | FW Wildlife | Chronic Exposure | | | | | | | | | | | |
| Eco RB0 | C FW Wildlif | e Acute Exposure | | | | | | | | | | | |
| Can Martin | CES | CM-AS-01 | 6/21/2007 | NA | NA | ND (0.0004) | ND (0.0005) | NA | ND (0.0001) | 9.8 | ND (0.01) | ND (0.0005) | 0.65 |
| Cap Martin | CES | CM-AS-02 | 6/21/2007 | NA | NA | ND (0.0004) | 0.0013 | NA | 0.0001 J | 9.9 | ND (0.01) | ND (0.0005) | 2.03 |
| | | ST-SFW-03 | 7/15/2003 | NA | ND (0.0236) | ND (0.0047) | ND (0.0048) | 0.0349 J | ND (0.0006) | 5.56 | ND (0.0014) | ND (0.0024) | ND (0.0333) |
| | | ST-SFW-04 | 7/15/2003 | NA | 0.126 J | ND (0.0047) | ND (0.0048) | 0.0415 J | ND (0.0006) | 7.06 | ND (0.0014) | ND (0.0024) | 0.0941 J |
| | | ST-SFW-05 | 7/13/2003 | NA | ND (0.0236) | ND (0.0047) | ND (0.0048) | 0.0385 J | ND (0.0006) | 7.13 | ND (0.0014) | ND (0.0024) | ND (0.0333) |
| | | ST-SFW-06 | 7/13/2003 | NA | ND (0.0236) | ND (0.0047) | ND (0.0048) | 0.0456 J | ND (0.0006) | 8.45 | ND (0.0014) | ND (0.0024) | ND (0.0333) |
| | EA | ST-SFW-07 | 7/12/2003 | NA | ND (0.0631) | ND (0.005) | ND (0.006) | 0.0455 J | ND (0.0012) | 8.7 | ND (0.0019) | ND (0.0033) | ND (0.0667) |
| | LA | ST-SFW-08 | 7/12/2003 | NA | ND (0.0236) | ND (0.0047) | ND (0.0048) | 0.0485 J | ND (0.0006) | 9.01 | ND (0.0014) | ND (0.0024) | ND (0.0333) |
| | | ST-SFW-09 | 7/11/2003 | NA | ND (0.0631) | ND (0.005) | ND (0.006) | 0.0509 J | ND (0.0012) | 9.69 | ND (0.0019) | ND (0.0033) | ND (0.0667) |
| | | ST-SFW-10 | 7/10/2003 | NA | ND (0.0631) | ND (0.005) | ND (0.006) | 0.0529 J | ND (0.0012) | 9.91 | ND (0.0019) | ND (0.0033) | ND (0.0667) |
| | | ST-SFW-53 | 7/17/2003 | NA | 0.0793 J | ND (0.0047) | 0.0131 | 0.055 J | ND (0.0006) | 15.3 | ND (0.0014) | ND (0.0024) | ND (0.0168) |
| | | ST-SFW-54 | 7/17/2003 | NA | 0.0264 J | ND (0.0038) | 0.0096 J | 0.051 J | ND (0.0003) | 15.9 | 0.00074 J | ND (0.0014) | 0.0323 J |
| Granite Creek | | GC-SW-01 | 6/25/2007 | NA | NA | ND (0.0004) | 0.0006 J | NA | ND (0.0001) | 4.5 | ND (0.01) | ND (0.0005) | 0.03 J |
| Granite Creek | CES | GC-SW-02 | 6/25/2007 | NA | NA | ND (0.0004) | ND (0.0005) | NA | ND (0.0001) | 4.5 | ND (0.01) | ND (0.0005) | 0.04 J |
| | | GC-SW-03 | 6/5/2007 | NA | NA | ND (0.0004) | 0.0006 J | NA | ND (0.0001) | 4.7 | ND (0.01) | ND (0.0005) | 0.1 |
| | | CS-SW-1 | 10/5/2024 | 18.1 (0.09) | NA | 0.000036 J (0.00005) | 0.00036 J (0.0005) | NA | ND (0.00002) | 5.59 (0.02) | 0.00011 J (0.0002) | NA | NA |
| | | CS-SW-2 | 10/3/2024 | 19.7 (0.09) | NA | 0.000025 J (0.00005) | 0.00067 (0.0005) | NA | ND (0.00002) | 6.07 (0.02) | 0.00011 J (0.0002) | NA | NA |
| | | CS-SW-2 (DUP) | 10/3/2024 | 19.3 (0.09) | NA | 0.000031 J (0.00005) | 0.00061 (0.0005) | NA | ND (0.00002) | 5.92 (0.02) | 0.00011 J (0.0002) | NA | NA |
| | | CS-SW-3 | 10/3/2024 | 21 (0.09) | NA | 0.000038 J (0.00005) | 0.00087 (0.0005) | NA | ND (0.00002) | 6.49 (0.02) | 0.00012 J (0.0002) | NA | NA |
| | TEI | CS-SW-4 | 10/3/2024 | 27.5 (0.09) | NA | 0.000036 J (0.00005) | 0.00092 (0.0005) | NA | ND (0.00002) | 8.41 (0.02) | 0.00014 J (0.0002) | NA | NA |
| | | CS-SW-5 | 10/4/2024 | 31.8 (0.09) | NA | 0.000098 (0.00005) | 0.00178 (0.0005) | NA | 0.00001 J (0.00002) | 9.55 (0.02) | 0.00011 J (0.0002) | NA | NA |
| | | CS-SW-6 | 10/4/2024 | 32.3 (0.09) | NA | 0.000076 (0.00005) | 0.00204 (0.0005) | NA | ND (0.00002) | 9.71 (0.02) | 0.00011 J (0.0002) | NA | NA |
| | | CS-SW-7 | 10/4/2024 | 36.3 (0.09) | NA | 0.000104 (0.00005) | 0.00199 (0.0005) | NA | 0.000019 J (0.00002) | 10.9 (0.02) | 0.00009 J (0.0002) | NA | NA |
| | | CS-SW-8 | 10/5/2024 | 36.7 (0.09) | NA | 0.000108 (0.00005) | 0.00221 (0.0005) | NA | 0.00002 J (0.00002) | 10.9 (0.02) | 0.00011 J (0.0002) | NA | NA |
| Granite Creek #5 | CES | GC5-AS-01 | 6/24/2007 | NA | NA | 0.0009 J | 0.0046 | NA | <u>0.0007</u> | 22.7 | ND (0.01) | <u>0.0038</u> | 1.74 |
| Golden Fraction | CES | GF-AS-01 | 6/25/2007 | NA | NA | 0.0007 J | 0.0119 | NA | ND (0.0001) | 28.2 | ND (0.01) | 0.0007 J | 1.87 |
| | EA | SP-SFW-19 | 7/19/2003 | NA | ND (0.0631) | ND (0.005) | 0.0214 | 0.0995 J | ND (0.0012) | 22.6 | ND (0.0019) | ND (0.0033) | ND (0.0667) |
| Lwr Mon'tl | | MMDGA-AS-01 | 9/28/2009 | NA | NA | NA | 0.0218 | NA | NA | NA | NA | NA | 0.13 |
| LWI WIOII (I | CES | MMDGA-SP-02 | 9/28/2009 | NA | NA | NA | 0.0199 | NA | NA | NA | NA | NA | 0.06 |
| | | MMDGA-SW-02 | | NA | NA | NA | 0.0242 | NA | NA | NA | NA | NA | ND (0.02) |
| | EA | SP-SFW-18 | 7/9/2003 | NA | ND (0.0631) | ND (0.005) | 0.0818 | 0.0677 J | ND (0.0012) | 17.4 | ND (0.0019) | ND (0.0033) | ND (0.0667) |
| | EA | SP-SFW-51 | 7/10/2003 | NA | ND (0.0631) | ND (0.005) | ND (0.006) | 0.0756 J | ND (0.0012) | 17.8 | ND (0.0019) | ND (0.0033) | ND (0.0667) |
| Upr Mon'tl | CES | MMDGA-AS-02 | 9/28/2009 | NA | NA | NA | 0.0272 | NA | NA | NA | NA | NA | 0.33 |
| | CES | MMDGA-SP-01 | 9/28/2009 | NA | NA | NA | 0.105 | NA | NA | NA | NA | NA | 5.61 |
| | CES | MMDGA-SW-01 | 9/28/2009 | NA | NA | NA | 0.051 | NA | NA | NA | NA | NA | 4.22 |

Table 3
Summary of Surface Water Analytical Results
Non-Time-Critical Removal Action Engineering Evaluation/Cost Analysis
Upper Granite Creek Watershed Mines
Wallowa-Whitman National Forest, Oregon

| | | | | | | | | Metals | | | | |
|-----------------------|--------------|------------------|----------------|----------------------|--------------|-------------|---------------|-----------|-------------|--------------|--------|------------------|
| AOI | Company | Location | Sample Date | Lead | Magnesium | Manganese | Mercury | Potassium | Selenium | Silver | Sodium | Zinc |
| Eco RBC | FW Aquatio | Chronic Exposure |) | 0.00054 | 82 | 0.093 | 0.000012 | 53 | 0.0046 | 0.0001 | 680 | 0.036 |
| Eco RB | C FW Aquati | c Acute Exposure | | 0.014 | | 1.7 | 0.0014 | | 0.02 | 0.0003 | | 0.036 |
| Eco RBC | FW Wildlife | Chronic Exposure | 2 | | | | 0.0000013 | | | | | |
| Eco RB0 | C FW Wildlif | e Acute Exposure | | | | | 0.000012 | | | | | |
| | | CM-AS-01 | 6/21/2007 | 0.0001 J | 2 | 0.021 J | 0.00000095 | NA | ND (0.0001) | ND (0.00005) | NA | 1.31 |
| Cap Martin | CES | CM-AS-02 | 6/21/2007 | 0.0001 J | 2.1 | 0.026 J | 0.00000574 | NA | ND (0.0001) | ND (0.00005) | NA | ND (0.01) |
| | | ST-SFW-03 | 7/15/2003 | ND (0.0013) | 0.998 J | ND (0.0007) | ND (0.0001) | 1.21 J | ND (0.0034) | ND (0.0022) | 2.81 J | 0.002 J |
| | | ST-SFW-04 | 7/15/2003 | ND (0.0013) | 1.32 J | 0.0057 J | ND (0.0001) | 1.75 J | ND (0.0034) | ND (0.0022) | 3.16 J | 0.0026 J |
| | | ST-SFW-05 | 7/13/2003 | ND (0.0013) | 1.33 J | 0.00088 J | ND (0.0001) | 2.34 J | ND (0.0034) | ND (0.0022) | 3.26 J | 0.0025 J |
| | | ST-SFW-06 | 7/13/2003 | ND (0.0013) | 1.72 J | 0.00072 J | ND (0.0001) | 1.99 J | ND (0.0034) | ND (0.0022) | 3.22 J | 0.0023 J |
| | F.A. | ST-SFW-07 | 7/12/2003 | 0.0017 J | 1.76 J | ND (0.0019) | ND (0.0001) | 1.59 J | ND (0.0017) | ND (0.0029) | 3.16 J | 0.0029 J |
| | EA | ST-SFW-08 | 7/12/2003 | ND (0.0013) | 1.82 J | 0.0011 J | ND (0.0001) | 2.67 J | ND (0.0034) | ND (0.0022) | 3.42 J | 0.003 J |
| | | ST-SFW-09 | 7/11/2003 | ND (0.0015) | 2.01 J | ND (0.0019) | ND (0.0001) | 1.62 J | ND (0.0017) | ND (0.0029) | 3.24 J | 0.0033 J |
| | | ST-SFW-10 | 7/10/2003 | ND (0.0015) | 2.07 J | ND (0.0019) | ND (0.0001) | 1.63 J | ND (0.0017) | ND (0.0029) | 3.14 J | 0.0035 J |
| | | ST-SFW-53 | 7/17/2003 | ND (0.0013) | 3.54 J | 0.0103 J | 0.0002 J | 1.87 J | ND (0.0017) | ND (0.0022) | 3.38 J | 0.0031 J |
| | | ST-SFW-54 | 7/17/2003 | ND (0.0013) | 4.04 J | 0.0067 J | 0.0001 J | 2.49 J | ND (0.0017) | ND (0.0009) | 3.65 J | ND (0.0057) |
| Constitution Constitu | | GC-SW-01 | 6/25/2007 | 0.0001 J | 0.7 J | ND (0.005) | ND (0.000001) | NA | ND (0.0001) | ND (0.00005) | NA | ND (0.01) |
| Granite Creek | CES | GC-SW-02 | 6/25/2007 | ND (0.0001) | 0.8 J | ND (0.005) | 0.0000048 | NA | ND (0.0001) | ND (0.00005) | NA | 0.01 J |
| | | GC-SW-03 | 6/5/2007 | 0.0001 J | 0.9 J | ND (0.005) | 0.0000048 | NA | ND (0.0001) | ND (0.00005) | NA | 0.01 J |
| | | CS-SW-1 | 10/5/2024 | 0.000013 J (0.00002) | 0.996 (0.01) | NA | ND (0.0002) | NA | NA | ND (0.00002) | NA | ND (0.002) |
| | | CS-SW-2 | 10/3/2024 | 0.000012 J (0.00002) | 1.11 (0.01) | NA | ND (0.0002) | NA | NA | ND (0.00002) | NA | ND (0.002) |
| | | CS-SW-2 (DUP) | 10/3/2024 | 0.000007 J (0.00002) | 1.09 (0.01) | NA | ND (0.0002) | NA | NA | ND (0.00002) | NA | ND (0.002) |
| | | CS-SW-3 | 10/3/2024 | 0.000012 J (0.00002) | 1.17 (0.01) | NA | ND (0.0002) | NA | NA | ND (0.00002) | NA | ND (0.002) |
| | TEI | CS-SW-4 | 10/3/2024 | ND (0.00002) | 1.59 (0.01) | NA | ND (0.0002) | NA | NA | ND (0.00002) | NA | ND (0.002) |
| | | CS-SW-5 | 10/4/2024 | 0.000018 J (0.00002) | 1.93 (0.01) | NA | ND (0.0002) | NA | NA | ND (0.00002) | NA | 0.0018 J (0.002) |
| | | CS-SW-6 | 10/4/2024 | 0.000013 J (0.00002) | 1.96 (0.01) | NA | ND (0.0002) | NA | NA | ND (0.00002) | NA | 0.0007 J (0.002) |
| | | CS-SW-7 | 10/4/2024 | 0.000022 (0.00002) | 2.2 (0.01) | NA | ND (0.0002) | NA | NA | ND (0.00002) | NA | 0.0008 J (0.002) |
| | | CS-SW-8 | 10/5/2024 | 0.000084 (0.00002) | 2.31 (0.01) | NA | ND (0.0002) | NA | NA | ND (0.00002) | NA | 0.0008 J (0.002) |
| Granite Creek #5 | CES | GC5-AS-01 | 6/24/2007 | 0.009 | 4.9 | 0.01 J | 0.000141 | NA | 0.0005 J | 0.00009 J | NA | 0.02 J |
| Golden Fraction | CES | GF-AS-01 | 6/25/2007 | 0.0002 J | 6.7 | 0.374 | 0.0000194 | NA | ND (0.0001) | ND (0.00005) | NA | ND (0.01) |
| | EA | SP-SFW-19 | 7/19/2003 | 0.0023 J | 7.15 | 0.0067 J | ND (0.0001) | 2.72 J | 0.0026 J | ND (0.0029) | 3.31 J | 0.0156 J |
| Lwr Mon'tl | | MMDGA-AS-01 | 9/28/2009 | ND (0.0001) | NA | NA | NA | NA | NA | NA | NA | 0.004 J |
| LWI WIOTI LI | CES | MMDGA-SP-02 | 9/28/2009 | ND (0.0001) | NA | NA | NA | NA | NA | NA | NA | 0.004 J |
| | | MMDGA-SW-02 | 9/28/2009 | 0.0003 J | NA | NA | NA | NA | NA | NA | NA | 0.009 J |
| | EA | SP-SFW-18 | 7/9/2003 | ND (0.0015) | 4.66 J | 0.0029 J | ND (0.000001) | 2.44 J | ND (0.0017) | ND (0.0029) | 2.94 J | 0.0276 |
| | EA | SP-SFW-51 | 7/10/2003 | 0.0021 J | 4.53 J | 0.0554 | ND (0.000001) | 1.61 J | ND (0.0017) | ND (0.0029) | 2.63 J | 0.005 J |
| Upr Mon'tl | CES | MMDGA-AS-02 | 9/28/2009 | 0.0004 J | NA | NA | NA | NA | NA | NA | NA | 0.014 |
| | CES | MMDGA-SP-01 | 9/28/2009 | <u>0.0294</u> | NA | NA | NA | NA | NA | NA | NA | <u>0.12</u> |
| | CES | MMDGA-SW-01 | 9/28/2009 | 0.0118 | NA | NA | NA | NA | NA | NA | NA | 0.028 |

Summary of Surface Water Analytical Results

Non-Time-Critical Removal Action Engineering Evaluation/Cost Analysis Upper Granite Creek Watershed Mines

Wallowa-Whitman National Forest, Oregon

| | | | | Physical Properties | | Metals | | | | | | | |
|--------|----------------|------------------|----------------|---------------------|----------|----------|---------|--------|----------|---------|------------------|--------|------|
| AOI | Company | Location | Sample Date | Hardness (total) | Aluminum | Antimony | Arsenic | Barium | Cadmium | Calcium | Chromium (total) | Copper | Iron |
| | | Chronic Exposure | 1 | | 0.32 | 0.19 | 0.15 | 0.22 | 0.000094 | 120 | 11 | 0.0014 | 1 |
| Eco F | RBC FW Aquati | c Acute Exposure | | | 0.69 | 0.9 | 0.34 | 2 | 0.00049 | | 16 | 0.0023 | |
| Eco RI | BC FW Wildlife | Chronic Exposure |) | | | | | | | | | | |
| Eco F | RBC FW Wildlif | e Acute Exposure | | | | | | | | | | | |

Note:

- 1. All concentrations reported in mg/L; detection limits in parentheses.
- 2. Only compounds with at least one detection are shown.
- 3. The numbers presented for Chromium (total) are the criteria established by ODEQ for Chromium VI.
- 4. Grey-shaded concentrations exceed the Eco RBC FW Aquatic Chronic Exposure.
- 5. Underlined concentrations exceed the Eco RBC FW Aquatic Acute Exposure.
- 6. Boldfaced concentrations exceed the Eco RBC FW Wildlife Chronic Exposure.
- 7. Italicized concentrations exceed the Eco RBC FW Wildlife Acute Exposure.

CES = Cascade Earth Scienes

EA = EA Engineering, Science, and Technology, Inc.

Eco = Ecological

FW = Freshwater

ND = Not Detected

NA = Not Analyzed

J = Estimated Concentration Mon'tl = Monumental

ODEQ =Oregon Department of Environmental Quality

RBC = Risk-Based Concentration

TEI = Terraphase Engineering Inc.

Table 4 Chemical-Specific Potential Applicable or Relevant and Appropriate Requirements

Non-Time-Critical Removal Action Engineering Evaluation/Cost Analysis
Upper Granite Creek Watershed Mines
Wallowa Whitman National Forest, Oregon

| Standard, Requirement Criteria, or Limitation | Citation | Description | Applicable/Relevant and Appropriate? |
|---|--|---|--|
| FEDERAL | | | |
| Safe Drinking Water Act | 42 USC § 300 | | |
| National Primary Drinking Water Regulations | 40 CFR 141 | Establishes health-based standards (primary maximum contaminant levels) for public water systems. | Not an ARAR; surface water and groundwater are not used as drinking water in the area surrounding the Site. |
| National Secondary Drinking Water Regulations | 40 CFR 143, Subpart A | Establishes aesthetic standards (secondary maximum contaminant levels) for public water systems. | Not an ARAR; these are not enforceable standards and are outside scope of removal action. |
| Clean Water Act | 33 USC §§ 1251-1387 | | |
| National Ambient Water Quality Criteria | 40 CFR 131 | Establishes water quality standards based on toxicity to aquatic organisms and human health. | Not an ARAR; the State of Oregon has been delegated this program (see State of Oregon ARARs). |
| Clean Air Act | 42 USC § 7409 | | |
| National Primary and Secondary Ambient Air Quality Standards | 40 CFR 50 | Establishes air quality levels that protect public health. | Not an ARAR; only "major" sources are subject to requirements related to National Ambient Air Quality Standards, defer to State (see State of Oregon ARARs). |
| Regional Screening Levels (RSLs) for Chemical Contaminants at Superfund Sites | | RSLs are tools for evaluating and cleaning up contaminated sites. They are risk-based concentrations that are intended to assist risk assessors and others in initial screening-level evaluations of environmental measurements. The RSLs contained in the 2024 Table are generic; they are calculated without site specific information. However, they may be re-calculated using site specific data. RSLs should be viewed as Agency guidelines, not legally enforceable standards. They are used for site "screening" and as initial cleanup goals, if applicable. | Potentially Relevant and Appropriate Requirement |
| Resource Conservation and Recovery Act | 42 USC § 6905 | | |
| Lists of Hazardous Wastes | 40 (FR 761 Supports (and I) | Characterizes and defines solid wastes which are subject to regulation as hazardous wastes under 40 CFR Parts 262-265 and Parts 124, 270, and 271. | Not an ARAR; mine waste is not a listed hazardous waste, Bevill exempt. Even if Toxicity Characteristic Leaching Procedure testing confirmed a characteristic waste (Subpart C), it is still exempt. Parts of the RCRA regulations may be potentially relevant and appropriate, however, and are discussed under action-specific requirements. |
| STATE OF OREGON | | | |
| Hazardous Substance Remedial Action Rules | OAR 340-177-0040 | Establishes ODEQ guidelines and requirements for assessing human and ecological risk assessments from contamination according to ODEQ risk guidelines and levels. Also specifies the use of risk-based cleanup concentrations and the use of background concentrations. | Potentially Applicable Requirement |
| Hazardous Substance Occupational Exposure | OAR 437 Division 2 Subdivision 7 | Establishes Oregon-Occupational Safety and Health Administration Permissible Exposure Limits. Oregon-Occupational Safety and Health Administration exposure limits mirror the federal chemical specific limits (refer to National Institute for Occupational Safety and Health Pocket Guide to Chemical Hazards for details on individual chemicals). | Potentially Applicable Requirement |
| Numeric Soil Cleanup Levels for Motor Fuel and Heating Oil | OAR 340-122-305 through 360 | Establishes cleanup standards for contamination of soil by motor fuel and heating oil. | To Be Considered |
| Oregon Soil Cleanup Rules for Simple Sites | | Establishes ODEQ rules for streamlined cleanup processes and cleanup standards at simple sites. | To Be Considered |
| Oregon Water Pollution Control Statutes | | Address effluent standards, permit requirements for discharges to US waters and minimum Federal water quality criteria. Applicable to the protection of surface water during removal activities. | Potentially Relevant and Appropriate Requirement |
| Groundwater Quality Protection Program | OAR Chapter 340 Division 40 | Establishes the mandatory minimum groundwater quality protection requirements for federal and state agencies, cities, industries, and citizens. | Potentially Relevant and Appropriate Requirement |
| State of Oregon is authorized by the USEPA to implement the Clean Water Act in Oregon | ORS 468B.050 OAR Chapter 340 Division 41, Table 20 | Establishes acceptable contaminant levels for ingestion of aquatic organisms and for intake by aquatic organisms in surface water. | Potentially Applicable Requirement |
| Oregon Air Pollution Laws | ORS 468A.005- ORS 468A.085 | Provides a state program with laws governing air pollution control, abatement, and prevention. | Potentially Relevant and Appropriate Requirement, during Removal Action. |

Chemical-Specific Potential Applicable or Relevant and Appropriate Requirements

Non-Time-Critical Removal Action Engineering Evaluation/Cost Analysis Upper Granite Creek Watershed Mines

Wallowa Whitman National Forest, Oregon

| Standard, Requirement Criteria, or Limitation | Citation | Description | Applicable/Relevant and Appropriate? |
|--|----------|---|--|
| STATE OF OREGON (continued) | | | |
| Ambient Air Quality Standards and PSD Increments | · | Establish concentrations, exposure time, and frequency of occurrence of an air contaminant in the ambient air that must not be exceeded. | Potentially Relevant and Appropriate Requirement, during Removal Action. |
| Asbestos Removal | | Establishes ODEQ requirements for licensing and certification for asbestos workers. All workers who handle asbestos-containing materials must meet certain training and certification requirements. | Potentially Applicable Requirement |

Note:

ARAR = Applicable/Relevant and Appropriate Requirement

CFR = The Code of Federal Regulations

OAR = Oregon Administrative Rules

ODEQ = Oregon Department of Environmental Quality

ORS = Oregon Revised Statutes

RSL = Regional Screening Level

USC = United States Code

USEPA = United States Environmental Protection Agency

Table 5 Location-Specific Potential Applicable or Relevant and Appropriate Requirements Non Time Critical Removal Action Engineering Evaluation (Cost Applysis

Non-Time-Critical Removal Action Engineering Evaluation/Cost Analysis
Upper Granite Creek Watershed Mines, Wallowa - Whitman National Forest, Oregon

| Standard, Requirement Criteria, or Limitation | Citation | Description | Applicable/Relevant and Appropriate? |
|--|--|--|--|
| FEDERAL | | | |
| Resource Conservation and Recovery Act | 42 USC § 6905 | | |
| Hazardous and Solid | 40 CFR 264.18 | Location standards and restrictions for hazardous waste treatment, storage, and disposal facilities. | Potentially Relevant and Appropriate Requirement |
| Waste Regulations | 40 CFR § 257.3-1 through 257.3-4 | Location standards and restrictions for municipal solid waste facilities. | Potentially Relevant and Appropriate Requirement |
| National Historic Preservation Act | 16 USC § 470; 36 CFR 800; 40 CFR 6.301(b) | Requires Federal Agencies to take into account the effect of any Federally assisted undertaking or licensing on any property with historic, architectural, archeological, or cultural value that is included in or eligible for inclusion in the National Register of Historic Places. | Potentially Applicable Requirement |
| Archeological and Historic Preservation Act | 16 USC § 469; 40 CFR 6.301(c) | Establishes procedures to provide for preservation of significant scientific, prehistoric, historic, and archeological data that might be destroyed through alteration of terrain as a result of a Federal construction project or a Federally licensed activity or program. | Potentially Relevant and Appropriate Requirement |
| The Archaeological Resources Protection Act of 1979 | 43 CFR 7 | Regulates requirements for authorized removal of archaeological resources from public or tribal lands. | Potentially Relevant and Appropriate Requirement |
| Executive Order 11593 | 16 USC § 469; 40 CFR § 6.301(c) | Provides for the inventory and nomination of historical and archeological sites. | Potentially Relevant and Appropriate Requirement |
| Federal Land Policy and Management Act of 1976 | 43 USC 1701 | Provides for multiple use and inventory, protection, and planning for cultural resources on public lands. | Potentially Relevant and Appropriate Requirement |
| Native American Graves Protection and Repatriation Act | 25 USC 3001-3013; 43 CFR 10 | Regulations that pertain to the identification, protection, and appropriate disposition of human remains, funerary objects, sacred objects, or objects of cultural patrimony. | Potentially Relevant and Appropriate Requirement |
| Federal Land Policy and Management Act of 1976 | 43 USC 1701 | Provides for multiple use and inventory, protection, and planning for cultural resources on public lands. | Potentially Relevant and Appropriate Requirement |
| Protection of Wetlands Executive Order No. 11990 | 40 CFR Part 6, Appendix A; 40 CFR 6.302(a) | Avoid adverse impacts associated with the destruction or loss of wetlands and avoid support of new construction in wetlands if a practicable alternative exists. | Potentially Relevant and Appropriate Requirement |
| Dredge and Fill Regulations | 33 USC § 1344, 33 CFR 323.1 et. seq. | Prohibits discharge of dredged or fill material into waters of the United States without a permit | Potentially Relevant and Appropriate Requirement |
| Fish and Wildlife Coordination Act | 16 USC Chapter 49, §§ 2901-2912; 40 CFR 6.302(g) | Requires consultation when Federal department or agency proposes or authorizes any modification of any stream or other water body to assure adequate protection of fish and wildlife resources. | Potentially Relevant and Appropriate Requirement |
| Floodplain Management Executive Order No. 11988 | 40 CFR Part 6, Appendix A; 40 CFR 6.302(b) | Requires Federal agencies to evaluate the potential effects of actions they may take in a floodplain to avoid the adverse impacts associated with direct and indirect development of a floodplain to the extent possible. | Potentially Applicable Requirement |
| Endangered Species Act | 16 USC §§ 1531-1543; 40 CFR 6.302 (h); 50 CFR Part 402 | Activities may not jeopardize the continued existence of any threatened or endangered species or destroy or adversely modify a critical habitat. | Potentially Applicable Requirement |
| Migratory Bird Treaty Act | 16 USC §§ 703 et seq. | Establishes federal responsibility for the protection of the international migratory bird resource and requires continued consultation with the USFWS during remedial design and remedial construction to ensure that the cleanup of the site does not unnecessarily impact migratory birds. | Potentially Applicable Requirement |

Table 5 Location-Specific Potential Applicable or Relevant and Appropriate Requirements Non-Time-Critical Removal Action Engineering Evaluation/Cost Analysis

Upper Granite Creek Watershed Mines, Wallowa-Whitman National Forest, Oregon

| Standard, Requirement Criteria, or Limitation | Citation | Description | Applicable/Relevant and Appropriate? | | |
|--|----------------------|--|--|--|--|
| FEDERAL (continued) | | | | | |
| Bald Eagle Protection Act | | Requires continued consultation with the USFWS during remedial design and remedial construction to ensure that any cleanup of the site does not unnecessarily adversely affect the bald or golden eagle. | Potentially Applicable Requirement | | |
| STATE OF OREGON | | | | | |
| Plants: Wildflowers and Endangered, Threatened and Candidate Species | OAR 603 Division 73 | Provides for protection of certain plants, wildflowers, and shrubs; guidelines on the listing, reclassification, and delisting of plant species as threatened or endangered. | Potentially Applicable Requirement | | |
| Wildlife Diversity Program | OAR 635 Division 100 | Provides rules for maintaining Oregon's wildlife diversity by protecting and enhancing populations and habitats of native wildlife at self-sustaining levels throughout geographic ranges. | Potentially Relevant and Appropriate Requirement | | |

Note:

ARAR = Applicable/Relevant and Appropriate Requirement

CFR = The Code of Federal Regulations

OAR = Oregon Administrative Rules

USC = United States Code

USFWS = United States Fish and Wildlife Service

Table 6 Action-Specific Potential Applicable or Relevant and Appropriate Requirements Non-Time-Critical Removal Action Engineering Evaluation/Cost Analysis

Upper Granite Creek Watershed Mines, Wallowa Whitman National Forest, Oregon

| Standard, Requirement Criteria, or Limitation | Citation | Description | Applicable/Relevant and Appropriate? |
|---|---|---|---|
| FEDERAL | | | |
| Clean Water Act | 33 USC § 1342 | | |
| National Pollutant Discharge Elimination System | 40 CFR § 122.26 | In general, Part 122 provides permit requirements for the discharge of pollutants from any point source into waters of the United States. Part 122.26 requires permits for storm-water discharges. | Potentially Relevant and Appropriate Requirement. |
| Surface Mining Control and Reclamation Act | 30 USC §§ 1201-1328 | Performance standards for surface mining activities. | Potentially Relevant and Appropriate Requirement |
| Hazardous Materials Transportation Act | 49 USC §§ 1801-1813 49 CFR 10, and 171-177 | Regulates transportation of hazardous materials. | Potentially Applicable Requirement, if any hazardous materials are transported offsite. |
| Resource Conservation and Recovery Act | 42 USC § 6905 | | |
| Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal (TSD) Facilities | 40 CFR § 264.13.14 | Requirements for proper handling, treatment, storage, and disposal of hazardous wastes. | Potentially Relevant and Appropriate Requirement |
| Land Disposal Restrictions (LDRs) | 40 CFR 268 | LDRs place specific restrictions (concentration levels or treatment) on RCRA hazardous wastes prior to their placement in a land disposal unit. Relevant and appropriate LDR requirements will be met if any material accumulations are treated <i>ex situ</i> . | Potentially Relevant and Appropriate Requirement |
| Disposal of Solid Waste | RCRA 42 U.S.C. § 6901 et seq ; 40 CFR 257 | Facility or practices in floodplains will not restrict flow of basic flood, reduce the temporary water storage capacity of the floodplain or otherwise result in a wash-out of solid waste. | Potentially Relevant and Appropriate Requirement |
| Closure Requirements | RCRA/HWMA 40 CFR 264, Subpart G | Closure of hazardous waste repositories must meet protective standards. Regulations to minimize contaminant migration, provide leachate collection and prevent contaminant exposure will be met. | Potentially Relevant and Appropriate Requirement |
| Landfill Design and Construction | RCRA/HWMA 40 CFR 264, Subpart N | Hazardous waste landfills must meet minimum design standards. Protectiveness will be achieved through capping and institutional controls. | Potentially Relevant and Appropriate Requirement |
| Ground Water Monitoring | RCRA/HWMA 40 CFR 264, Subpart F 40 CFR 264, Subpart X | Establishes standards for detection and compliance monitoring. Site wide monitoring will accommodate specific ground water monitoring requirements. | Potentially Relevant and Appropriate Requirement |
| Criteria for Classification of Solid Waste Disposal Facilities and Practices | 40 CFR 257 | Establishes criteria for determining which solid waste disposal practices pose threats to human health and the environment. | Potentially Relevant and Appropriate Requirement |
| Occupational Exposure to Asbestos | 29 CFR 1910 and 1926 | Establishes OSHA requirements for asbestos-related work in the construction and demolition industry. Requirements on exposure limits, work practices and engineering controls to provide worker safety in handling, removal, disposal, or other workplace exposure to asbestos. | To Be Considered |
| Fugitive Dust Emissions | 40 CFR § 50.6 | Establishes standards for particulate matter with a diameter of 10 microns or less. | Potentially Relevant and Appropriate Requirement |

Table 6 Action-Specific Potential Applicable or Relevant and Appropriate Requirements

Non-Time-Critical Removal Action Engineering Evaluation/Cost Analysis
Upper Granite Creek Watershed Mines, Wallowa Whitman National Forest, Oregon

| Standard, Requirement Criteria, or Limitation | Citation | Description | Applicable/Relevant and Appropriate? | | |
|--|---------------------------------|---|--|--|--|
| STATE OF OREGON | | | | | |
| Regulations pertaining to National Pollutant Discharge Elimination System and Water Pollution Control Facility Permits | OAR 340 Division 45 | Prescribes limitations on discharge of wastes and the requirements and procedures for obtaining National Pollutant Discharge Elimination System and Water Pollution Control Facility permits from the ODEQ | Potentially Relevant and Appropriate Requirement | | |
| Groundwater Quality Protection Program | OAR 340 Division 40 | Establishes the mandatory minimum groundwater quality protection requirements for federal and state agencies, cities, counties, industries, and citizens. | Potentially Relevant and Appropriate Requirement | | |
| Solid Waste: Land Disposal Sites other than Municipal Solid Waste Landfills | OAR 340 Division 95 | Regulates the siting, operation and maintenance of any non-municipal land disposal site. | Potentially Relevant and Appropriate Requirement | | |
| Storage, Treatment and Disposal of Hazardous Waste | ORS Chapter 466 | Regulates the transportation and disposal of hazardous waste. | Potentially Relevant and Appropriate Requirement | | |
| Reduction of use of Toxic Substances and Hazardous Waste Generation | ORS 465.200455 and 465.900 | Establishes ODEQ removal and remedial action program | Potentially Relevant and Appropriate Requirement | | |
| | OAR 340-32-5620 through 5650 | Establish ODEQ requirements for licensing and certification for asbestos workers. All workers who handle asbestos-containing materials must meet certain training, licensing and certification requirements. | Potentially Applicable Requirement | | |
| Asbestos Removal | OAR 340-248-005 through 130 | Establish ODEQ requirements for handling asbestos-containing materials. Handling, removing, transporting and disposing of asbestos material in a manner that prevents it from becoming friable and releasing asbestos fibers. | Potentially Applicable Requirement | | |

Note:

ARAR = Applicable/Relevant and Appropriate Requirement

CFR = The Code of Federal Regulations

LDR = Land Disposal Restrictions

OAR = Oregon Administrative Rules

ODEQ = Oregon Department of Environmental Quality

ORS = Oregon Revised Statutes

OSHA = Occupational Safety and Health Administration

RCRA = Resource Conservation and Recovery Act

USC = United States Code

Table 7
Cost Estimate for Alternative 2 - Onsite Containment
Non-Time-Critical Removal Action Engineering Evaluation/Cost Analysis
Upper Granite Creek Watershed Mines

Wallowa-Whitman National Forest, Oregon

| Task | | Quantity | Units | Unit Cost | Cost |
|---|---|----------|-----------|------------|------------|
| Mobilization | | 1 | LS | \$ 10,000 | \$ 10,000 |
| Improvements to existing ro | mprovements to existing roads- FS 7345, FS 720, FS 280, and unnamed roads | | | | \$ 40,000 |
| Creation of new roads to accat Golden Fraction Mine | 2 | PM | \$ 80,000 | \$ 160,000 | |
| Grubbing and Scraping | | 3 | PA | \$ 10,000 | \$ 30,000 |
| Erosion Control - Silt Fences | - Spring Diversion | 1 | LS | \$ 10,000 | \$ 10,000 |
| | Upper Upper Monumental Mine | 470 | CY | \$ 10.0 | \$ 4,700 |
| | Upper Monumental Mine | 8,405 | CY | \$ 10.0 | \$ 84,050 |
| | Lower Monumental Mine | 5,910 | CY | \$ 10.0 | \$ 59,100 |
| | Granite Creek Aquatic Station 03 | 80 | CY | \$ 10.0 | \$ 800 |
| Grading | Cap Martin Mine | 735 | CY | \$ 10.0 | \$ 7,350 |
| Oraumg | Granite Creek #6 Mine | 45 | CY | \$ 10.0 | \$ 450 |
| | Tillicum Mine | 205 | CY | \$ 10.0 | \$ 2,050 |
| | Granite Creek #5 Mine | 285 | CY | \$ 10.0 | \$ 2,850 |
| | Golden Fraction Mine | 295 | CY | \$ 10.0 | \$ 2,950 |
| | Central Mine | 80 | CY | \$ 10.0 | \$ 800 |
| | Upper Upper Monumental Mine | 1,200 | SF | \$ 10.0 | \$ 12,000 |
| | Upper Monumental Mine | 6,700 | SF | \$ 20.0 | \$ 134,000 |
| | Lower Monumental Mine | 5,700 | SF | \$ 10.0 | \$ 57,000 |
| Cover Placement - assumes | Granite Creek Aquatic Station 03 | 259 | SF | \$ 10.0 | \$ 2,590 |
| | Cap Martin Mine | 3,000 | SF | \$ 10.0 | \$ 30,000 |
| Monumental Mine | Granite Creek #6 Mine | 150 | SF | \$ 10.0 | \$ 1,500 |
| (assumes sourced from | Tillicum Mine | 425 | SF | \$ 10.0 | \$ 4,250 |
| Granite Creek Saddle) | Granite Creek #5 Mine | 1,000 | SF | \$ 10.0 | \$ 10,000 |
| | Golden Fraction Mine | 400 | SF | \$ 10.0 | \$ 4,000 |
| | Central Mine | 441 | SF | \$ 10.0 | \$ 4,410 |

Table 7
Cost Estimate for Alternative 2 - Onsite Containment

Non-Time-Critical Removal Action Engineering Evaluation/Cost Analysis
Upper Granite Creek Watershed Mines

Wallowa-Whitman National Forest, Oregon

| Task | | Quantity | Units | Unit Cost | Cost |
|----------------------------|--|----------|--------------|--------------|--------------|
| | Upper Monumental Mine - Adit seep pipe construction | 1 | LS | \$ 5,000 | \$ 5,000 |
| Water Engineering | Upper Monumental Mine - settling pond diversion | 1 | LS | \$ 15,000 | \$ 15,000 |
| Controls | Lower Monumental Mine - adit and settling pond diversion channel | 1 | LS | \$ 25,000 | \$ 25,000 |
| | HDPE Culvert Under Access Roads | 2 | Each | \$ 5,000 | \$ 10,000 |
| Revegetation | Seed/Fertilization | 5 | PA | \$ 2,000 | \$ 10,000 |
| Revegetation | Mulch | 5 | PA | \$ 3,000 | \$ 15,000 |
| Road Decommissioning | | 1 | LS | \$ 10,000 | \$ 10,000 |
| Confirmation sampling ana | lytical cost and XRF rental | 1 | LS | \$ 30,000 | \$ 30,000 |
| Demobilization | | 1 | LS | \$ 10,000 | \$ 10,000 |
| | | | Subtotal C | apital Costs | \$ 804,850 |
| Design Expenses (10%) | | | | | \$ 80,485 |
| Construction Oversight (15 | %) | | | | \$ 120,728 |
| Post Construction Monitor | ing (6 years) | 6 | PY | \$ 15,000 | \$ 90,000 |
| | | Subtota | I Indirect C | apital Costs | \$ 291,213 |
| Contingency (10%) | | | | | \$ 29,121 |
| | | TOTAL F | RESENT W | ORTH COST | \$ 1,125,184 |

Note:

CY = cubic yards

LS = lump sum

PA = per acre

PM = per mile

SF = square foot

PY = per year

Table 8
Cost Estimate for Alternative 3 - Excavation and Disposal in Onsite Repository

Non-Time-Critical Removal Action Engineering Evaluation/Cost Analysis Upper Granite Creek Watershed Mines

Wallowa-Whitman National Forest, Oregon

| Task | | Quantity | Units | Unit Cost | Cost |
|--|---|----------|-------|------------|------------|
| Mobilization | | 1 | LS | \$ 10,000 | \$ 10,000 |
| Improvements to existing ro | pads- FS 7345, FS 720, FS 280, and unnamed roads | 8 | PM | \$ 5,000 | \$ 40,000 |
| Creation of new roads to acat Golden Fraction Mine | cess Granite Creek #6 and Cap Martin Mines, and upper waste rock pile | 2 | PM | \$ 80,000 | \$ 160,000 |
| Grubbing and Scraping | | 3 | PA | \$ 10,000 | \$ 30,000 |
| Erosion Control - Silt Fences | - Spring Diversion | 1 | LS | \$ 10,000 | \$ 10,000 |
| | Upper Upper Monumental Mine | 470 | CY | \$ 14.0 | \$ 6,580 |
| | Upper Monumental Mine | 8,405 | CY | \$ 14.0 | \$ 117,670 |
| Waste Rock Excavation and | Lower Monumental Mine | 5,910 | CY | \$ 17.0 | \$ 100,470 |
| Hauling (rates increase | Granite Creek Aquatic Station 03 | 80 | CY | \$ 32.0 | \$ 2,560 |
| with number of trucks and | Cap Martin Mine | 735 | CY | \$ 52.0 | \$ 38,220 |
| distance due to hauling | Granite Creek #6 Mine | 45 | CY | \$ 37.0 | \$ 1,665 |
| costs) | Tillicum Mine | 205 | CY | \$ 25.0 | \$ 5,125 |
| | Granite Creek #5 Mine | 285 | CY | \$ 25.0 | \$ 7,125 |
| | Golden Fraction Mine | 295 | CY | \$ 20.0 | \$ 5,900 |
| | Central Mine | 80 | CY | \$ 15.0 | \$ 1,200 |
| | Upper Upper Monumental Mine | 1,200 | SF | \$ 10.0 | \$ 12,000 |
| | Upper Monumental Mine | 6,700 | SF | \$ 10.0 | \$ 67,000 |
| | Lower Monumental Mine | 5,700 | SF | \$ 10.0 | \$ 57,000 |
| | Granite Creek Aquatic Station 03 | 259 | SF | \$ 10.0 | \$ 2,590 |
| | Cap Martin Mine | 3,000 | SF | \$ 10.0 | \$ 30,000 |
| Regrading After Excavation | Granite Creek #6 Mine | 150 | SF | \$ 10.0 | \$ 1,500 |
| | Tillicum Mine | 425 | SF | \$ 10.0 | \$ 4,250 |
| | Granite Creek #5 Mine | 1,000 | SF | \$ 10.0 | \$ 10,000 |
| | Golden Fraction Mine | 400 | SF | \$ 10.0 | \$ 4,000 |
| | Central Mine | 441 | SF | \$ 10.0 | \$ 4,410 |
| Tailings Evenyation | Upper and Lower Monumental Mine (Vacuum Truck) | 10 | Day | \$ 2000.0 | \$ 20,000 |
| Tailings Excavation | Wetland Rehabilitation | 1 | LS | \$ 50000.0 | \$ 50,000 |

Table 8
Cost Estimate for Alternative 3 - Excavation and Disposal in Onsite Repository

Non-Time-Critical Removal Action Engineering Evaluation/Cost Analysis Upper Granite Creek Watershed Mines

Wallowa-Whitman National Forest, Oregon

| Task | | Quantity | Units | Unit Cost | Cost |
|---------------------------------|--|---------------|------------|--------------|--------------|
| | Subgrade Excavation | 1 | LS | \$ 10,000 | \$ 10,000 |
| Repository Construction | Capping, grading, liner installation, engineering controls | 1 | LS | \$ 100,000 | \$ 100,000 |
| | Revegetation | 2 | PA | \$ 5,000 | \$ 10,000 |
| | Upper Monumental Mine - Adit seep pipe construction | 1 | LS | \$ 5,000 | \$ 5,000 |
| Water Engineering | Upper Monumental Mine - settling pond diversion | 1 | LS | \$ 15,000 | \$ 15,000 |
| Controls | Lower Monumental Mine - adit and settling pond diversion channel | 1 | LS | \$ 25,000 | \$ 25,000 |
| | HDPE Culvert Under Access Roads | 2 | Each | \$ 5,000 | \$ 10,000 |
| Revegetation | Seed/Fertilization | 5 | PA | \$ 2,000 | \$ 10,000 |
| Revegetation | Mulch | 5 | PA | \$ 3,000 | \$ 15,000 |
| Road Decommissioning | | 1 LS \$10,000 | | | \$ 10,000 |
| Confirmation sampling ana | ytical cost and XRF rental | 1 | LS | \$ 30,000 | \$ 30,000 |
| Demobilization | | 1 LS \$10,000 | | \$ 10,000 | \$ 10,000 |
| | | | Subtotal C | apital Costs | \$ 1,049,265 |
| Design Expenses (20% to ac | count for additional design and permitting of the landfill) | | | | \$ 209,853 |
| Construction Oversight (159 | %) | | | | \$ 157,390 |
| Post Construction Monitori | ng (20 years - longer to account for the presence of the landfill) | 20 | PY | \$ 15,000 | \$ 300,000 |
| Subtotal Indirect Capital Costs | | | | | \$ 667,243 |
| Contingency (10%) | | | | | \$ 66,724 |
| | | TOTAL P | RESENT W | ORTH COST | \$ 1,783,232 |

Note:

CY = cubic yards

LS = lump sum

PA = per acre

PM = per mile

Table 9
Cost Estimate for Alternative 4 - Excavation and Offsite Disposal
Non-Time-Critical Removal Action Engineering Evaluation/Cost Analysis
Upper Granite Creek Watershed Mines

Wallowa-Whitman National Forest, Oregon

| Task | | Quantity | Units | Unit Cost | Cost |
|--|---|----------|-------|-----------|------------|
| Mobilization | | 1 | LS | \$ 10,000 | \$ 10,000 |
| Improvements to existing ro | oads- FS 7345, FS 720, FS 280, and unnamed roads | 8 | PM | \$ 5,000 | \$ 40,000 |
| Creation of new roads to acat Golden Fraction Mine | cess Granite Creek #6 and Cap Martin Mines, and upper waste rock pile | 2 | PM | \$ 80,000 | \$ 160,000 |
| Grubbing and Scraping | | 3 | PA | \$ 10,000 | \$ 30,000 |
| Erosion Control - Silt Fences | s - Spring Diversion | 1 | LS | \$ 10,000 | \$ 10,000 |
| | Upper Upper Monumental Mine | 470 | CY | \$ 14.0 | \$ 6,580 |
| | Upper Monumental Mine | 8,405 | CY | \$ 14.0 | \$ 117,670 |
| | Lower Monumental Mine | 5,910 | CY | \$ 17.0 | \$ 100,470 |
| | Granite Creek Aquatic Station 03 | 80 | CY | \$ 32.0 | \$ 2,560 |
| Waste Rock Excavation | Cap Martin Mine | 735 | CY | \$ 52.0 | \$ 38,220 |
| Waste Nock Excavation | Granite Creek #6 Mine | 45 | CY | \$ 37.0 | \$ 1,665 |
| | Tillicum Mine | 205 | CY | \$ 25.0 | \$ 5,125 |
| | Granite Creek #5 Mine | 285 | CY | \$ 25.0 | \$ 7,125 |
| | Golden Fraction Mine | 295 | CY | \$ 20.0 | \$ 5,900 |
| | Central Mine | 80 | CY | \$ 15.0 | \$ 1,200 |
| | Upper Upper Monumental Mine | 470 | CY | \$ 100.0 | \$ 47,000 |
| | Upper Monumental Mine | 7,965 | CY | \$ 100.0 | \$ 796,500 |
| Waste Rock Hauling to | Lower Monumental Mine | 5,730 | CY | \$ 100.0 | \$ 573,000 |
| Subtitle D Landfill (costs | Granite Creek Aquatic Station 03 | 80 | CY | \$ 100.0 | \$ 8,000 |
| assume 4 round trips to | Cap Martin Mine | 735 | CY | \$ 100.0 | \$ 73,500 |
| the landfill per truck day + | Granite Creek #6 Mine | 45 | CY | \$ 100.0 | \$ 4,500 |
| tipping fees) | Tillicum Mine | 205 | CY | \$ 100.0 | \$ 20,500 |
| | Granite Creek #5 Mine | 285 | CY | \$ 100.0 | \$ 28,500 |
| | Golden Fraction Mine | 295 | CY | \$ 100.0 | \$ 29,500 |
| | Central Mine | 80 | CY | \$ 100.0 | \$ 8,000 |

Table 9
Cost Estimate for Alternative 4 - Excavation and Offsite Disposal
Non-Time-Critical Removal Action Engineering Evaluation/Cost Analysis
Upper Granite Creek Watershed Mines

Wallowa-Whitman National Forest, Oregon

| Task | | Quantity | Units | Unit Cost | Cost |
|---------------------------------|--|----------|------------|--------------|--------------|
| | Upper Upper Monumental Mine | 1,200 | SF | \$ 10.0 | \$ 12,000 |
| | Upper Monumental Mine | 6,700 | SF | \$ 10.0 | \$ 67,000 |
| | Lower Monumental Mine | 5,700 | SF | \$ 10.0 | \$ 57,000 |
| | Granite Creek Aquatic Station 03 | 259 | SF | \$ 10.0 | \$ 2,590 |
| | Cap Martin Mine | 3,000 | SF | \$ 10.0 | \$ 30,000 |
| Regrading After Excavation | Granite Creek #6 Mine | 150 | SF | \$ 10.0 | \$ 1,500 |
| | Tillicum Mine | 425 | SF | \$ 10.0 | \$ 4,250 |
| | Granite Creek #5 Mine | 1,000 | SF | \$ 10.0 | \$ 10,000 |
| | Golden Fraction Mine | 400 | SF | \$ 10.0 | \$ 4,000 |
| | Central Mine | 441 | SF | \$ 10.0 | \$ 4,410 |
| | Onsite Vacuum Truck | 10 | Day | \$ 2000.0 | \$ 20,000 |
| Tailings Excavation +Hauling | Haul to Subtitle C Landfill and Tipping Fees | 620 | CY | \$ 320.0 | \$ 198,400 |
| Friduling | Wetland Rehabilitation and Clean Soil Cover | 1 | LS | \$ 50000.0 | \$ 50,000 |
| | Upper Monumental Mine - Adit seep pipe construction | 1 | LS | \$ 5,000 | \$ 5,000 |
| Water Engineering | Upper Monumental Mine - settling pond diversion | 1 | LS | \$ 15,000 | \$ 15,000 |
| Controls | Lower Monumental Mine - adit and settling pond diversion channel | 1 | LS | \$ 25,000 | \$ 25,000 |
| | HDPE Culvert Under Access Roads | 2 | Each | \$ 5,000 | \$ 10,000 |
| Revegetation | Seed/Fertilization | 5 | PA | \$ 2,000 | \$ 10,000 |
| Nevegetation | Mulch | 5 | PA | \$ 3,000 | \$ 15,000 |
| Road Decommissioning | | 1 | LS | \$ 10,000 | \$ 10,000 |
| Confirmation sampling anal | ytical cost and XRF rental | 1 | LS | \$ 30,000 | \$ 30,000 |
| Demobilization | | 1 | LS | \$ 10,000 | \$ 10,000 |
| | | | Subtotal C | apital Costs | \$ 2,716,665 |

Cost Estimate for Alternative 4 - Excavation and Offsite Disposal

Non-Time-Critical Removal Action Engineering Evaluation/Cost Analysis Upper Granite Creek Watershed Mines

Wallowa-Whitman National Forest, Oregon

| Task | Quantity | Units | Unit Cost | Cost |
|--|----------|--------------|------------------|--------------|
| Design Expenses (Equal to Alternative 2) | • | | | \$ 80,485 |
| Construction Oversight (Twice Alternative 3 to account for longer implementation time) | | | | \$ 314,780 |
| Post Construction Monitoring (6 years) | 6 | PY | \$ 15,000 | \$ 90,000 |
| | Subtota | l Indirect C | apital Costs | \$ 485,265 |
| Contingency (10%) | | | | \$ 48,526 |
| | TOTAL | PRESENT W | ORTH COST | \$ 3,250,456 |

Note:

CY = cubic yards

LS = lump sum

PA = per acre

PM = per mile

Table 10 Cost Estimate for Recommended AlternativeNon-Time-Critical Removal Action Engineering Evaluation/Cost Analysis

Upper Granite Creek Watershed Mines Wallowa-Whitman National Forest, Oregon

| Task | | Quantity | Units | Unit Cost | Cost |
|---|--|----------|-------|------------|------------|
| Mobilization | | 1 | LS | \$ 10,000 | \$ 10,000 |
| Improvements to existing ro | ads- FS 7345, FS 720, and unnamed roads | 5 | PM | \$ 5,000 | \$ 25,000 |
| Grubbing and Scraping | | 2 | PA | \$ 10,000 | \$ 20,000 |
| Erosion Control - Silt Fences | - Spring Diversion | 1 | LS | \$ 10,000 | \$ 10,000 |
| | Upper Upper Monumental Mine | 470 | CY | \$ 10.0 | \$ 4,700 |
| | Upper Monumental Mine | 8,405 | CY | \$ 10.0 | \$ 84,050 |
| Grading | Lower Monumental Mine | 5910 | CY | \$ 10.0 | \$ 59,100 |
| | Granite Creek Aquatic Station 03 | 80 | CY | \$ 10.0 | \$ 800 |
| | Central Mine | 80 | CY | \$ 10.0 | \$ 800 |
| | Upper Upper Monumental Mine | 1,200 | SF | \$ 10.0 | \$ 12,000 |
| Cover Placement - assumes local cover except at Upper | Upper Monumental Mine | 6,700 | SF | \$ 20.0 | \$ 134,000 |
| Monumental Mine | Lower Monumental Mine | 5700 | SF | \$ 10.0 | \$ 57,000 |
| (assumes sourced from Granite Creek Saddle) | Granite Creek Aquatic Station 03 | 259 | SF | \$ 10.0 | \$ 2,590 |
| | Central Mine | 441 | SF | \$ 10.0 | \$ 4,410 |
| | Upper Monumental Mine - Adit seep pipe construction | 1 | LS | \$ 5,000 | \$ 5,000 |
| Water Engineering | Upper Monumental Mine - settling pond diversion | 1 | LS | \$ 15,000 | \$ 15,000 |
| Controls | Lower Monumental Mine - adit and settling pond diversion channel | 1 | LS | \$ 25,000 | \$ 25,000 |
| | HDPE Culvert Under Access Roads | 2 | Each | \$ 5,000 | \$ 10,000 |
| | Onsite Vacuum Truck | 10 | Day | \$ 2000.0 | \$ 20,000 |
| Tailings Excavation +Hauling | Haul to Subtitle C Landfill and Tipping Fees | 620 | CY | \$ 320.0 | \$ 198,400 |
| rriddiirig | Wetland Rehabilitation and Clean Soil Cover | 1 | LS | \$ 50000.0 | \$ 50,000 |
| | Subgrade Excavation | 1 | LS | \$ 10,000 | \$ 10,000 |
| Repository Construction | Capping, Grading, Engineering Controls (no Liner) | 1 | LS | \$ 50,000 | \$ 50,000 |
| | Revegetation | 2 | PA | \$ 5,000 | \$ 10,000 |
| Povogotation | Seed/Fertilization | 2 | PA | \$ 2,000 | \$ 4,000 |
| Revegetation | Mulch | 2 | PA | \$ 3,000 | \$ 6,000 |

Cost Estimate for Recommended Alternative

Non-Time-Critical Removal Action Engineering Evaluation/Cost Analysis Upper Granite Creek Watershed Mines

Wallowa-Whitman National Forest, Oregon

| Task | Quantity | Units | Unit Cost | Cost |
|--|----------|--------------|------------------|--------------|
| Road Decommissioning | 1 | LS | \$ 10,000 | \$ 10,000 |
| Confirmation sampling analytical cost and XRF rental | 1 | LS | \$ 30,000 | \$ 30,000 |
| Demobilization | 1 | LS | \$ 10,000 | \$ 10,000 |
| | | Subtotal C | Capital Costs | \$ 877,850 |
| Design Expenses (10%) | | | | \$ 87,785 |
| Construction Oversight (15%) | | | | \$ 131,678 |
| Post Construction Monitoring (6 years) | 6 | PY | \$ 15,000 | \$ 90,000 |
| | Subtota | l Indirect C | Capital Costs | \$ 309,463 |
| Contingency (10%) | | | | \$ 30,946 |
| | TOTAL F | RESENT W | ORTH COST | \$ 1,218,259 |

Note:

CY = cubic yards

LS = lump sum

PA = per acre

PM = per mile

SF = square foot

PY = per year

Table 11 Recommended Removal Action Summary

Non-Time-Critical Removal Action Engineering Evaluation/Cost Analysis Upper Granite Creek Watershed Mines Wallowa-Whitman National Forest, Oregon

| | | Volume | |
|---|---------------------------------|---------------|---|
| Mine | Waste Rock Pile | (cubic yards) | Recommended Alternative |
| | WRA | 395 | Alternative 2 - Onsite Containment |
| | WRB | 5 | Alternative 1 - No Action |
| | WRC | 5 | Alternative 1 - No Action |
| <u>L</u> | WRD | 10 | Alternative 2 - Onsite Containment |
| Upper-Upper | WRE | 5 | Alternative 1 - No Action |
| Monumental | WRF | 10 | Alternative 2 - Onsite Containment |
| | WRG | 10 | To be determined (requires characterization) |
| | WRH | 25 | To be determined (requires characterization) |
| | WRI | 5 | To be determined (requires characterization) |
| | WRJ | 15 | To be determined (requires characterization) |
| _ | TLA | 125 | Alternative 4 - Offsite Disposal |
| | TLB | 305 | Alternative 4 - Offsite Disposal |
| Upper | TLC | 10 | Alternative 4 - Offsite Disposal |
| Monumental | WRA | 7,905 | Alternative 2 - Onsite Containment / |
| | WIG | 7,505 | Alternative 3 - Disposal in Onsite Repository |
| | WRB | 60 | Alternative 2 - Onsite Containment |
| Lower | TLA | 180 | Alternative 4 - Offsite Disposal |
| Monumental | WRA | 5,560 | Alternative 2 - Onsite Containment |
| | WRB | 170 | Alternative 2 - Onsite Containment |
| Granite Creek Aq. | WRA | 15 | Alternative 1 - No Action |
| Station 03 | WRB | 80 | Alternative 2 - Onsite Containment |
| | WRA | 370 | Alternative 1 - No Action |
| Cap Martin | WRB | 10 | Alternative 1 - No Action |
| | WRC | 735 | Alternative 1 - No Action |
| | WRA | 65 | Alternative 1 - No Action |
| Sheridan | WRB | 30 | Alternative 1 - No Action |
| | WRC | 5 | Alternative 1 - No Action |
| Granite Creek #6 | WRA | 45 | Alternative 1 - No Action |
| Granite Creek #0 | WTP | 140 | Alternative 1 - No Action |
| Granite Creek #7 | WRA | 195 | Alternative 1 - No Action |
| Granite Creek #7 | WRB | 125 | Alternative 1 - No Action |
| | WRA | 205 | Alternative 1 - No Action |
| Tillicum | WRB | 145 | Alternative 1 - No Action |
| | WRC | 210 | Alternative 1 - No Action |
| Consider Considering | WRA | 285 | Alternative 1 - No Action |
| Granite Creek #5 | WRB | 10 | Alternative 1 - No Action |
| | WRA | 295 | Alternative 1 - No Action |
| 0.11 5 .: | WRB | 145 | Alternative 1 - No Action |
| Golden Fraction — | WRC | 295 | Alternative 1 - No Action |
| | WRD | 1,105 | Alternative 1 - No Action |
| | WRA | 80 | Alternative 2 - Onsite Containment |
| | WRB | 25 | Alternative 1 - No Action |
| Central | WRC | 105 | Alternative 1 - No Action |
| | WRD | 25 | Alternative 1 - No Action |
| <u> </u> | 5 | | |
| otal Volume for Alteri | native 1 - No Action | | 5,400 cubic yards |
| otal Volume for Alternative 1 - No Action | | | 10,257.5 cubic yards |
| | native 3 - Disposal in Onsite R | | 3952.5 cubic yards |
| | native o pioposai ili Olisile N | CPOSITOLY | L SESSES LUDIC VALUE |

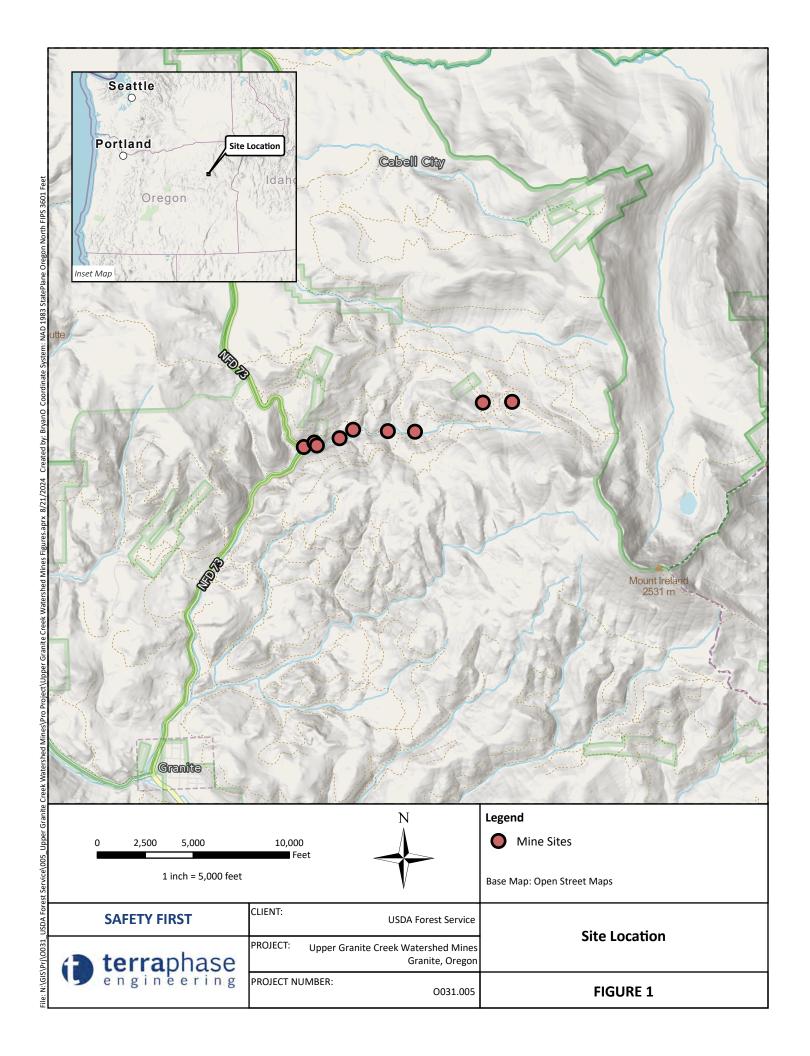
Notes:

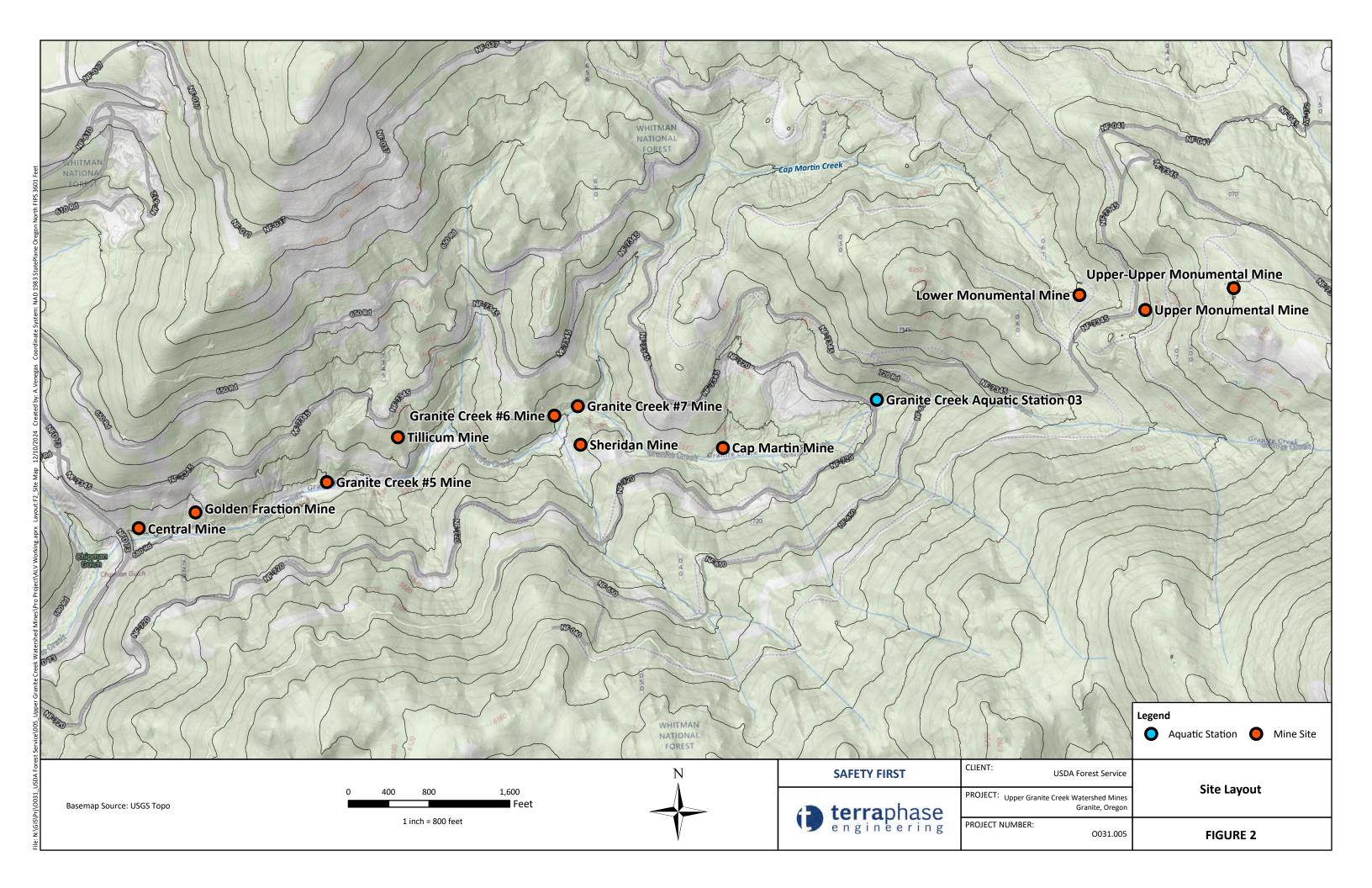
All waste rock volume estimates have been rounded to the nearest 5 cubic yards, with 5 cubic yards being the minimum volume. Total volumes assume half of Upper Monumental Mine waste rock pile A would require disposal in an onsite repository.

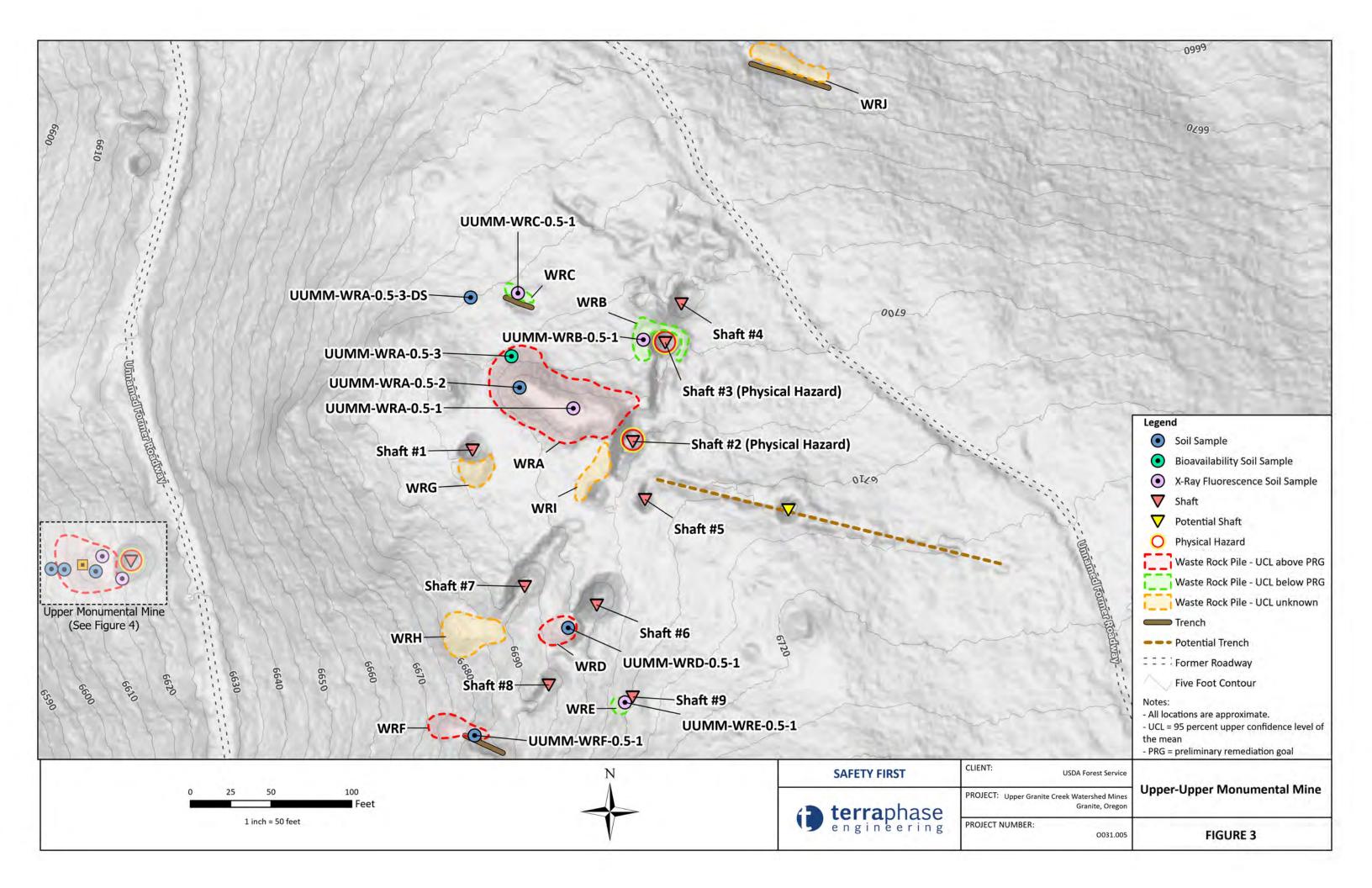
Figures

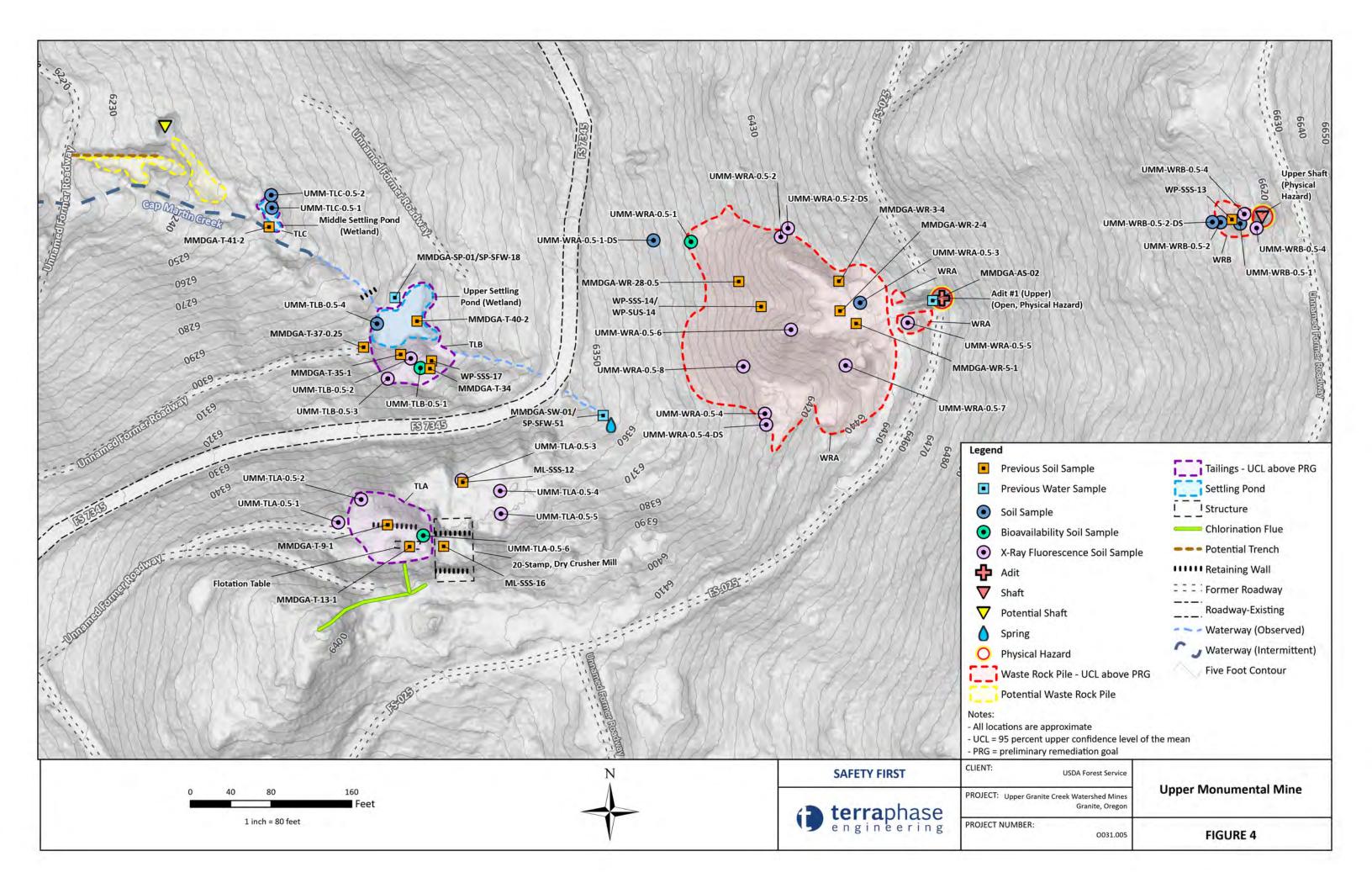
- 1 Site Location
- 2 Site Layout
- 3 Upper-Upper Monumental Mine
- 4 Upper Monumental Mine
- 5 Lower Monumental Mine
- 6 Granite Creek Aquatic Station 03
- 7 Cap Martin Mine
- 8 Sheridan Mine
- 9 Granite Creek #6 Mine
- 10 Granite Creek #7 Mine
- 11 Tillicum Mine
- 12 Granite Creek #5 Mine
- 13 Golden Fraction Mine
- 14 Central Mine
- 15 Background Soil and Surface Water Sampling Locations

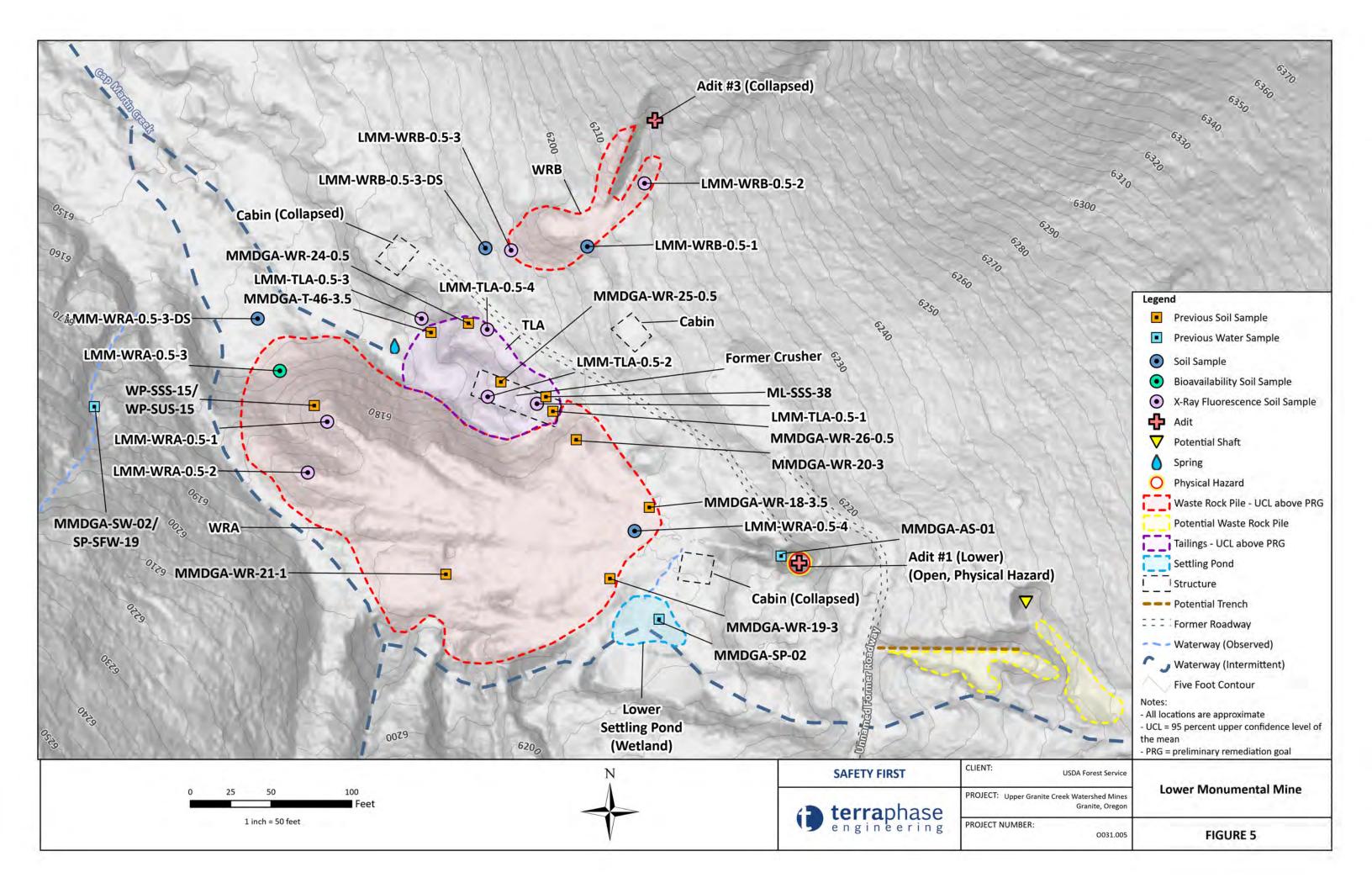


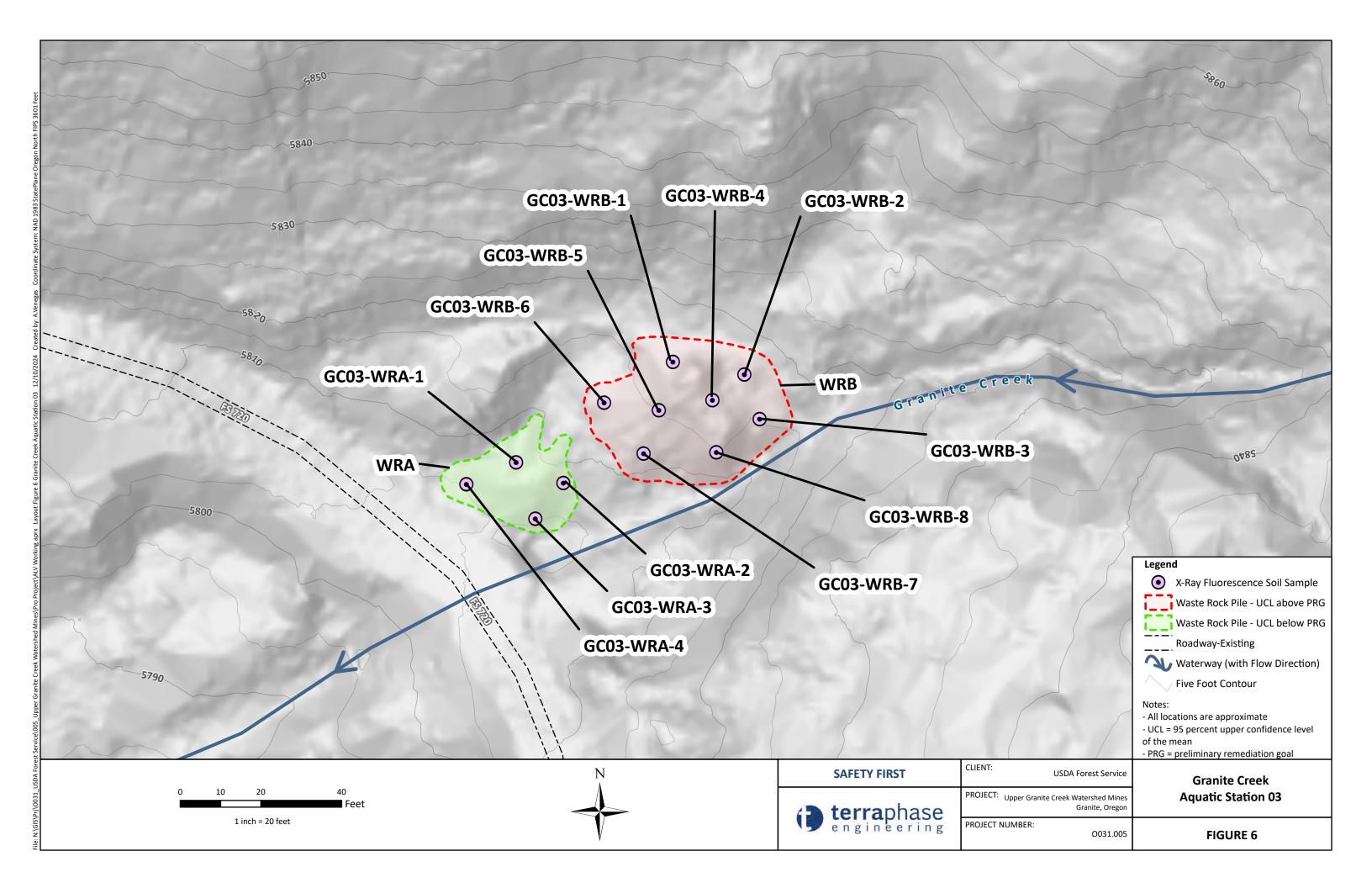


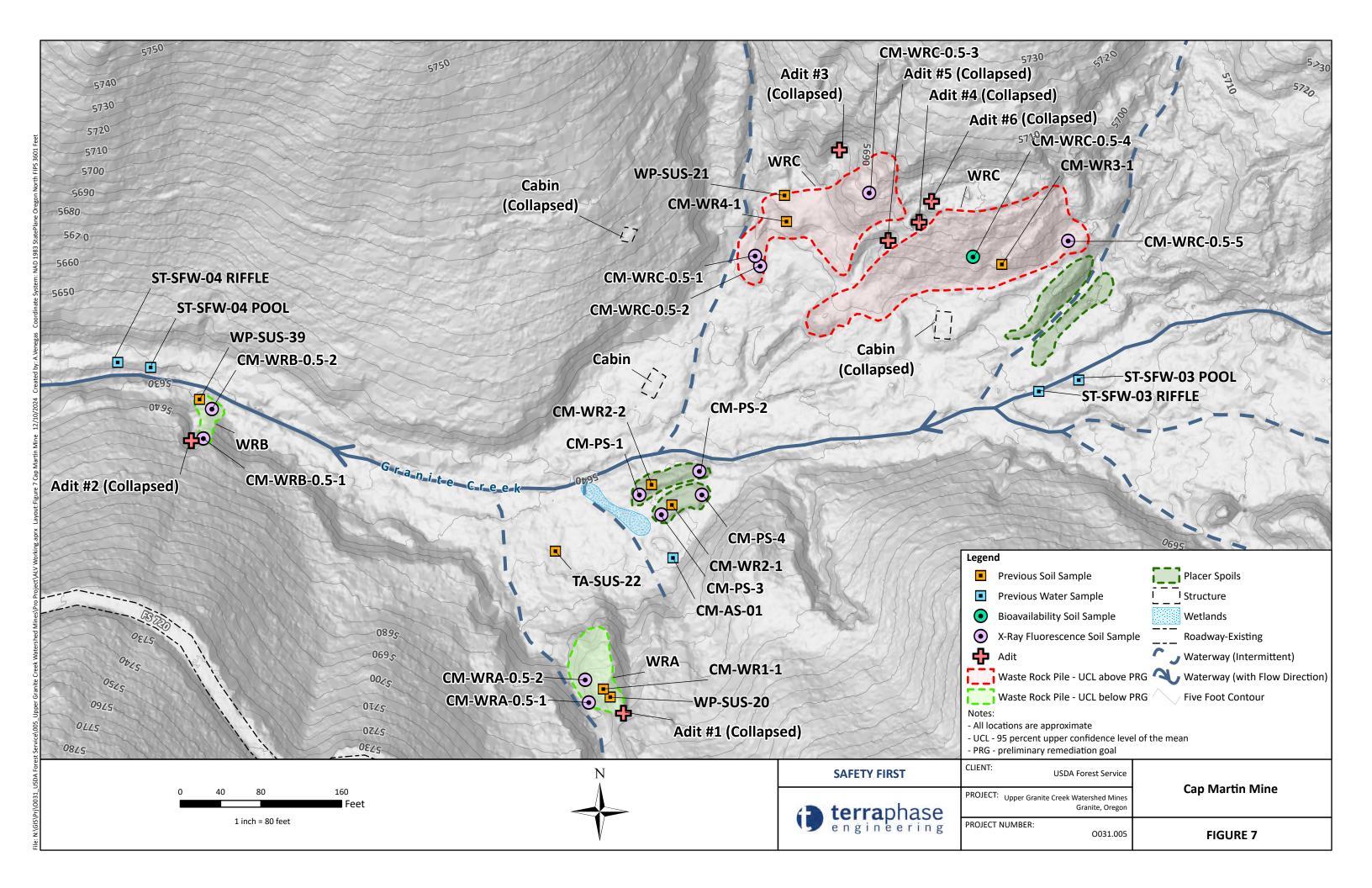


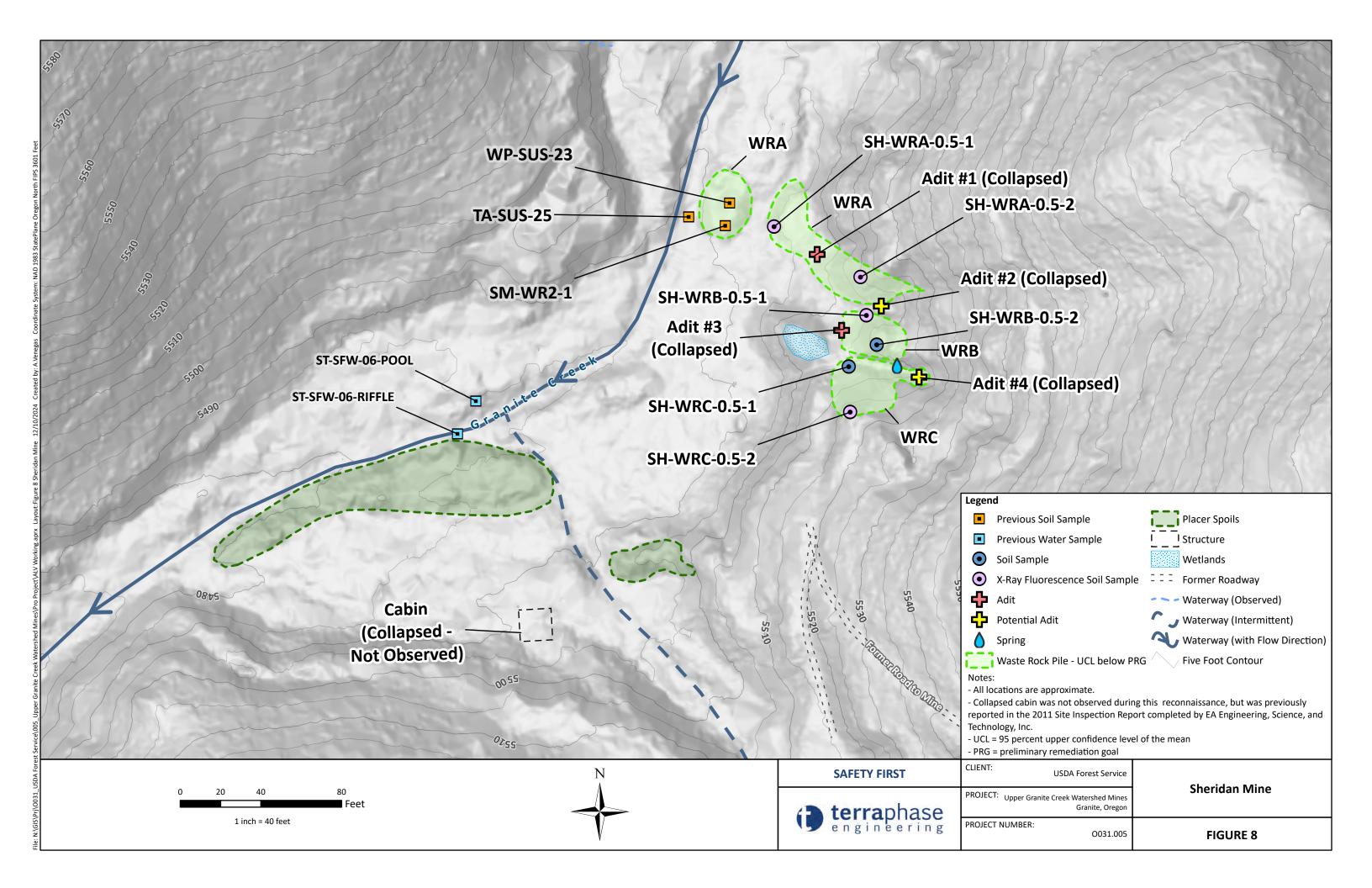


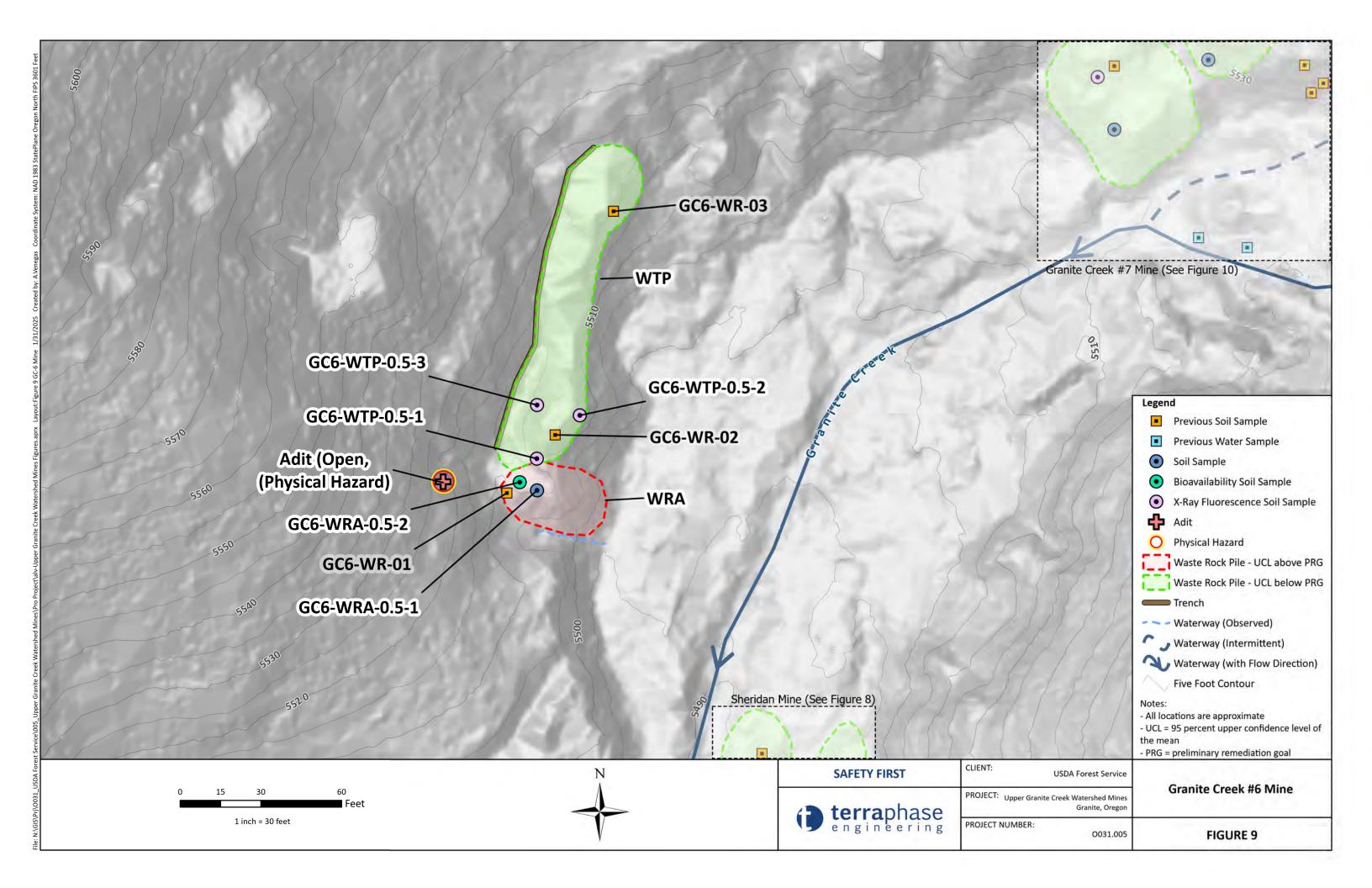


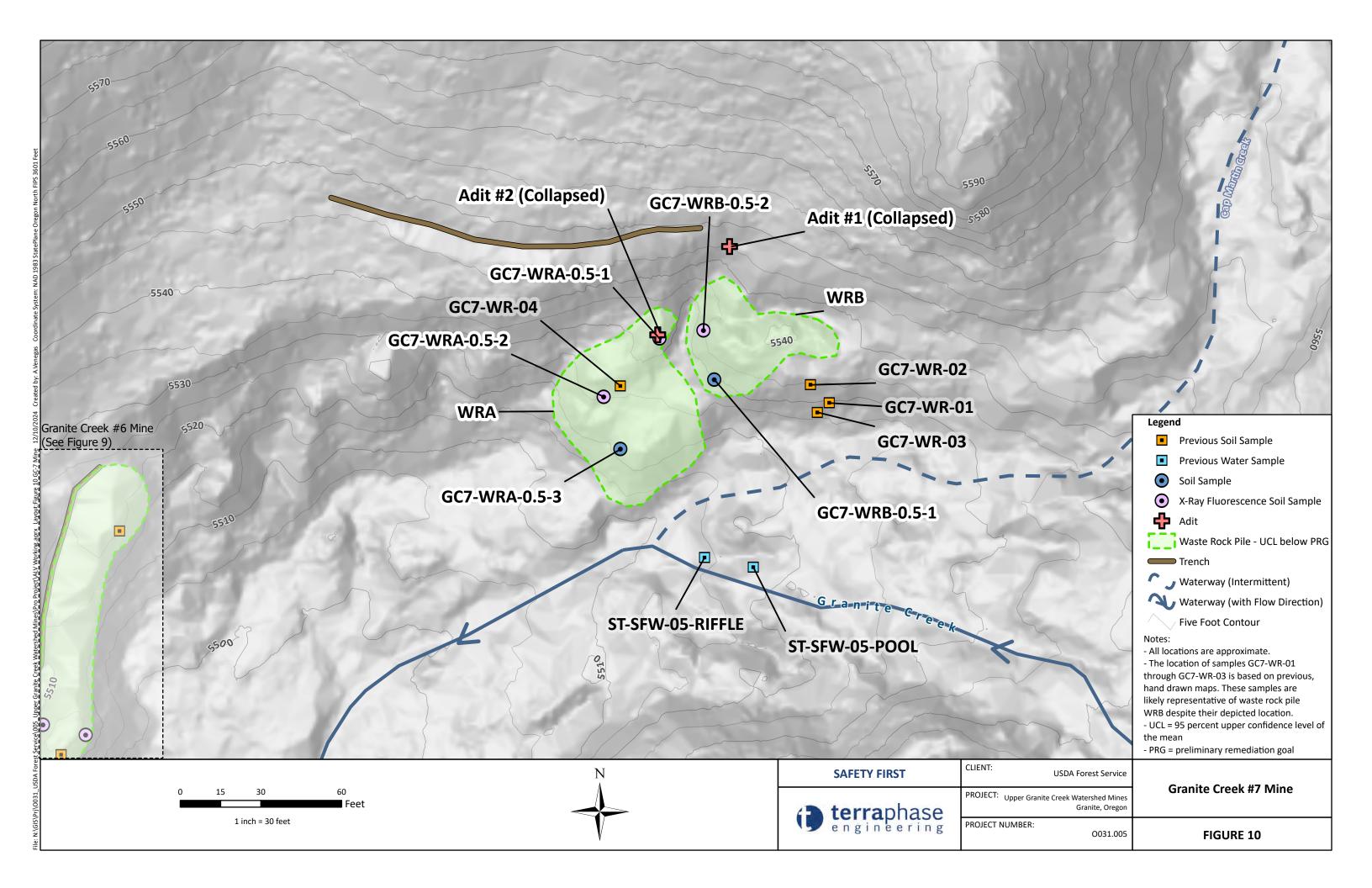


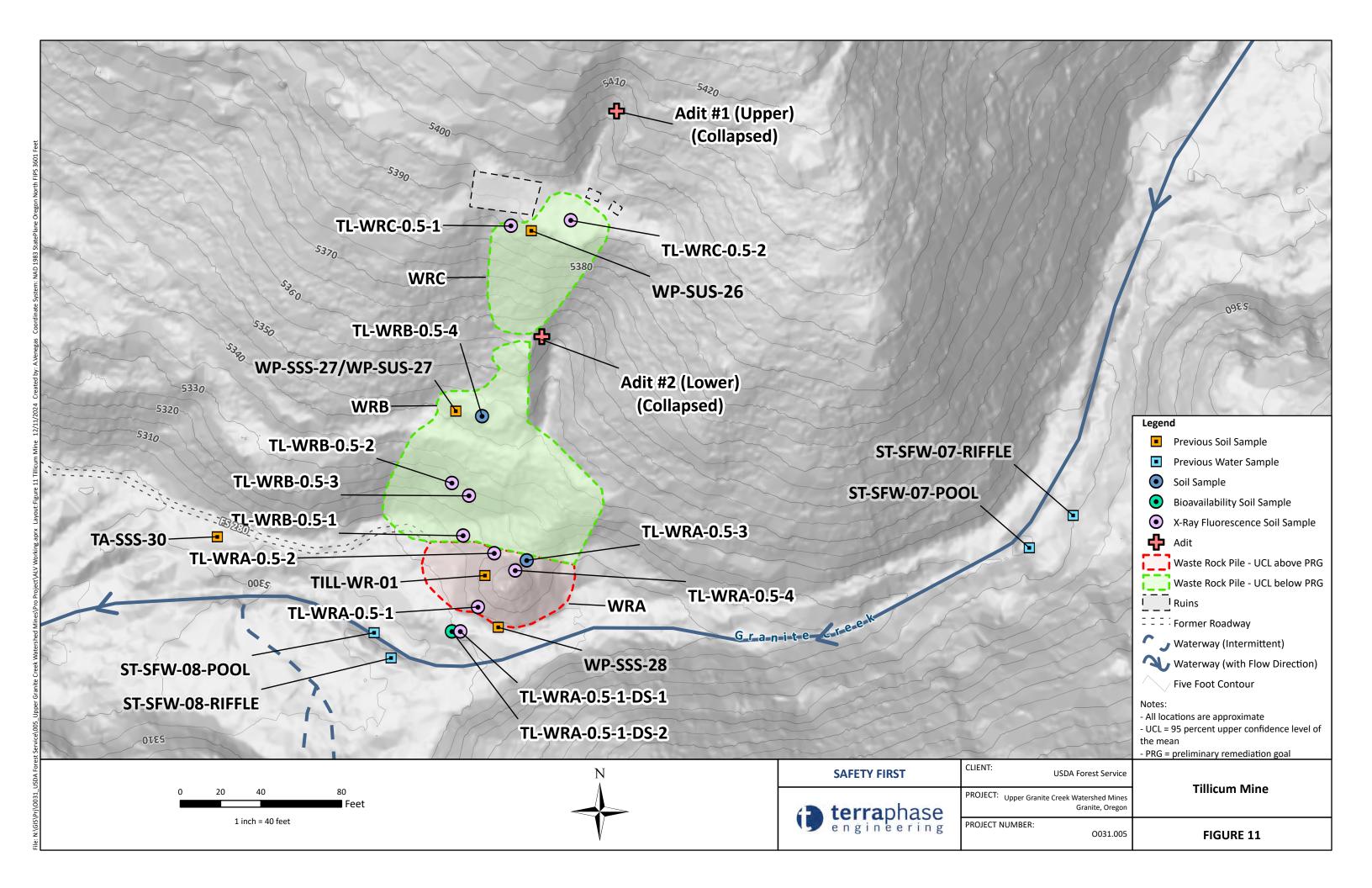


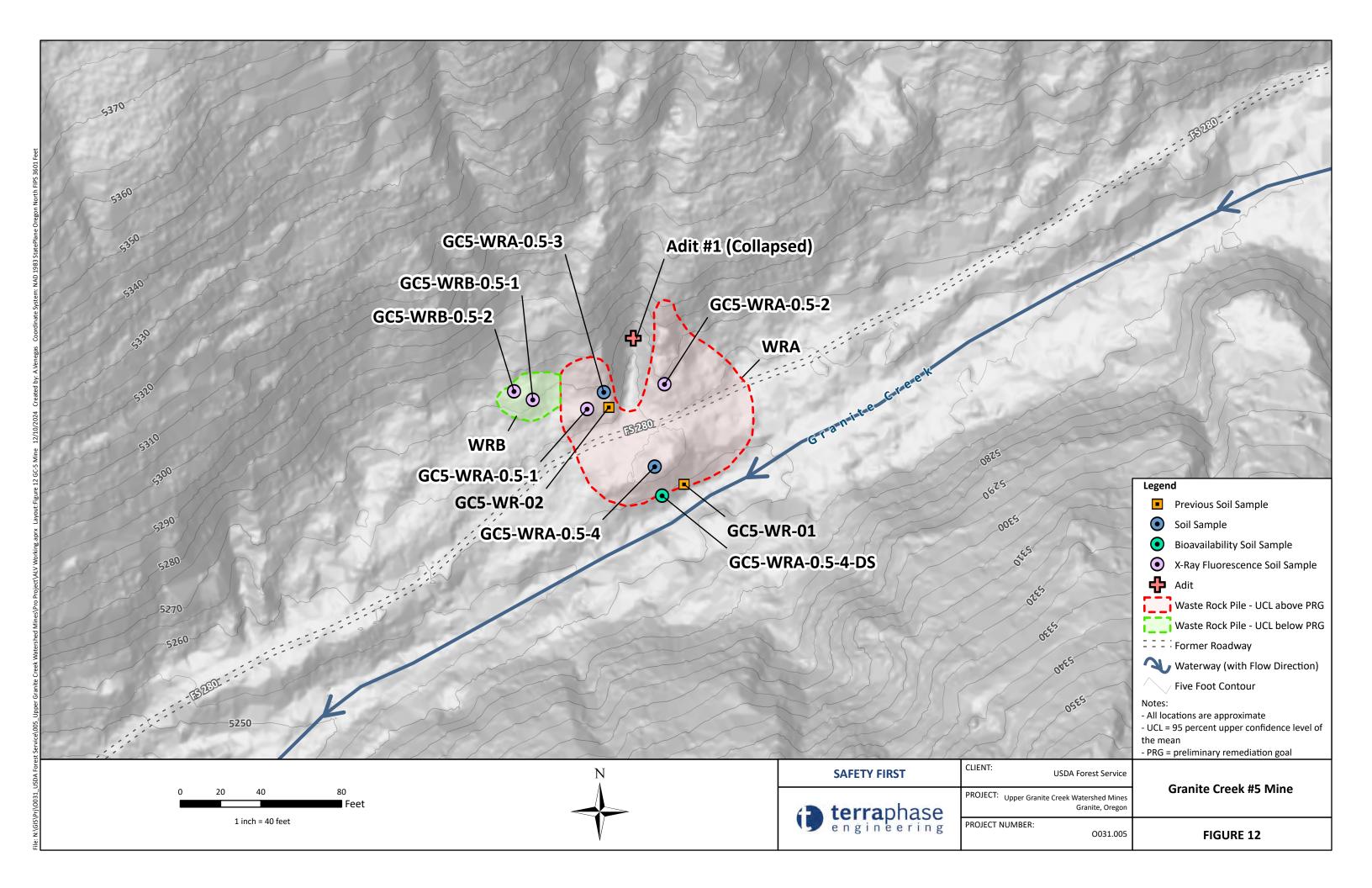


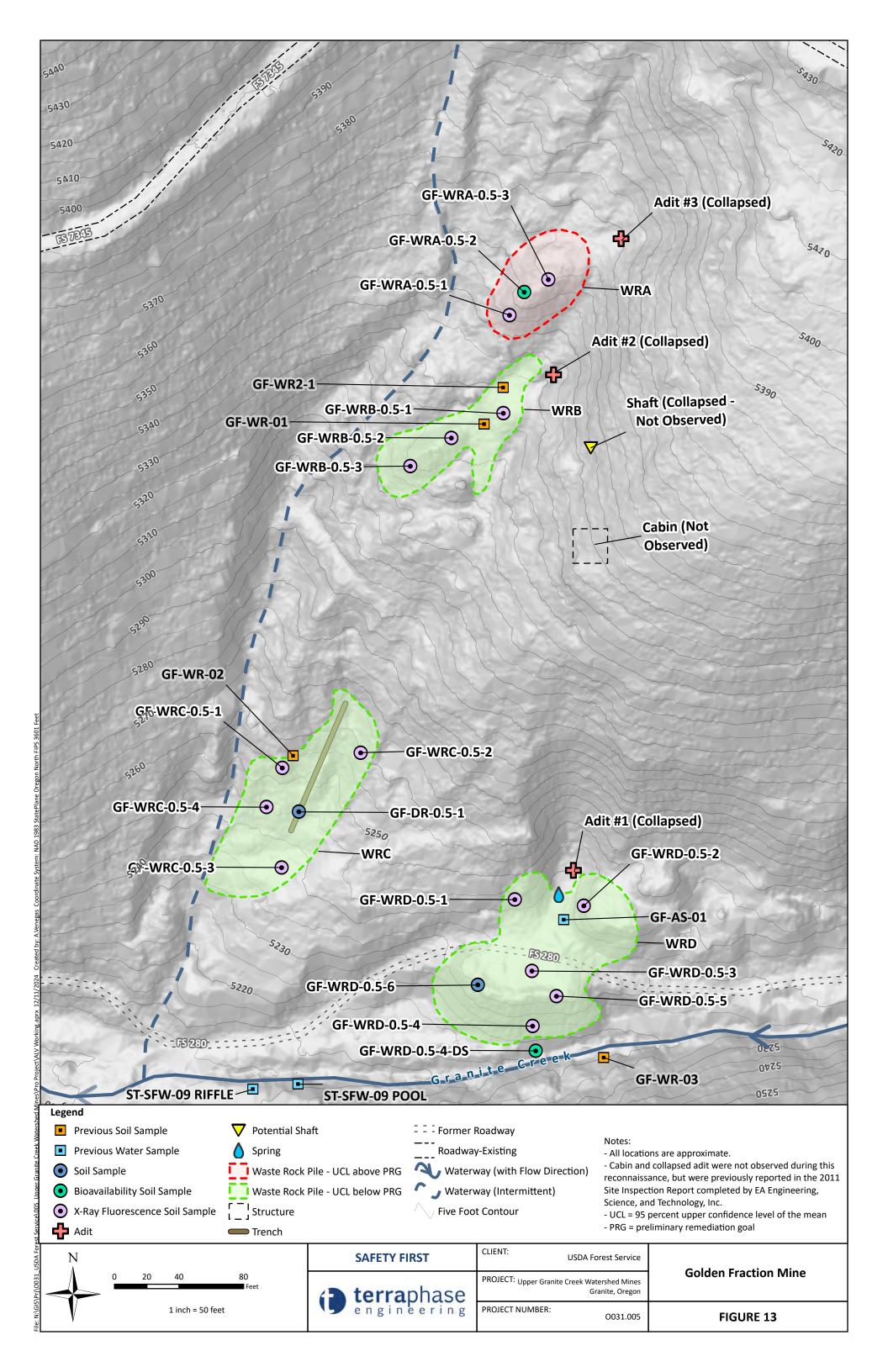


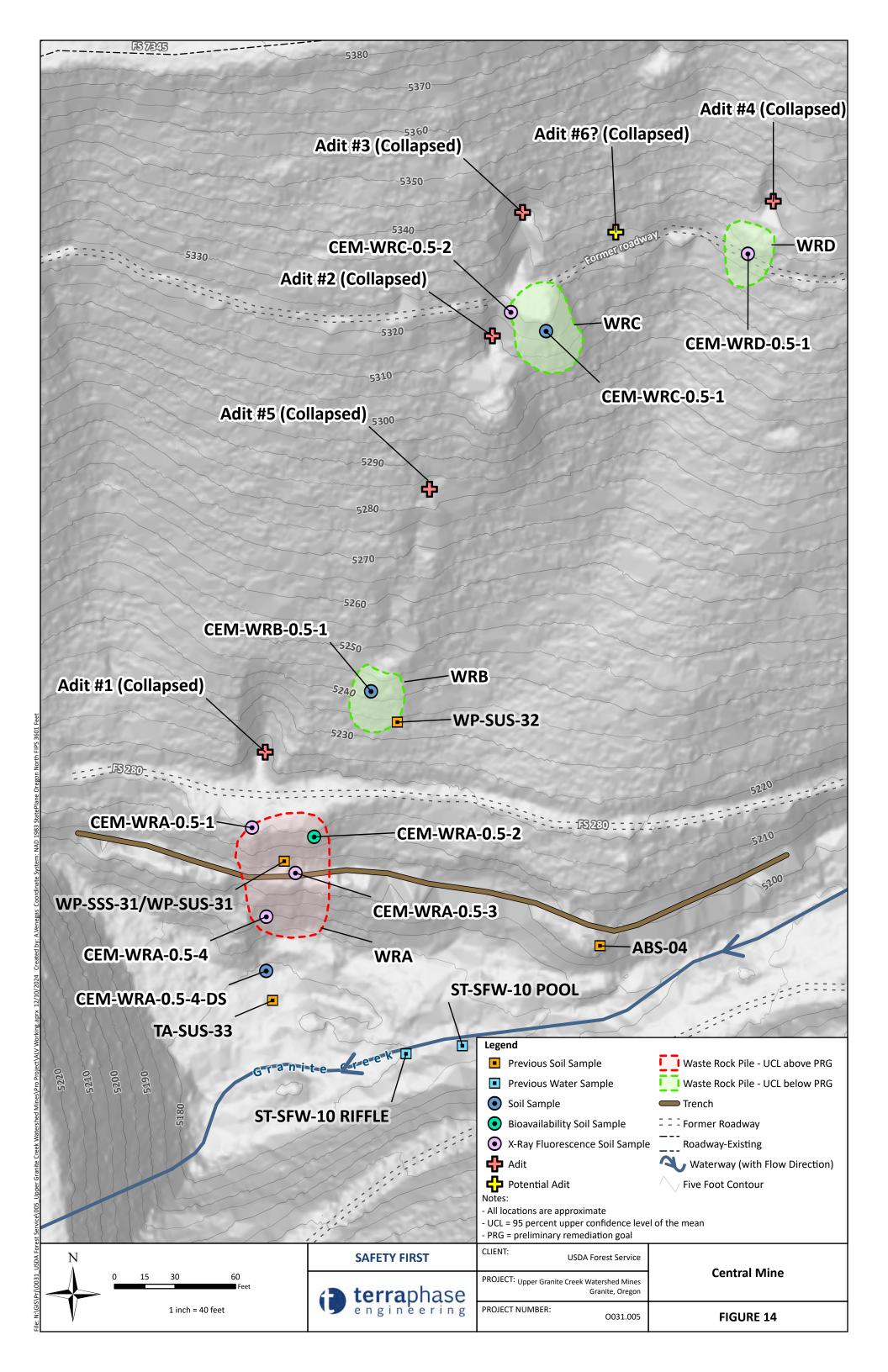


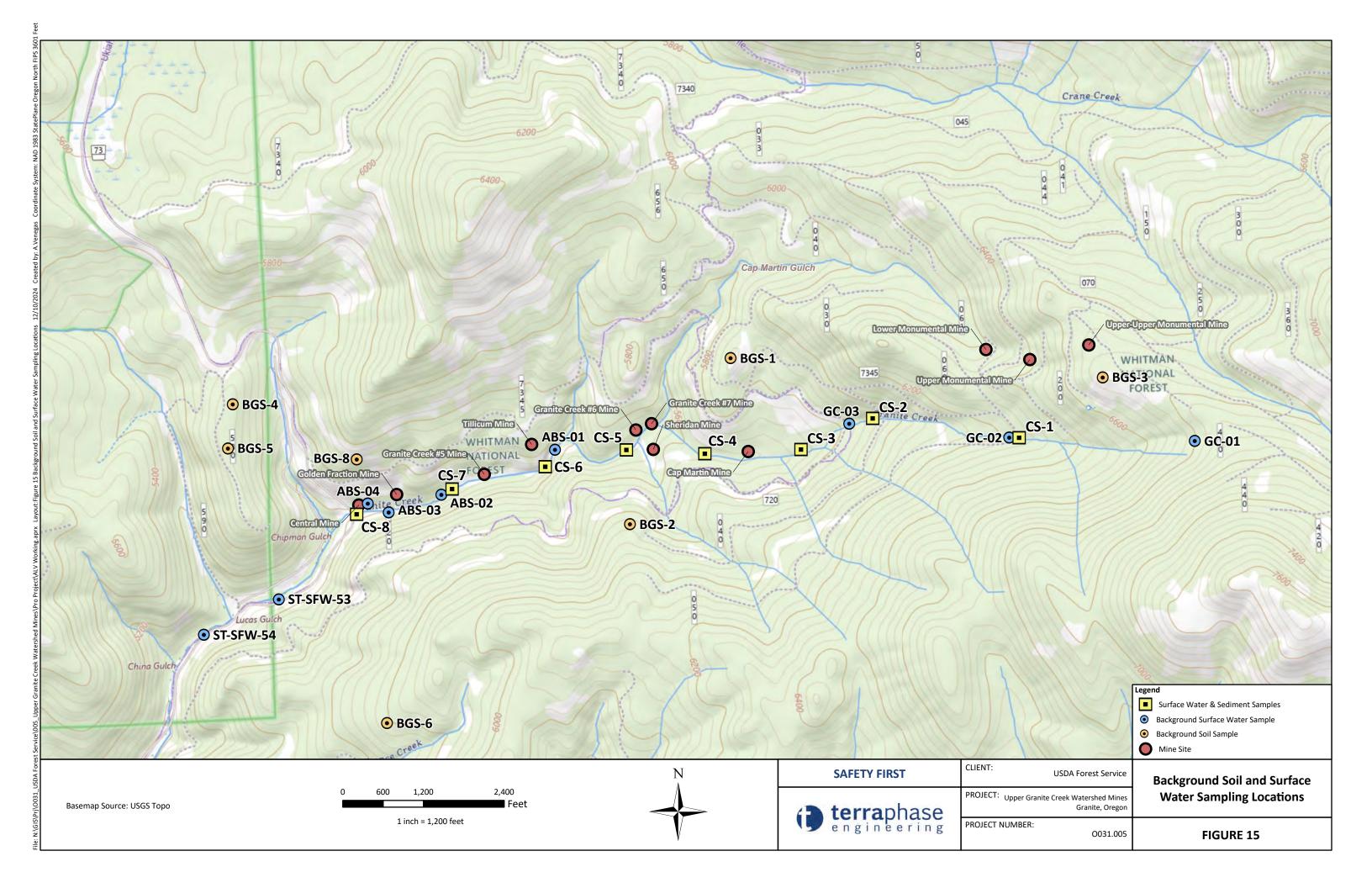












Appendix A

Wetland Delineation Report



Wetland Delineation Report Monumental Mine Data Gap Assessment Grant County, Oregon

May 2011

Project Number 2723018-007



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Wetland Delineation Report Monumental Mine Data Gap Assessment Grant County, Oregon

| Prepared For: | Mr. Pete Jones Region 6 On-Scene Coordinator, Oregon 645 Washington Street Ashland, Oregon 97520 |
|-------------------|---|
| Prepared By: | Cascade Earth Sciences 3511 Pacific Boulevard SW Albany, Oregon 97321 (541) 926-7737 |
| Principal Author: | Ryan Tobias, Project Biologist |
| Reviewed By: | Dustin Wasley, PE, Principal Engineer Rone Brewer, Senior Ecologist |
| Report Date: | May 2011 |
| Project Number: | 2723018-007 |
| Submitted By: | |
| | Ryan Tobias, Project Biologist |

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| A. | Maps | | Aerial Photographs | |
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EXECUTIVE SUMMARY

Cascade Earth Sciences (CES) has prepared the following wetland delineation report in preparation of the remediation of mine-related contamination at the U.S. Forest Service (Forest Service) Monumental Mine (Site).

- This delineation was conducted in concurrence with the Engineering Evaluation / Cost Analysis
 (EE/CA) for completing a Non-Time-Critical Removal Action related to hazardous substances in the
 Upper Granite Creek Watershed near Granite, Oregon (Site).
- The purpose of this delineation was to identify wetland boundaries, characteristics, functions, values, and area, and provide mitigation recommendations for wetlands disturbed during Site remediation.
- Typically, the Oregon Department of State Land and U.S. Army Corps of Engineers (Corps) would have jurisdiction of any impacts to onsite wetlands. However, this delineation was conducted within the authority of a federal Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) cleanup. As such, the U.S. Environmental Protection Agency (USEPA) has jurisdiction over Site wetlands (40 Code of Federal Regulation [CFR] 300.400(e); USEPA, 1992).
- Per Executive Orders 12580 and 13106, the President of the United States has delegated authority to
 the U.S. Department of Agriculture (USDA) to conduct CERCLA actions for projects administered
 inside National Forest System (Forest Service) lands. Thus, the Forest Service is the lead agency for
 CERCLA actions at the Site.
- While the local, regional, and national wetland regulations are not applicable, they are relevant and appropriate. Therefore, efforts reported herein were conducted to comply with appropriate state and federal wetland regulations.
- The wetland delineation was conducted using criteria outlined in the 2008 Interim Regional Supplement to the Corps Wetland Delineation Manual. Results of the delineation identified one wetland area at the Site, approximately 0.08 acres in size.

Proposed remedial actions at the Site may include removal of mine-contaminated tailings within the delineated wetland. Loss of wetlands resulting from removal of the tailings material should be mitigated by restoring the disturbed portion of the wetland or creating a new area of wetland.

- Compensatory mitigation is required for fill or excavation activities within a wetland.
- The proposed remedial action may require excavation of the upper and middle tailings ponds portions of the wetland (about 0.04 acres). Wetland restoration and creation replacement ratios are as follows:
 - o Restoration ratio is 1:1 (1 acre restored for every 1 acre lost).
 - Creation ration is 1.5:1 (1.5 acres created for every 1 acre lost).
- Restoration/creation of approximately 0.04 to 0.06 acres is recommended to compensate for wetlands excavated during possible Site remedial actions.
- The actual acreage of filled wetlands (if necessary) and subsequent final determination of mitigation acreage can be verified following development of the final remedial design.

1.0 INTRODUCTION AND PURPOSE

Cascade Earth Sciences (CES) has prepared the following Wetland Delineation report in concurrence with the Engineering Evaluation / Cost Analysis (EE/CA) for completing a Non-Time-Critical Removal Action (RA) related to hazardous substances at the abandoned Monumental Mine (Site) in Grant County, Oregon. The Site consists of an abandoned underground gold mine located in the Wallowa-Whitman National Forest, about 8 aerial miles north of Granite, Oregon, along Forest Road (FR) 7345 (Appendix A; Figure 1).

This Wetland Delineation was completed in general accordance with the Interim Regional Supplement to the Corps of Engineers (Corps) Wetland Delineation Manual (Corps, 2008). The purpose of the delineation is to document acreage and functions of onsite wetlands for the purposes of possible mitigation following removal of hazardous substances. This delineation was conducted within the authority of a federal Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) cleanup. As such, no federal, state, or local permits are required to perform on-site repose actions pursuant to CERCLA Sections 104, 106, 120, 121, or 122 (40 CFR 300.400(e)). Although procedural (permit or permit equivalency) approval is not and applicable or relevant and appropriate requirements under CERCLA Section 121(d)(2) and the National Oil and Hazardous Substances Pollution Contingency Plan (USEPA, 1992), the efforts reported herein were conducted to comply with appropriate state and federal wetland regulations.

Proposed Removal Alternatives outlined in the EE/CA report include excavation and disposal of hazardous substances from areas at the Site with wetland characteristics. Therefore, a delineation is required to identify appropriate mitigation activities to be completed as part of the RA. Moreover, a functional assessment was performed to document current functions and values of wetlands located in the footprint of proposed RA areas.

2.0 SITE SETTING AND LAND USE

The wetland Assessment Area (AA) is located near the headwaters of an unnamed tributary to Granite Creek at an elevation of approximately 6,300 feet above mean sea level (amsl; USGS, 1982).

- The Monumental Mine, millsite, adits, settling ponds, tailings, and waste rock piles are approximately 10 acres in size (EA, 2003).
- The AA is about 0.1 acres in size, and includes two settling ponds and connecting riparian area located downslope from the former mill.
- This AA was selected because wetland characteristics and contaminated mine tailings were identified
 in this area of the Site. Therefore, RA activities at the Site could impact wetland functions and
 values.
- Additional wetlands are potentially located within boundaries of the 10-acre Site. These areas were not delineated as part this assessment since it in not anticipated they will be impacted during the RA.
- Slopes vary within the Site, but are moderately to relatively steep, with depositional areas near the headwaters of the unnamed tributary.
- These depositional areas are located downslope from the millsite, and were likely formed by dumping tailings from the mill. The two former settling ponds within the AA are the focus of this wetland delineation.
- Unvegetated to sparsely vegetated waste rock piles located upslope from the AA likely contribute to sedimentation and ongoing contaminant loading to the AA via overland erosion, leaching, infiltration, and subsurface transport.

- General topography trends downhill toward the northwest.
- The Site is administered by the Forest Service, with active claims at the Upper and Lower Monumental Mine adits (Appendix A; Figure 2).
- The landscape is dominated by mid to late-successional conifer forest with a subalpine fir/grand fir/Engelmann spruce overstory.
- Runoff is directed to the northwest and locally toward the unnamed tributary, which bisects the AA.
- The settling ponds appear to be hydraulically connected. No outlet was observed from the lowest settling pond during field investigation activities.
- The unnamed tributary daylights downslope from the lowest waste rock pile and converges with Granite Creek, about 2.5 miles west of the Site.
- Color photographs of the AA are presented in Appendix C.

3.0 SITE ALTERATIONS

Gold mining activities began in the Granite Creek area in the 1860's (EA, 2003). The Monumental Mine was discovered and claimed in 1870. In 1875, a 20-stamp mill and chlorination plant were constructed and the mine and mill operated intermittently until about 1928.

Many of the remnants from mining operations remain at the Site, which include the following:

- The foundation and timbers of the former 20-stamp mill, floatation table, and chlorination flue (millsite upslope from the AA).
- Two adits and large waste rock piles. The upper adit and waste rock pile are located upslope from the AA and could contribute contaminant loading to the wetland.
- Contaminated tailings adjacent to the south and upslope from the upper settling pond. These tailings likely contribute to arsenic and other hazardous substances loading to the wetland.
- Two filled settling ponds in series, which are the focus of this delineation.
- The ponds are located to the northwest and downslope from the former millsite, adit, waste rock piles, and tailings piles.
- The former settling ponds were likely created to dump contaminated tailings from the mill. These
 depositional areas were also probably filled with depositional sediment since mining and milling
 operations ceased at the Site.
- The former settling ponds are primarily filled with tailings and depositional sediment and are vegetated with palustrine emergent wetland plants.

4.0 PRECIPITATION DATA AND ANALYSIS

The Site is located within the Blue Mountain physiographic province at an elevation of approximately 6,300 feet amsl.

- In the Blue Mountains, the fall, winter, and spring months are typically cold and wet, while summer months are warm and dry.
- At the Granite 4 west southwest (WSW) weather station, which operated from 1948 to 1967 about 8 miles southwest of the Site, approximately 84% of annual precipitation was recorded between the months of October and May, with snowfall the primary source of precipitation between November

and April (WRCC, 2010). Precipitation recorded at this weather station showed average annual precipitation was 26.37 inches per year.

The nearest continually operating weather station in the Blue Mountains is located at Meacham, Oregon, approximately 60 miles north of the Site at an elevation of 4,055 feet amsl.

- Precipitation totals average about 34.13 inches per year at the Meacham #2 (355394) station (NOAA, 2009).
- Table 1 (Appendix D) includes a summary of precipitation data for the 2008-2009 water year for the Meacham #2 weather station.
- In addition, the table below identifies precipitation during the three months preceding the delineation, as well as the water year beginning October 1, 2008.

Table A. Summary of Normal and Recorded Precipitation Between July 1, 2009 and September 31, 2009, Meacham, Oregon Station

| Category | July 2009 | August 2009 | September 2009 | Total Water Year to Date |
|------------------------|-----------|-------------|----------------|--------------------------|
| Recorded Precipitation | 0.39 in. | 1.36 in. | Trace | 34.13 in. |
| Precipitation Average | 0.21 in. | 0.77 in. | 1.72 in. | 27.21 in. |
| Percent of Normal | 186% | 176% | 0% | 125% |

NOTE: Data obtained from the NOAA online weather data website: http://www.weather.gov/climate/. July 2009 data were obtained from the Weather Underground website: www.wunderground.com

As shown, precipitation trends varied in the months preceding the delineation.

- Precipitation totals in July and August 2009 were well above average.
- Very little precipitation fell in the month of September 2009, which is well below average.
- Collectively, precipitation for the three months preceding the delineation was about 65% of average.

Table B. Summary of Recorded Precipitation Between September 15-30, 2009 and October 1, 2009, Meacham, Oregon Station

| Category | September 15-30 2009 | October 1, 2009 | Total Water Year to Date |
|------------------------|----------------------|-----------------|--------------------------|
| Recorded Precipitation | Trace | 0.05 in. | 34.13 in. |
| Average* | ~ 0.86 in. | | 27.21 in. |
| Percent of Normal | 0% | | 125% |

NOTE: Average was calculated from half the average monthly total of 1.72 inches.

As shown, about 0.05 inches of precipitation fell the day of the delineation, and a trace of precipitation was recorded for the two weeks preceding the investigation in September 2009.

- The monthly average for September is 1.72 inches of precipitation.
- As such, precipitation for the two weeks preceding the delineation was well below average.
- However, precipitation for the water year (October 1, 2008 September 30, 2009) was about 125% of average.

5.0 WETLAND DELINEATION METHODS

On October 1, 2009, Ryan Tobias and Timothy Otis, P.E., of CES conducted a routine wetland delineation of the AA. The study area includes the upper settling pond, downslope along the riparian area of the unnamed tributary, to the second settling pond. The wetland delineation methodology for this investigation included the following:

- Previous investigations and public domain resources were reviewed prior to the field effort to
 determine, to the extent possible, existing conditions and potential wetland indicators on the subject
 property. These resources included:
 - o Site Inspection Report (EA Engineering, Science, and Technology, 2003).
 - o The Mt. Ireland, Oregon quadrangle National Wetland Inventory (NWI) map (Appendix A; Figure 3).
 - o Forest Service Wallowa Whitman soils data (Appendix A; Figure 4).
 - o Historic aerial photographs (Appendix A; Figures A1-A4).
- Nine data plot locations were identified, three within the wetland and six outside the wetland, to determine wetland/upland characteristics.
- Soil conditions at the Site were determined by advancing shallow hand auger borings at the
 established data plots to approximately 18 inches or refusal. A Munsell color chart was used to
 identify soil hue, value, and chroma at each data plot.
- Hydrologic conditions were documented at each data plot.
- Vegetation and estimated percent cover were documented within a 20-foot radius of each data plot.
- Wetland boundaries were delineated, flagged, and surveyed by Anderson Perry and Associates, Inc. in La Grande, Oregon
 - o For each distinct wetland area, representative data plots were selected to characterize both wetland and upland habitats.
 - Nine data plots MMW-1 through MMW-9 (Figure 5) were established to collect vegetation, soils, and hydrology information. Each data plot was flagged and mapped with a handheld global positioning system (GPS) device.
- Wetland conditions were determined using the 2008 Corps Interim Regional Supplement to the Corps of Engineering Wetland Delineation Manual (Corps, 2008).
- A routine wetland determination was used since wetlands within the subject property contained homogeneous vegetation, soil, and hydrologic regimes.
- Data regarding vegetation, soil, and hydrology were collected at each sample plot and recorded on routine wetland determination data forms, which are presented in Appendix B.
- The wetland boundaries were determined at the location in which upland conditions changed to wetland conditions. Wetland conditions were defined by the following three parameters:
 - O Dominant plant species were considered hydrophytic by the U.S. Fish and Wildlife Service (USFWS) (Reed, 1988; Reed et, al, 1993).
 - o Soil was considered hydric under federal definition.
 - Hydrologic conditions meeting the federal wetland definitions were present or inferred.
- Wetland functions and values were determined using the Oregon Wetland Assessment Protocol (ORWAP) (reference) method, as defined by DSL regulations and guidance (Oregon Administrative Rule [OAR] 141-090-005 to 0055; DSL, 2009) and were determined with consideration of the entire wetland system associated with onsite wetlands.

6.0 DESCRIPTION OF WETLAND AND NON-WETLAND WATERS

A 0.08-acre contiguous wetland was delineated within the AA during field activities at the Site. The boundaries and characteristics of the wetland system are described below:

- The delineated wetland is a Palustrine Emergent (PEM)/riverine wetland that extends from the upper settling pond, along the riparian corridor of the unnamed tributary, to the bottom of the second settling pond.
- Data plots MMW-2, MMW-5, and MMW-8 were located within the wetland area. Please refer to Appendix B for additional information regarding these sample plot characteristics.
- The wetland supports various hydric plant species, dominated by Pacific onion (*Allium validium* OBL); tall managrass (*Glyceria elata* FACW); spotted saxifrage (Saxifraga punctata FAC); cow parsnip (*Heracleum lanatum* FAC); and monkey flower (*Mimulus spp.*) (possibly musk flower).
- Upland plots included a variety of coniferous species such as subalpine fir (*Abies lasiocarpa* FACU), grand fir (*Abies grandis* NI), lodgepole pine (*Pinus contorta* FAC-), Engelmann spruce (*Picea* engelmannii FAC), and Western larch (*Larix occidentialis* FACU). Understory species in upland plots included Idaho fescue (*Fescue idahoensis* NI), one-sided wintergreen (*Pyrolla secunda* FACU), and Canada goldenrod (*Solidago canadensis* FACU).
- Wetland hydrology is provided by perennial flow from a spring that forms the headwaters of the unnamed tributary to Granite Creek. The spring is located approximately 150 feet upslope from the upper settling pond.
- Seeps also emanate adjacent to the unnamed tributary channel and appear to provide year-round flow to the wetland system.
- Saturated conditions and surface water flow were noted during the delineation throughout the wetland area.
- The frequency and duration of saturated conditions support hydric soil characteristics in the wetland.
- Hydric soil criteria were met in three of the nine data plots established at the Site.
 - Soils collected from data plots MMW-2, MMW-5, and MMW-8 exhibited characteristics commonly observed in hydric soils (e.g., saturation in the upper 12-inches, matrix color, and sediment deposits).
 - o Gleyed soil conditions were noted within plot MMW-5 from 9 to 18 inches.
 - o Apparent mine tailings were encountered in wetland plots MMW-2, and MMW-8 during the field investigation at depths ranging from 10 to 18 inches below ground surface.
 - Upland habitat (Data Plots MMW-1, MMW -3, MMW -4, MMW -6, MMW -7, and MMW -9)
 was dominated by dry shallow forest soils consisting of duff/litter, underlain by loamy silt and
 gravel.

7.0 DEVIATION FROM LOCAL WETLAND INVENTORY OR NATIONAL WETLAND INVENTORY

Prior to conducting field activities at the Site, the Mt. Ireland 7.5-minute Quadrangle NWI map was reviewed to identify the possible presence of wetlands (Appendix A; Figure 3). There is no known local wetland inventory (LWI) map for the Site or surrounding areas.

• A review of the NWI map of the Site identified the unnamed tributary channel as riverine, upper perennial, unconsolidated bottom, permanently flooded (R3UBH) (USFWS, 1994).

- The NWI map did not show the presence of wetlands at the site.
- The onsite delineation identified a wetland system within this channel, however; the primary feature of the wetland system is the two settling ponds, which support PEM/riverine vegetation.

8.0 MAPPING METHOD

Wetland boundaries were marked with numbered flags during delineation activities at the Site using ribbon flagging and/or colored pin flags.

- The wetland boundaries were surveyed by a Professional Land Surveyor from Anderson Perry Associates, Inc.
- Flags were surveyed to an accuracy of one foot and the survey was extended approximately 100-feet beyond the wetland boundary.

A map of the delineated wetland is included in Appendix A (Figure 5).

9.0 ADDITIONAL INFORMATION

A review of public domain documents provided soil, wetland, rare, threatened or endangered species presence information, and historical background information for the Site. This information is presented in the following sections.

9.1 Soils

Preliminary soils data for the Site were provided by the Wallowa-Whitman National Forest, Baker Ranger District (USFS, 2010). A copy of the soil survey map for the Site is presented in Appendix A (Figure 4).

- The AA is mapped within soil type 0991CS. This soil is characterized by the Elkhorn, Prouty, and Hoffer components on 30 to 60 percent slopes.
 - o Elevations range from 6,273 to 7,037 feet amsl.
 - Soils are typically well-drained.
 - o The typical profile includes ashy sandy and silty loam, underlain by sandy to cobbly loam, with bedrock encountered at approximately 15 inches to 57 inches below ground surface.

9.2 Aerial Photograph Review

Aerial photographs can sometimes help identify historic areas of inundation and/or wetland features at a property. Evaluation of aerials is controlled by the photograph scale and quality. CES reviewed reasonably available aerial photographs depicting the Site and surrounding vicinity at periodic intervals (UO, 2009).

A total of 4 aerial photographs were available for review for the years 1956, 1971, 1994, and 2005. CES has summarized information from the review in Table C and provided copies of the aerial photographs in Appendix A (Figures A1-A4).

Table C. Aerial Photograph Review of the Site and Surrounding Areas

| Date | Description |
|------|--|
| 1956 | The Site appears to be primarily forested, although a slight change in vegetation type is apparent at the assessment area. Waste rock piles are visible to the east and west. A cleared area adjacent to the south of the Site appears to have one structure. Remaining areas surrounding the Site are primarily forested. |
| 1971 | The Site and surrounding areas are relatively unchanged from the 1956 photograph. |
| 1994 | The Site appears to be primarily forested, with a very slight change in vegetation type depicted at the assessment area. A road is visible adjacent to the east of the Site, beyond which, is an apparent waste rock pile. Additional roadways and clearcuts are depicted to the north and west of the Site. The remaining areas are primarily forested. |
| 2005 | The Site and surrounding areas are relatively unchanged from the 1994 photograph. |

As shown, a slight difference in vegetation type was visible at the AA in the available historic aerial photographs. The AA appears to have a more open canopy than the surrounding forested areas. Wetlands at the Site could not be deciphered on the aerial photographs.

9.3 <u>Historic Photograph - Monumental Mine</u>

CES has included a historic photograph of the Monumental Mine for reference purposes (Figure 6). The photograph depicts the 20-stamp mill, chlorination plant and exhaust, and approximate location of the upper settling pond in the AA (Baker County, 2009). Widespread Site alterations are visible in the photograph, including logging around the upper settling pond and headwaters of the unnamed tributary.

9.4 Rare, Threatened, and Endangered Species

A review of the possible presence of Rare, Threatened, and Endangered species was conducted as part of the SI (EA, 2003). The report identified the potential presence of the following species:

- Mid-Columbia River steelhead (federal threatened)
- Bull trout (federal threatened)
- Inland redband trout (species of concern)
- Westslope cutthroat trout (species of concern)
- Olive sided flycatcher (species of concern)
- Columbia spotted frog (state sensitive)

The presence of these species was not field verified during wetlands delineation activities. However, fish have been documented in the unnamed tributary to Granite Creek, which originates at the Site wetland.

10.0 WETLAND FUNCTIONAL ASSESSMENT

The purpose of the wetland functional assessment is to document wetlands and values anticipated to be lost as a result of the project and to assess mitigation success in terms of lost function and value replacement.

• The Oregon Rapid Wetland Assessment Protocol (ORWAP; Adamus et al., 2009) was used to evaluate the functions and values of the Site wetland. Using the ORWAP provides a rating score between 0 (low) and 10 (high) for selected wetland functions and values. The highest ratings identify the principle functions and values for a given wetland that should be protected or replaced (mitigated for), and lower ratings identify functions and values that may be improved during mitigation actions.

- The tables of ORWAP output scores calculated for the Site wetland are provided in Appendix D.
- Functions are the physical, chemical, and biological processes that characterize wetland ecosystems.
- ORWAP function scores rate the relative effectiveness of the wetland in performing each function.
- Values are the importance (worth) of wetland functions that include public attitude and the opportunity for a wetland to provide a specific function based on location.

Function and value scores are described in the Table D.

Table D. Oregon Rapid Wetland Assessment Protocol Function Scores for the Forest Service – Monumental Wetland

| Function | Relative Effectiveness of the Function | Relative Value of the Function |
|---|--|--------------------------------|
| Water Storage and Delay (WS) | 0.00 | 2.92 |
| Sediment Retention and Stabilization (SR) | 7.17 | 2.94 |
| Phosphorus Retention (PR) | 9.08 | 4.18 |
| Nitrate Removal and Retention (NR) | 5.33 | 4.35 |
| Thermoregulation (T) | 0.00 | 0.00 |
| Carbon Sequestration (CS) | 4.19 | |
| Organic Matter Export (OE) | 0.00 | |
| Aquatic Invertebrate Habitat (INV) | 3.50 | 5.28 |
| Anadromous Fish Habitat (FA) | 0.00 | 0.33 |
| Non-Anadromous Fish Habitat (FR) | 1.50 | 10.00 |
| Amphibian and Reptile Habitat (AM) | 4.80 | 6.67 |
| Waterbird Feeding Habitat (WBF) | 0.33 | 4.50 |
| Waterbird Nesting Habitat (WNH) | 0.00 | 3.00 |
| Songbird, Raptor, & Mammal Habitat (SBM) | 5.28 | 3.33 |
| Pollinator Habitat (PH) | 4.95 | 5.00 |
| Native Plant Diversity (PD) | 3.33 | 5.14 |

As shown, function and value scores varied greatly for the Site wetland. Based on this:

- Potential enhancement opportunities are available for a number of components that scored low in the ORWAP assessment.
- Some functional components such as anadromous fish habitat cannot be enhanced since these species do not inhabit the uppermost headwaters of Granite Creek and tributaries.

Grouped services are considered a "roll-up" of individual functions and their associated values. A summary of grouped service function scores is provided in Table E.

Table E. Oregon Rapid Wetland Assessment Protocol Group Service Function and Value Scores for the Forest Service – Monumental Wetland

| Grouped Service Function | Group Function Scores | Group Value Scores |
|---|------------------------------|--------------------|
| Hydrologic Function (WS) | 0.00 | 2.92 |
| Water Quality Support Group | 9.08 | 4.35 |
| Carbon Sequestration Function | 4.19 | |
| Fish Support Group (FISH) | 1.50 | 10.00 |
| Aquatic Support Group (AQ) | 4.80 | 6.67 |
| Terrestrial Support Group (TERR) | 5.28 | 5.14 |
| Public Use & Recognition (PU) | | 0.83 |
| Provisioning Services | | 0.00 |
| Other Attributables | | |
| Wetland Ecological Condition ¹ | | 5.73 |
| Wetland Stressors ² | | 6.44 |
| Wetland Sensitivity ³ | | 5.07 |

NOTES:

- 1 Condition is the integrity or health of a wetland based primarily on the vegetation component.
- 2 Stressors include the degree to which the wetland has been recently altered by, or exposed to risk, from human alterations.
- 3 Sensitivity is the resistance and resilience of a wetland to human and natural stressors.

11.0 RESULTS AND CONCLUSIONS

CES has completed a wetland delineation of the former settling ponds and riparian channel at the Forest Service Monumental Mine in Grant County, Oregon. Results of this delineation identified the following:

- Based on soil, vegetation, and hydrological conditions exhibited during the field investigation, one 0.08-acre PEM/riverine wetland was delineated at the Site.
- An assessment of functions and values was completed using ORWAP. The assessment identified a wide variety of component values.
- The highest function scores were for phosphorus retention and sediment retention and stabilization. Function scores of 0 were exhibited for water storage and delay, thermoregulation, organic matter export, anadromous fish habitat, and waterbird nesting habitat. Other low function scores were identified for non-anadromous fish habitat, waterbird feeding habitat, and native plant diversity.
- The ecological condition of the wetland, based solely on the vegetative component, scored 5.73. The stressor score, which measures alterations and risk to the wetland, measured 6.44. The wetland sensitivity score was 5.07.
- The ponds will likely need to be remediated as part of the CERCLA non-time critical RA at the Site.
- The wetland is considered to have a high potential for enhancement.
- Remediation of hazardous substances within the settling ponds will result in unavoidable impacts to
 the wetland. The RA must therefore include measures to avoid and minimize wetland impacts, and
 impacts to the unnamed tributary channel between the settling ponds should be avoided.

12.0 PROPOSED WETLAND IMPACTS AND MITIGATION OPTIONS

Remedial alternatives for the Monumental Mine are described in the EE/CA document. Proposed remedial actions at the Site may include removal of tailings from the settling ponds and restoration of the wetland system. The contaminated tailings are proposed to be disposed in an onsite repository.

- Compensatory mitigation is required for fill or excavation activities within a wetland.
- The proposed remedial action would excavate tailings from approximately 0.04 acres of wetland.
- To meet the 1:1 restoration mitigation ratio requirements approximately 0.04 to 0.06 acres of the excavated area will be restored to equivalent or enhanced pre-remediation functions and values.
- The actual acreage of excavated wetlands and subsequent final determination of restoration acreage can be verified following development of the final remedial design.

12.1 Mitigation Assumptions and Alternatives

12.1.1 Assumptions

The following assumptions have been developed with respect to wetland remedial activities:

- The Site waste rock and tailings piles will be excavated and disposed in an onsite repository. As such, sources of arsenic contamination, including the contaminated tailings within the AA, will be removed from the wetland and upslope sources.
- Since the source of arsenic contamination will be removed during the RA, the newly restored wetland system will not need to be engineered to treat contaminated water originating from the mine.

12.1.2 Goals

The primary objective of wetland restoration is promotion of native wetland characteristics with functions and values higher than pre-remediation conditions. To meet this objective, the following mitigation alternatives have been developed for the Site:

Mitigation options should include preservation of the current riparian areal extent, connecting the upper and middle settling ponds, and restoration of about 0.04 acres of wetland impacted from RA activities at the Site.

- Details of the wetland restoration, if completed, will be provided at a later date. Restoration may
 include replacement of contaminated tailings with clean organic fill and contouring to promote water
 retention within these areas.
- Target wetland types should resemble the current filled settling ponds and could include replanting of dominant species.
- As discussed in Section 9.4, the fish have been documented in the unnamed tributary to Granite
 Creek, which originates at the Site wetland. Moreover, federally threatened summer steelhead have
 been documented at the confluence of the unnamed tributary and Granite Creek. Therefore, water
 quality at the Site and downstream from the Site; fish and wildlife habitat; and human
 health/ecological considerations should be the key functions and values targeted for wetland
 restoration planning.
- The restoration will include post-construction monitoring and ORWAP assessment to verify enhanced wetland functions and values.

13.0 DISCLAIMER

This report documents the investigation, best professional judgment, and conclusions of the investigator. It is correct and complete to the best of CES' knowledge. It should be considered a Preliminary Jurisdictional Determination of wetlands and other waters of the state and used for CERCLA response actions conducted entirely on-site, where such action is selected and carried out in compliance with CERCLA Section 121(e)(1).

LITERATURE CITATIONS

- 1. 40 CFR 300.400(e). Code of Federal Regulations (CFR), Chapter 1 (7-1-03 Edition).
- 2. Adamus, P., J. Morlan, and K. Verble, 2009. Oregon Rapid Wetland Assessment Protocol (ORWAP): Calculator spreadsheet, databases, and data forms. Oregon Department of State Lands. Salem, Oregon.
- 3. Baker County, 2009. Monumental Mine Located 5 Miles NNE of Granite. Object I.D. 1981.1.1526. McCord Collection. Baker County Public Library, Baker, Oregon.
- 4. EA Engineering, Science, and Technology (EA), 2003. Site Inspection Report, Granite Creek Mines. U.S. Forest Service, Wallowa-Whitman National Forest.
- National Oceanic and Atmospheric Administration (NOAA), 2010. "NOAA Online Weather Data (NOWData), Meacham #2, (355394." http://www.weather.gov/climate/. NOAA National Weather Service website. Accessed January 4, 2009.
- 6. Oregon Administrative Rule [OAR] 141-090-0005 to 0055.
- 7. Oregon Department of State Lands (DSL), 2009. Wetland Determination/Determination Report Requirements Checklist. Division of State Lands, Salem, Oregon.
- 8. Reed, P.B., Jr., 1988. National List of Plant Species that Occur in Wetlands: Northwest (Region 9). U.S. Fish and Wildlife Service Biological Report 88(26.9). Washington D.C.
- 9. Reed, P.B., Jr., et al., 1993. Supplemental List to Plant Species that Occur in Wetlands: Northwest (Region 9). U.S. Fish and Wildlife Service Biological Report 88(26.9). Washington D.C.
- 10. University of Oregon (UO), 2009. Aerial photographs of AA: 1956, 1971, 1994, and 2005. University of Oregon Library System, Map Services Center. Eugene, Oregon.
- 11. U.S. Army Corps of Engineers (Corps), 2008. Interim Regional Supplement to the Corps of Engineers Wetlands Delineation Manual: Western Mountains, Valleys, and Coast Region. U.S. Army Corps of Engineers Research and Development Center, Environmental Laboratory. Vicksburg, Mississippi.
- 12. U.S. Environmental Protection Agency (USEPA), 1992. Permits and Permit "Equivalency" Processes CERCLA On-site Responses. Memorandum dated February 19. Office of Solid Waste and Emergency Response. Directive 9355.7-03.
- 13. U.S. Forest Service (USFS), 2010. Monumental Mine Soil Sample Sites. Wallowa-Whitman National Forest, Baker Ranger District. Baker, Oregon

- 14. U.S. Fish and Wildlife Service (USFWS), 1994. National Wetlands Inventory, Mt. Ireland, Oregon. U.S. Department of the Interior. Fish and Wildlife Service, Washington, D.C.
- 15. United States Geological Survey (USGS), 1982. 7.5 Minute Series Topographic Map Mt. Ireland, Oregon. U.S. Geological Survey, Washington, D.C.
- 16. Western Regional Climate Center (WRCC), 2010. "Period of Record Monthly Climate Summary, Granite 4 WSW, Oregon (353430)." wrcc@dri.edu. Western Regional Climate Center website. Accessed January 4, 2010.

APPENDICES

| A. | Maps | | Aer | ial Photographs |
|----|-----------|---------------------------------------|------------|------------------------|
| | Figure 1. | Site Location Map | A1. | 1956 Aerial Photograph |
| | Figure 2. | Tax Lot Map | A2. | 1971 Aerial Photograph |
| | Figure 3. | National Wetland Inventory Map | A3. | 1994 Aerial Photograph |
| | Figure 4. | Soil Survey Map | A4. | 2005 Aerial Photograph |
| | Figure 5. | Wetland Delineation Map | | |
| | Figure 6. | Historic Mine Photograph | | |

- B. Field Data Forms
- C. Ground Level Color Photographs
- D. Additional Tables and Information
 - ${\bf 1. \ Summary \ of \ Precipitation \ for \ 2008-2009 \ Water \ Year}$
 - 2. Precipitation Data from the NOAA Online Weather Database
 - 3. ORWAP Calculation Tables

Appendix A.

Maps

Figure 1. Site Location Map

Figure 2. Tax Lot Map

Figure 3. National Wetland Inventory Map

Figure 4. Soil Survey Map
Figure 5. Wetland Delineation Map Figure 6. Historic Mine Photograph

Aerial Photographs

A1. 1956 Aerial Photograph
A2. 1971 Aerial Photograph
A3. 1994 Aerial Photograph
A4. 2005 Aerial Photograph

Appendix B.

Field Data Forms

| Project/Site: USFS – Monumental Mine | City/County | : 8 Miles | NE of Grani | ite, Oregon S | Sampling Date: _ | 10/1/2009 |
|---|---|---------------|-------------|--|-------------------|-------------------|
| Applicant/Owner: <u>U.S. Forest Service, Wallowa-Whit</u> | itman National Forest State: Oregon Sampling Point: MMW-1 | | | | | MMW-1 |
| Investigator(s): Tobias/Otis | Section, Town | ship, Range | e: Sectio | n 18, Township 8 Sou | th, Range 36 Ea | st |
| Landform (hillslope, terrace, etc.): Hillslope | Lo | cal relief (c | oncave, cor | nvex, none): Conca | <u>ve</u> Slop | oe (%): <u>30</u> |
| Subregion (LRR): _E | | | | | | |
| Soil Map Unit Name: Elkhorn, Prouty, Hoffer (0991CS | | | | | | |
| Are climatic / hydrologic conditions on the site typical for | | | | | | |
| Are Vegetation X, Soil X, or Hydrology | - | | | | | Yes No > |
| Are Vegetation, Soil, or Hydrology | | | | | | |
| SUMMARY OF FINDINGS – Attach site ma | | | | | | |
| Hydrophytic Vegetation Present? Yes | NoX | Is th | e Sampled | Area | | |
| | NoX | | _ | nd? Yes_ | No | X |
| | NoX | | | | | |
| Remarks: Site conditions were altered significantly due to mining | a practices that h | nogan in 19 | 70 Thoan | os dolinostod includos | two cottling por | ads from the mine |
| with tailings material containing high concentrations of | f arsenic. | Jegan in 10 | 70. THE are | sa delineated includes | two setting pon | ds nom the mine |
| VEGETATION – Use scientific names of p | olants. | | | | | |
| | | Dominant | Indicator | Dominance Test w | orksheet: | |
| <u>Tree Stratum</u> (Plot size: <u>20-foot radius</u>) | | Species? | | Number of Dominan | | |
| 1. Abies lasiocarpa | | | | That Are OBL, FAC | W, or FAC: | 1 (A) |
| 2. Pinus contorta | | | | Total Number of Do | | |
| 3 | | | | Species Across All S | Strata: | 1 (B) |
| 4 | | = Total Cov | | Percent of Dominan | | (4/5) |
| Sapling/Shrub Stratum (Plot size: 20-foot radius) | | - Total Co | V C I | That Are OBL, FAC | W, or FAC: | 0 (A/B) |
| Chimpaphilia umbellata | 10 | No | | Prevalence Index v | vorksheet: | |
| 2. Vaccinium spp | 5 | <u>No</u> | | Total % Cover of | | |
| 3 | | | | OBL species | | |
| 4 | | | | FACW species | | |
| 5 | | | | FAC species | | |
| Herb Stratum (Plot size: 20-foot radius) | | = Total Co | ver | UPL species | | |
| 1. Fragaria virginiana | 5 | No | UPL | Column Totals: | | |
| 2. Fescue idahoensis | 15 | No | NI | | | . , |
| 3. Solidago canadensis | | | FACU | | dex = B/A = | |
| 4. Mertensia paniculata | | | | Hydrophytic Veget | | \$: |
| 5 | | | | Dominance Tes Prevalence Inde | | |
| 6 | | | | Morphological A | | ovide supporting |
| 7 8 | | | | data in Rema | arks or on a sepa | arate sheet) |
| 9. | | | | Wetland Non-Va | | |
| 10 | | | | Problematic Hyd | | |
| 11. | | | | ¹ Indicators of hydric be present, unless of | | |
| | | = Total Cov | | Do procent, amose o | | Tomatio. |
| Woody Vine Stratum (Plot size:) | | | | | | |
| 1 | | | | Hydrophytic Vegetation | | |
| 2 | | = Total Cov | | | Yes N | lo <u>X</u> |
| % Bare Ground in Herb Stratum | | _ 10ta1 C0 | v G1 | | | |
| Remarks: | | | | | | |
| | | | | | | |
| 1 | | | | | | |

| OIL | | | | | | | Sampling Point: <u>MMW-1</u> |
|---|--|--|--|--|--|--------------------------------------|---|
| Profile Des | cription: (Describ | e to the de | pth needed to docur | ment the indicator | or confirn | n the absence | of indicators.) |
| Depth | Matrix | | Redo | x Features | | | |
| (inches) | Color (moist) | % | Color (moist) | % Type ¹ | Loc ² | Texture | Remarks |
| 0-4" | | | · - | . <u> </u> | | Duff/Litter | |
| 4-15" | 10YR 2/2 | 100 | | | | Loamy silt | Dark brown |
| 15-18" | 2.5YR 3/2 | 100 | | | | | |
| 10 10 | 2.011(0/2 | | - | · | | | |
| | · · · · · · · · · · · · · · · · · · · | | | · | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | - <u> </u> | | | |
| | | | · | <u> </u> | | | |
| ¹ Type: C=C | concentration, D=De | pletion, RN | M=Reduced Matrix, CS | S=Covered or Coate | ed Sand Gi | rains. ² Loc | cation: PL=Pore Lining, M=Matrix. |
| Hydric Soil | Indicators: (Appl | cable to a | I LRRs, unless other | rwise noted.) | | Indicato | rs for Problematic Hydric Soils ³ : |
| Histoso | ` ' | | Sandy Redox (| • | | _ | n Muck (A10) |
| | pipedon (A2) | | Stripped Matrix | ` ' | | | Parent Material (TF2) |
| | listic (A3) en Sulfide (A4) | | Loamy Mucky N | Mineral (F1) (excep | t MLRA 1) | Otne | er (Explain in Remarks) |
| | ed Below Dark Surfa | ice (A11) | Depleted Matrix | | | | |
| | ark Surface (A12) | (7111) | Redox Dark Su | | | ³ Indicato | rs of hydrophytic vegetation and |
| | Mucky Mineral (S1) | | Depleted Dark | , , | | | nd hydrology must be present, |
| | Gleyed Matrix (S4) | | Redox Depress | sions (F8) | | unles | s disturbed or problematic. |
| Restrictive | Layer (if present): | | | | | | |
| | | | | | | | |
| Type: | | | | | | | |
| Type: | nches): | | | | | Hydric Soil | Present? Yes No X |
| Type: Depth (in | | | | | | Hydric Soil | Present? Yes No <u>X</u> |
| Type: Depth (in Remarks: | nches): | | | | | Hydric Soil | Present? Yes No X |
| Type: Depth (in Remarks: | oches): | | | | | Hydric Soil | Present? Yes No X |
| Type: Depth (in Remarks: IYDROLC Wetland Hy | OGY vdrology Indicators | 3: | | vi) | | | |
| Type: | OGY rdrology Indicators | 3: | ed; check all that appl | | veent MIL | Secon | ndary Indicators (2 or more required) |
| Type: Depth (in Remarks: IYDROLO Wetland Hy Primary Indi Surface | OGY rdrology Indicators cators (minimum of | 3: | ed; check all that appl | ined Leaves (B9) (e | except MLI | Secon | ndary Indicators (2 or more required) Vater-Stained Leaves (B9) (MLRA 1, 2 |
| Type: Depth (in Remarks: IYDROLO Wetland Hy Primary Indi Surface High W. | OGY vdrology Indicators cators (minimum of Water (A1) ater Table (A2) | 3: | ed; check all that appl Water-Sta 1, 2, 4 | ined Leaves (B9) (e A, and 4B) | xcept MLI | <u>Secor</u> RA W | ndary Indicators (2 or more required) /ater-Stained Leaves (B9) (MLRA 1, 2 4A, and 4B) |
| Type: Depth (in Remarks: IYDROLO Wetland Hy Primary Indi Surface High Woods | OGY rdrology Indicators cators (minimum of Water (A1) ater Table (A2) ion (A3) | 3: | ed; check all that appl Water-Sta 1, 2, 44 Salt Crust | ined Leaves (B9) (e A, and 4B) (B11) | xcept MLI | <u>Secor</u> R A W | ndary Indicators (2 or more required) /ater-Stained Leaves (B9) (MLRA 1, 2 4A, and 4B) rainage Patterns (B10) |
| Type: Depth (in Remarks: IYDROLO Wetland Hy Primary Indi Surface High Wi Saturati Water M | ordes): | 3: | ed; check all that appl Water-Sta 1, 2, 4,4 Salt Crust Aquatic In | ined Leaves (B9) (eA, and 4B) (B11) vertebrates (B13) | xcept MLI | <u>Secor</u> RA W D D | ndary Indicators (2 or more required) /ater-Stained Leaves (B9) (MLRA 1, 2 4A, and 4B) rainage Patterns (B10) ry-Season Water Table (C2) |
| Type: Depth (in Remarks: IYDROLO Wetland Hy Primary Indi Surface High Wi Saturati Water M | order (A1) ater Table (A2) ion (A3) Marks (B1) arthur Deposits (B2) | 3: | ed; check all that appl Water-Sta Salt Crust Aquatic In: Hydrogen | ined Leaves (B9) (eA, and 4B) (B11) vertebrates (B13) Sulfide Odor (C1) | · | <u>Secor</u> RA W D D S. | ndary Indicators (2 or more required) /ater-Stained Leaves (B9) (MLRA 1, 2 4A, and 4B) rainage Patterns (B10) |
| Type: Depth (in Remarks: IYDROLC Wetland Hy Primary Indi Surface High Water Mater Mater Mater Mater Mater Mater Mater Drift De | order (A1) ater Table (A2) ion (A3) Marks (B1) arthur Deposits (B2) | 3: | ed; check all that appl Water-Sta 1, 2, 44 Salt Crust Aquatic In Hydrogen Oxidized F | ined Leaves (B9) (eA, and 4B) (B11) vertebrates (B13) Sulfide Odor (C1) | Living Roc | Secor RA V D D S ots (C3) G | ndary Indicators (2 or more required) /ater-Stained Leaves (B9) (MLRA 1, 2 4A, and 4B) rainage Patterns (B10) ry-Season Water Table (C2) aturation Visible on Aerial Imagery (CS |
| Type: Depth (in Remarks: IYDROLC Wetland Hy Primary Indi Surface High Water Mater Mater Mater Mater Mater Mater Mater Drift De | ordes): OGY Indicators Indi | 3: | ed; check all that appl Water-Sta 1, 2, 44 Salt Crust Aquatic In: Hydrogen Oxidized F Presence | ined Leaves (B9) (e A, and 4B) (B11) vertebrates (B13) Sulfide Odor (C1) Rhizospheres along | Living Roo 4) | Secor RA D D S. ots (C3) G S | ndary Indicators (2 or more required) /ater-Stained Leaves (B9) (MLRA 1, 2 4A, and 4B) rainage Patterns (B10) ry-Season Water Table (C2) aturation Visible on Aerial Imagery (CS) eomorphic Position (D2) |
| Type: Depth (in Remarks: IYDROLO Wetland Hy Primary Indi Surface High W Saturati Water N Sedime Drift De Algal M Iron De | ordes): OGY Indicators Indi | 3: | ed; check all that appl Water-Sta 1, 2, 4 Salt Crust Aquatic In: Hydrogen Oxidized F Presence Recent Iro | ined Leaves (B9) (e A, and 4B) (B11) vertebrates (B13) Sulfide Odor (C1) Rhizospheres along of Reduced Iron (C- | Living Roc 4) d Soils (C6 | Secon RA W D S Sots (C3) G S S | ndary Indicators (2 or more required) /ater-Stained Leaves (B9) (MLRA 1, 2 4A, and 4B) rainage Patterns (B10) ry-Season Water Table (C2) aturation Visible on Aerial Imagery (Cs) eomorphic Position (D2) hallow Aquitard (D3) |
| Type: Depth (in Remarks: IYDROLO Wetland Hy Primary Indi Surface High W Saturati Water M Sedime Drift De Algal M Iron De Surface | OGY rdrology Indicators icators (minimum of Water (A1) ater Table (A2) ion (A3) Marks (B1) ant Deposits (B2) posits (B3) at or Crust (B4) posits (B5) | s: one requir | ed; check all that appl Water-Sta 1, 2, 44 Salt Crust Aquatic In Hydrogen Oxidized F Presence Recent Iro Stunted or | ined Leaves (B9) (e A, and 4B) (B11) vertebrates (B13) Sulfide Odor (C1) Rhizospheres along of Reduced Iron (Con In Reduction in Tille | Living Roc 4) d Soils (C6 | Secor RA W D S S S S S S S S | ndary Indicators (2 or more required) /ater-Stained Leaves (B9) (MLRA 1, 2 4A, and 4B) rainage Patterns (B10) ry-Season Water Table (C2) aturation Visible on Aerial Imagery (CS) eomorphic Position (D2) hallow Aquitard (D3) AC-Neutral Test (D5) |
| Type: | OGY rdrology Indicators cators (minimum of Water (A1) ater Table (A2) ion (A3) Marks (B1) ant Deposits (B2) posits (B3) at or Crust (B4) posits (B5) e Soil Cracks (B6) | s: one require | ed; check all that appl Water-Sta 1, 2, 44 Salt Crust Aquatic In Hydrogen Oxidized F Presence Recent Iro Stunted or 37) Other (Exp | ined Leaves (B9) (eA, and 4B) (B11) vertebrates (B13) Sulfide Odor (C1) Rhizospheres along of Reduced Iron (Con Reduction in Tille | Living Roc 4) d Soils (C6 | Secor RA W D S S S S S S S S | ndary Indicators (2 or more required) /ater-Stained Leaves (B9) (MLRA 1, 2 4A, and 4B) rainage Patterns (B10) ry-Season Water Table (C2) aturation Visible on Aerial Imagery (CS) eomorphic Position (D2) hallow Aquitard (D3) AC-Neutral Test (D5) aised Ant Mounds (D6) (LRR A) |
| Type: Depth (in Remarks: IYDROLC Wetland Hy Primary Indi Surface High Water N Sedime Drift De Algal M Iron De Surface Inundat Sparsel | ordes): OGY Indicators Indicato | s: one require | ed; check all that appl Water-Sta 1, 2, 44 Salt Crust Aquatic In Hydrogen Oxidized F Presence Recent Iro Stunted or 37) Other (Exp | ined Leaves (B9) (eA, and 4B) (B11) vertebrates (B13) Sulfide Odor (C1) Rhizospheres along of Reduced Iron (Con Reduction in Tille | Living Roc 4) d Soils (C6 | Secor RA W D S S S S S S S S | ndary Indicators (2 or more required) /ater-Stained Leaves (B9) (MLRA 1, 2 4A, and 4B) rainage Patterns (B10) ry-Season Water Table (C2) aturation Visible on Aerial Imagery (CS) eomorphic Position (D2) hallow Aquitard (D3) AC-Neutral Test (D5) aised Ant Mounds (D6) (LRR A) |
| Type: Depth (in Remarks: IYDROLO Wetland Hy Primary Indi Surface High W Saturati Water N Sedime Drift De Algal M Iron De Surface Inundat Sparsel Field Obser | OGY rdrology Indicators icators (minimum of water (A1) ater Table (A2) ion (A3) Marks (B1) ant Deposits (B2) posits (B3) at or Crust (B4) posits (B5) e Soil Cracks (B6) ion Visible on Aeria by Vegetated Conca rvations: ter Present? | one require I Imagery (I | ed; check all that appl Water-Sta 1, 2, 44 Salt Crust Aquatic In: Hydrogen Oxidized F Presence Recent Iro Stunted or Other (Exp. | ined Leaves (B9) (eA, and 4B) (B11) vertebrates (B13) Sulfide Odor (C1) Rhizospheres along of Reduced Iron (Con Reduction in Tille Stressed Plants (Dolain in Remarks) | Living Roo 4) d Soils (C6 1) (LRR A | Secor RA W D S S S S S S S S | ndary Indicators (2 or more required) /ater-Stained Leaves (B9) (MLRA 1, 2 4A, and 4B) rainage Patterns (B10) ry-Season Water Table (C2) aturation Visible on Aerial Imagery (CS) eomorphic Position (D2) hallow Aquitard (D3) AC-Neutral Test (D5) aised Ant Mounds (D6) (LRR A) |
| Type: Depth (in Remarks: IYDROLO Wetland Hy Primary Indi Surface High W Saturati Water N Sedime Drift De Algal M Iron De Surface Inundat Sparsel Field Obser | ordes): | one require I Imagery (Ive Surface Yes | ed; check all that appl Water-Sta 1, 2, 4,4 Salt Crust Aquatic In: Hydrogen Oxidized F Presence Recent Iro Stunted or 37) (B8) | ined Leaves (B9) (eA, and 4B) (B11) vertebrates (B13) Sulfide Odor (C1) Rhizospheres along of Reduced Iron (Con Reduction in Tille Stressed Plants (Dolain in Remarks) ches): | Living Roc 4) d Soils (C6 1) (LRR A | Secor RA | ndary Indicators (2 or more required) /ater-Stained Leaves (B9) (MLRA 1, 2 4A, and 4B) rainage Patterns (B10) ry-Season Water Table (C2) aturation Visible on Aerial Imagery (CS) eomorphic Position (D2) hallow Aquitard (D3) AC-Neutral Test (D5) aised Ant Mounds (D6) (LRR A) |

Remarks:

| Project/Site: <u>USFS – Monumental Mine</u> | City/County | : 8 Miles | NE of Grani | te, Oregon Sampl | ling Date: 10/1/2009 | |
|---|---|---------------|----------------|--|--|------|
| Applicant/Owner: <u>U.S. Forest Service, Wallowa-Whitr</u> | man National Forest State: Oregon Sampling Point: MMW-2 | | | | | |
| Investigator(s): | Section, Towns | ship, Rang | e: Section | n 18, Township 8 South, Ra | ange 36 East | |
| Landform (hillslope, terrace, etc.): Hillslope | Lo | cal relief (c | concave, cor | ivex, none): Concave | Slope (%): 0 | _ |
| Subregion (LRR): E | Lat: N 44° | 51.618 | Long: | W 118° 21.225' | Datum: <u>NAD 1983</u> | |
| Soil Map Unit Name: Elkhorn, Prouty, Hoffer (0991C | | | | | | |
| Are climatic / hydrologic conditions on the site typical for | | | | | | |
| Are Vegetation X, Soil X, or Hydrology | - | | | | | o > |
| Are Vegetation, Soil, or Hydrology | | | | | | |
| SUMMARY OF FINDINGS – Attach site ma | | | | | | etc. |
| Hydrophytic Vegetation Present? Yes X | No | | | | | |
| | No | | ne Sampled | Area nd? | No | |
| Wetland Hydrology Present? Yes X | No | Witi | iiii a vvetiai | iu: les X | NO | |
| Remarks: | | | | | | |
| Site conditions were altered significantly due to mining with tailings material containing high concentrations of | practices that barsenic. | egan in 18 | 370. The are | ea delineated includes two | settling ponds from the mi | ne |
| VEGETATION – Use scientific names of p | lants. | | | | | |
| | | Dominant | | Dominance Test worksh | heet: | |
| Tree Stratum (Plot size:) 1 | % Cover | | | Number of Dominant Spe That Are OBL, FACW, or | ecies FAC: <u>2</u> (A | A) |
| 2 | | | | Total Number of Dominar | nt | |
| 3 | | | | Species Across All Strata | a: <u>3</u> (E | B) |
| 4 | | | | Percent of Dominant Spe | | |
| Sapling/Shrub Stratum (Plot size: _20-foot radius) | | = Total Co | ver | That Are OBL, FACW, or | FAC: <u>67</u> (A | A/B) |
| 1. Alnus tenuifolia | 5 | No | FACW | Prevalence Index works | sheet: | |
| 2. Ribes lacustre | 5 | No | FAC+ | Total % Cover of: | Multiply by: | |
| 3. Ribes spp | 5 | No | | OBL species | x 1 = | |
| 4 | | | | FACW species | | |
| 5 | | | | FAC species | | |
| Herb Stratum (Plot size: 20-foot radius) | 15 | = Total Co | over | FACU species | | |
| 1. Allium validium | 30 | Yes | OBL | UPL species | X S = | (B) |
| 2. Glyceria elata | 0.5 | | FACW | Coldinii Totals. | (^) | (D) |
| 3. Senecio triangularis | 5 | No | FACW+ | Prevalence Index = | = B/A = | |
| 4. Solidago canadensis | <1 | No | FACU | Hydrophytic Vegetation | | |
| 5. Saxifraga punctata | | Yes | FAC | X Dominance Test is > | | |
| 6. <u>Liverwort spp</u> | | | | Prevalence Index is s | | |
| 7. Moss spp | | | | data in Remarks of | ations ¹ (Provide supporting or on a separate sheet) | g |
| 8. | | | | Wetland Non-Vascula | ar Plants ¹ | |
| 9 | | | | Problematic Hydroph | nytic Vegetation ¹ (Explain) | |
| 10 11 | | | | | and wetland hydrology mus | st |
| | | = Total Co | | be present, unless disturb | bed or problematic. | |
| Woody Vine Stratum (Plot size:) | | | | | | |
| 1 | | | | Hydrophytic Vegetation | | |
| 2 | | | | | X No | |
| % Bare Ground in Herb Stratum10 | | = Total Co | ver | | | |
| Remarks: | | | | L | | |
| | | | | | | |
| | | | | | | |

SOIL Sampling Point: MMW-2

| Profile Desc | ription: (Describe | to the depth | needed to document the indicator or confi | rm the abse | nce of indic | ators.) |
|---------------------------------------|---------------------------------|-----------------|---|---------------------------------------|----------------|--|
| Depth | <u>Matrix</u> | | Redox Features | | | 5 |
| (inches) | Color (moist) | % | Color (moist) % Type ¹ Loc ² | Texture | | Remarks |
| 0-5" | 7.5YR 3/1 | 100 | | <u>Clayey si</u> | lt <u>Dark</u> | brown |
| <u>5-10"</u> | 7.5YR 4/4 | 100 | | Coarse s | and Brow | n/orange |
| 10-18" | 5YR 5/2 | 100 | | Tailings | Pink/ | /brown/gray |
| | | | | | | |
| | | | | | | |
| | | | | _ | | |
| | | | | _ | | |
| | | | | _ | | · |
| | | | | | | |
| | | | educed Matrix, CS=Covered or Coated Sand | | | L=Pore Lining, M=Matrix. |
| - | | cable to all LR | RRs, unless otherwise noted.) | | | roblematic Hydric Soils ³ : |
| Histosol | ` ' | _ | _ Sandy Redox (S5) | | 2 cm Muck (| , |
| Histic Ep | nipedon (A2) | _ | Stripped Matrix (S6)Loamy Mucky Mineral (F1) (except MLRA | · · · · · · · · · · · · · · · · · · · | | Material (TF2) |
| | n Sulfide (A4) | _ | Loamy Gleyed Matrix (F2) | ') ' | Jiriei (Expia | in in Remarks) |
| | Below Dark Surfac | e (A11) | C Depleted Matrix (F3) | | | |
| | ark Surface (A12) | | Redox Dark Surface (F6) | ³ Indi | cators of hyd | Irophytic vegetation and |
| X Sandy M | lucky Mineral (S1) | _ | Depleted Dark Surface (F7) | | | ology must be present, |
| Sandy G | leyed Matrix (S4) | <u> </u> | _ Redox Depressions (F8) | uı | nless disturb | ed or problematic. |
| Restrictive L | ayer (if present): | | | | | |
| Type: | | | <u> </u> | | | |
| Depth (inc | ches): | | <u> </u> | Hydric S | Soil Present | ? Yes <u>X</u> No |
| Remarks: Co | ontaminated mine ta | ailings encoun | tered from 10-18". | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| HYDROLO | GV. | | | | | |
| | | _ | | | | |
| - | drology Indicators | | shoot all that and A | 0 | | |
| | | one requirea; o | check all that apply) | | - | licators (2 or more required) |
| X Surface | ` ' | | Water-Stained Leaves (B9) (except M | LRA | | ined Leaves (B9) (MLRA 1, 2, |
| _ | ater Table (A2) | | 1, 2, 4A, and 4B) | | 4A, an | |
| X Saturation | ` , | | Salt Crust (B11) | _ | _ | Patterns (B10) |
| Water M | | | Aquatic Invertebrates (B13) | | | on Water Table (C2) |
| · · · · · · · · · · · · · · · · · · · | nt Deposits (B2) posits (B3) | | Hydrogen Sulfide Odor (C1)Oxidized Rhizospheres along Living R | · | _ | Visible on Aerial Imagery (C9) |
| | it or Crust (B4) | | Presence of Reduced Iron (C4) | | | quitard (D3) |
| Iron Dep | | | Recent Iron Reduction in Tilled Soils (| · | | ral Test (D5) |
| | Soil Cracks (B6) | | Stunted or Stressed Plants (D1) (LRR | | | nt Mounds (D6) (LRR A) |
| | on Visible on Aerial | Imagery (B7) | Other (Explain in Remarks) | | | ve Hummocks (D7) |
| | Vegetated Concav | | | | | (= :) |
| Field Observ | | | , | | | |
| Surface Wate | er Present? | res X No | Depth (inches): At surface | | | |
| Water Table | | | Depth (inches): | | | |
| Saturation Pr | | | | etland Hydro | logy Preser | nt? Yes <u>X</u> No |
| (includes cap | | 7 <u>7</u> 110 | Bopan (monoo). | riiana myano | .097000. | 160 <u>-X</u> |
| Describe Red 1994 and 200 | | n gauge, monit | toring well, aerial photos, previous inspections | s), if available | : Aerial Pho | otos reviewed from 1956, 1971, |
| Remarks: | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

| Project/Site: USFS – Monumental Mine | City/County | : 8 Miles NE of Gra | nite, Oregon Sampl | ling Date: 10/1/2009 |
|---|----------------------------------|----------------------|--|---|
| Applicant/Owner: <u>U.S. Forest Service, Wallowa-Whit</u> | man National Fo | orest State | e: <u>Oregon</u> Samp | ling Point: MMW-3 |
| Investigator(s): Tobias/Otis | Section, Town | ship, Range: Secti | ion 18, Township 8 South, Ra | ange 36 East |
| Landform (hillslope, terrace, etc.): Hillslope | | · - | | - |
| Subregion (LRR): E | | | | |
| Soil Map Unit Name: Elkhorn, Prouty, Hoffer (0991C | | | | |
| Are climatic / hydrologic conditions on the site typical fo | | | | |
| | - | | | |
| Are Vegetation X, Soil X, or Hydrology | | | | |
| Are Vegetation, Soil, or Hydrology SUMMARY OF FINDINGS – Attach site ma | | | | |
| | • | | | |
| | No X No X | Is the Sample | | |
| | No <u>X</u> | within a Wetla | and? Yes | No <u></u> |
| Remarks: | <u> </u> | | | |
| Site conditions were altered significantly due to mining with tailings material containing high concentrations of | g practices that I f arsenic. | began in 1870. The a | rea delineated includes two | settling ponds from the mine |
| VEGETATION – Use scientific names of p | lants. | | | |
| Tron Stratum (Plot aiza: 20 fact radius) | Absolute | | | |
| Tree Stratum (Plot size: 20-foot radius) 1. Abies lasiocarpa | | Species? Status | - I Number of Dominant Spe | ecies FAC: <u> </u> |
| Larix occidentalis | | Yes FACU+ | | |
| 3. Pinus contorta | | No FAC- | Total Number of Dominar Species Across All Strata | |
| 4. Abies grandis | | | · · | |
| Sapling/Shrub Stratum (Plot size: 20-foot radius) | | = Total Cover | Percent of Dominant Spe That Are OBL, FACW, or | cies FAC: <u>0</u> (A/B) |
| 1. | | | Prevalence Index works | sheet: |
| 2. | | | Total % Cover of: | Multiply by: |
| 3. | | | OBL species | x 1 = |
| 4 | | | FACW species | x 2 = |
| 5 | | | FAC species | x 3 = |
| (5) | 0 | = Total Cover | FACU species | |
| Herb Stratum (Plot size: 20-foot radius) | 20 | Van FACU | UPL species | |
| 1. Pyrolla secunda | | | - Column Totals: | (A) (B) |
| 2 | | | - Prevalence Index = | = B/A = |
| 3 4 | | | Hydrophytic Vegetation | |
| 5 | | | Dominance Test is > | |
| 6. | | | Prevalence Index is | ≤3.0 ¹ |
| 7 | | | Morphological Adapt | ations ¹ (Provide supporting or on a separate sheet) |
| 8. | | | Wetland Non-Vascul | |
| 9 | | | Problematic Hydroph | ytic Vegetation ¹ (Explain) |
| 10. | | | | and wetland hydrology must |
| 11 | | = Total Cover | be present, unless disturb | ped or problematic. |
| Woody Vine Stratum (Plot size:) | | = Total Cover | | |
| 1. | | | Hydrophytic | |
| 2 | | | Vegetation Present? Yes | No <u>X</u> |
| | | = Total Cover | 11030111: 165 | NU <u> </u> |
| % Bare Ground in Herb Stratum 80 Remarks: | | | | |
| INGINAINS. | | | | |
| | | | | |

SOIL Sampling Point: MMW-3

| Profile Desc | cription: (Describe | to the dep | th needed to document the indicator or o | confirm | the absence of indicators.) |
|--|--|--------------------------|--|----------------------------|---|
| Depth | Matrix Color (moist) | % | Redox Features Color (moist) % Type ¹ L | oc² | Toytura Pomorka |
| (inches) | Color (moist) | | Color (moist) % Type ¹ L | | Texture Remarks |
| 0-5" | - | | | | Duff/Litter |
| 5-8" | 5YR 5/2 | 100 | | | Tailings Pink/brown |
| 8-13" | 10YR 2/2 | 100 | | | Loamy silt Dark brown |
| 13-18" | 2.5YR | 100 | | | Loamy silt Brown |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | - | |
| | | | =Reduced Matrix, CS=Covered or Coated S LRRs, unless otherwise noted.) | and Gra | ains. ² Location: PL=Pore Lining, M=Matrix. Indicators for Problematic Hydric Soils ³ : |
| - | | cable to all | | | • |
| Histosol | oipedon (A2) | | Sandy Redox (S5) Stripped Matrix (S6) | | 2 cm Muck (A10) Red Parent Material (TF2) |
| | istic (A3) | | _RA 1) | Other (Explain in Remarks) | |
| | en Sulfide (A4) | | Loamy Mucky Mineral (F1) (except MLLoamy Gleyed Matrix (F2) | | <u> </u> |
| | d Below Dark Surfac | ce (A11) | Depleted Matrix (F3) | | |
| | ark Surface (A12) | | Redox Dark Surface (F6) | | ³ Indicators of hydrophytic vegetation and |
| | Mucky Mineral (S1) | | Depleted Dark Surface (F7) | | wetland hydrology must be present, |
| | Bleyed Matrix (S4) Layer (if present): | | Redox Depressions (F8) | 1 | unless disturbed or problematic. |
| | | | | | |
| Type: | -l\- | | | | Hudria Cail Brasanto Van Na V |
| Depth (in | , | | | | Hydric Soil Present? Yes No X |
| Remarks: C | ontaminated tailings | 8 -c mon 8 | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| HYDROLO | GY | | | | |
| Wetland Hy | drology Indicators | : | | | |
| Primary India | cators (minimum of | one require | d; check all that apply) | | Secondary Indicators (2 or more required) |
| Surface | Water (A1) | | Water-Stained Leaves (B9) (exce | pt MLR | A Water-Stained Leaves (B9) (MLRA 1, 2, |
| High Wa | ater Table (A2) | | 1, 2, 4A, and 4B) | - | 4A, and 4B) |
| Saturation | on (A3) | | Salt Crust (B11) | | Drainage Patterns (B10) |
| Water M | larks (B1) | | Aquatic Invertebrates (B13) | | Dry-Season Water Table (C2) |
| Sedimer | nt Deposits (B2) | | Hydrogen Sulfide Odor (C1) | | Saturation Visible on Aerial Imagery (C9) |
| Drift Dep | posits (B3) | | Oxidized Rhizospheres along Livi | ng Roots | s (C3) Geomorphic Position (D2) |
| Algal Ma | at or Crust (B4) | | Presence of Reduced Iron (C4) | | Shallow Aquitard (D3) |
| Iron Dep | oosits (B5) | | Recent Iron Reduction in Tilled So | oils (C6) | FAC-Neutral Test (D5) |
| _ | Soil Cracks (B6) | | Stunted or Stressed Plants (D1) (| LRR A) | |
| | | Imagani (D | 7) Other (Explain in Remarks) | | Frost-Heave Hummocks (D7) |
| | on Visible on Aerial | | | | |
| Sparsely | y Vegetated Concav | | B8) | | |
| Sparsely Field Obser | y Vegetated Concav | ve Surface (| , | | |
| Sparsely Field Obser Surface Water | y Vegetated Concav vations: er Present? | ve Surface (| No X Depth (inches): | | |
| Sparsely Field Obser Surface Wate Water Table | y Vegetated Concavorations: er Present? | ve Surface (| , | | |
| Sparsely Field Obser Surface Wate Water Table Saturation P | y Vegetated Concavorations: er Present? Present? | ve Surface (Yes Yes | No X Depth (inches): | Wetlar | nd Hydrology Present? Yes No <u>X</u> |
| Field Obser Surface Water Table Saturation P (includes cap | y Vegetated Concavorations: er Present? Present? resent? pillary fringe) corded Data (stream | ye Surface (Yes Yes Yes | NoX Depth (inches): NoX Depth (inches): NoX Depth (inches): | | nd Hydrology Present? Yes No _X f available: Aerial Photos reviewed from 1956, 1971, |
| Sparsely Field Obser Surface Water Table Saturation P (includes cap Describe Re | y Vegetated Concavorations: er Present? Present? resent? pillary fringe) corded Data (stream | ye Surface (Yes Yes Yes | NoX Depth (inches): NoX Depth (inches): NoX Depth (inches): | | |
| Sparsely Field Obser Surface Wate Water Table Saturation P (includes cap Describe Re 1994 and 20 | y Vegetated Concavorations: er Present? Present? resent? pillary fringe) corded Data (stream | ye Surface (Yes Yes Yes | NoX Depth (inches): NoX Depth (inches): NoX Depth (inches): | | |
| Sparsely Field Obser Surface Wate Water Table Saturation P (includes cap Describe Re 1994 and 20 | y Vegetated Concavorations: er Present? Present? resent? pillary fringe) corded Data (stream | ye Surface (Yes Yes Yes | NoX Depth (inches): NoX Depth (inches): NoX Depth (inches): | | |
| Sparsely Field Obser Surface Wate Water Table Saturation P (includes cap Describe Re 1994 and 20 | y Vegetated Concavorations: er Present? Present? resent? pillary fringe) corded Data (stream | ye Surface (Yes Yes Yes | NoX Depth (inches): NoX Depth (inches): NoX Depth (inches): | | |

| Project/Site: USFS – Monumental Mine | City/County | : 8 Miles NE of Gr | ranite, Oregon | Sampling Date: | 10/1/2009 |
|--|-----------------------------------|--------------------------|--------------------------------------|--------------------|------------------|
| Applicant/Owner: U.S. Forest Service, Wallowa-Whit | tman National Fo | orest Sta | ate: Oregon | Sampling Point: _ | MMW-4 |
| Investigator(s): Tobias/Otis | _ Section, Town | ship, Range: Sec | ction 18, Township 8 So | uth, Range 36 Eas | st |
| Landform (hillslope, terrace, etc.): Hillslope | Lo | ocal relief (concave, | convex, none): Conc | ave Slop | e (%): <u>20</u> |
| Subregion (LRR): _E | Lat: N 44° | ° 51.630' Loi | ng: W 118° 21.244' | Datum: | NAD 1983 |
| Soil Map Unit Name: <u>Elkhorn, Prouty, Hoffer (0991</u> | | | | | |
| Are climatic / hydrologic conditions on the site typical for | | | | | |
| Are Vegetation X, Soil X, or Hydrology | - | | | | ∕es No > |
| Are Vegetation, Soil, or Hydrology | | | | | |
| SUMMARY OF FINDINGS – Attach site m | | | | | |
| Hydrophytic Vegetation Present? Yes | NoX | | | | |
| | NoX | Is the Samp | oled Area etland? | No | v |
| Wetland Hydrology Present? Yes | NoX | Within a We | tiana: res_ | | <u>~</u> |
| Remarks: | | | | | |
| Site conditions were altered significantly due to minin with tailings material containing high concentrations of | g practices that I of arsenic. | began in 1870. The | area delineated include | s two settling pon | ds from the mine |
| VEGETATION – Use scientific names of p | olants. | | | | |
| Tree Stratum (Plot size: _20-foot radius_) | | Dominant Indicate | _ | | |
| Abies lasiocarpa 1. Abies lasiocarpa | <u> </u> | Species? Status Yes FACU | Number of Domina | | 0 (A) |
| Picea engelmannii | | | | | (/,) |
| 3 | | | Total Number of D Species Across All | | 2 (B) |
| 4 | | - <u></u> | , | | |
| Sapling/Shrub Stratum (Plot size: 20-foot radius) | 50 | = Total Cover | Percent of Domina That Are OBL, FAC | | 0 (A/B) |
| Chimpaphilia umbellata | 5 | <u>No</u> | Prevalence Index | worksheet: | |
| 2 | | | | of: Mu | |
| 3. | | | OBL species | | |
| 4 | | | FACW species FAC species | | |
| 5 | | = Total Cover | FACU species | | |
| Herb Stratum (Plot size: 20-foot radius) | | _ = Total Cover | UPL species | | |
| 1. Pyrola secunda | 5 | No FACU | Column Totals: | | |
| 2 | | | _ | | |
| 3 | | | | ndex = B/A = | |
| 4 | | | Hydrophytic Vege Dominance Te | | • |
| 5 | | | - | | |
| 6 | | | Morphological | | vide supporting |
| 8 | | | Wetland Non-\ | • | ilato circot, |
| 9 | | | Problematic H | | tion¹ (Explain) |
| 10. | | | Indicators of hydri | | |
| 11 | | = Total Cover | be present, unless | disturbed or probl | ematic. |
| Woody Vine Stratum (Plot size:) | | = Total Cover | | | |
| 1 | | | Hydrophytic | | |
| 2 | | | Vegetation Present? | Yes N | o X |
| % Bare Ground in Herb Stratum 95 | | = Total Cover | | | |
| Remarks: | | | | | |
| | | | | | |
| | | | | | |

| MW-4 |
|------|
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| |

| (inches) | Color (moist) | % | Color (moist) | <u>% T</u> | ype ¹ | Loc ² | Texture | | Remark | (S | |
|------------------------|-----------------------|-------------|---------------------|--------------------|------------------|------------------|---|------------------------------------|------------|------------|----|
| 0-3" | | | | | | | Duff/Litter | | | | |
| 3-5" | 5YR 5/2 | 100 | | <u> </u> | | | Tailings | Pink/bro | wn | | |
| 5-14" | 10YR 2/2 | 100 | | | | | Loamy silt | Dark bro | own | | |
| 14-18 | 2.5YR 3/2 | 100 | | | | | Loamy silt | Brown | | | |
| | | | | | | | | | | | |
| | | | | - — — — - — — — | | | | | | | |
| ¹ Type: C=0 | Concentration, D=Dep | oletion, RM | =Reduced Matrix, CS | S=Covered or | Coated | Sand G | | ation: PL= | | | |
| Hydric Soil | Indicators: (Applic | able to all | LRRs, unless other | rwise noted.) |) | | Indicato | rs for Prob | lematic Hy | dric Soils | 3. |
| Histoso | ol (A1) | | Sandy Redox (| S5) | | | 2 cm | n Muck (A10 | 0) | | |
| Histic E | pipedon (A2) | | Stripped Matrix | (S6) | | | Red Parent Material (TF2) | | | | |
| Black F | Histic (A3) | | Loamy Mucky N | √lineral (F1) (€ | except N | ILRA 1) | Other (Explain in Remarks) | | | | |
| Hydrog | en Sulfide (A4) | | Loamy Gleyed | Matrix (F2) | | | | | | | |
| Deplete | ed Below Dark Surfac | e (A11) | X Depleted Matrix | | | | | | | | |
| Thick D | Oark Surface (A12) | , , | Redox Dark Su | rface (F6) | | | ³ Indicators of hydrophytic vegetation and | | | | |
| Sandy | Mucky Mineral (S1) | | Depleted Dark | Surface (F7) | | | wetla | wetland hydrology must be present, | | | |
| Sandy | Gleyed Matrix (S4) | | Redox Depress | ions (F8) | | | unles | s disturbed | or problem | atic. | |
| Restrictive | Layer (if present): | | | - | | | | | | | - |
| Type: | | | | | | | | | | | |
| Depth (ir | nches): | | | | | | Hydric Soil | Present? | Yes | No | Х |
| Remarks: (| Contaminated tailings | present at | 3-5" | | | | - L | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |

HYDROLOGY

| TIT DIGEOGI | | | | | | | | | |
|--|--------------|--------------------------|---|--------------------|--|--|--|--|--|
| Wetland Hydrology Indica | tors: | | | | | | | | |
| Primary Indicators (minimum | n of one req | uired; chec | k all that apply) | | Secondary Indicators (2 or more required) | | | | |
| Surface Water (A1) | | _ | Water-Stained Leaves (B9) (exc | ept MLRA | Water-Stained Leaves (B9) (MLRA 1, 2, | | | | |
| High Water Table (A2) | | | 1, 2, 4A, and 4B) | | 4A, and 4B) | | | | |
| Saturation (A3) | | _ | Salt Crust (B11) | | Drainage Patterns (B10) | | | | |
| Water Marks (B1) | | | Dry-Season Water Table (C2) | | | | | | |
| Sediment Deposits (B2) |) | | Saturation Visible on Aerial Imagery (C9) | | | | | | |
| Drift Deposits (B3) | | Geomorphic Position (D2) | | | | | | | |
| Algal Mat or Crust (B4) | | Shallow Aquitard (D3) | | | | | | | |
| Iron Deposits (B5) | | FAC-Neutral Test (D5) | | | | | | | |
| Surface Soil Cracks (B6) Stunted or Stressed Plants (D1) (LRR A) | | | | | Raised Ant Mounds (D6) (LRR A) | | | | |
| Inundation Visible on Aerial Imagery (B7) Other (Explain in Remarks) | | | | | Frost-Heave Hummocks (D7) | | | | |
| Sparsely Vegetated Co | ncave Surfa | ce (B8) | | | | | | | |
| Field Observations: | | | | | | | | | |
| Surface Water Present? | Yes | No | X Depth (inches): | | | | | | |
| Water Table Present? | Yes | No | X Depth (inches): | | | | | | |
| Saturation Present? | Yes | No | X Depth (inches): | Wetland Hyd | drology Present? Yes No X | | | | |
| (includes capillary fringe) | | | | | | | | | |
| Describe Recorded Data (st 1994 and 2005. | ream gauge | e, monitorin | ig well, aerial photos, previous inspe | ctions), if availa | ble: Aerial Photos reviewed from 1956, 1971, | | | | |
| | | | | | | | | | |
| Remarks: | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
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| Project/Site: USFS – Monumental Mine | _ City/County | : 8 Miles | NE of Grani | te, Oregon Sampl | ing Date: 10/1/2009 |
|---|--------------------------|--------------|-------------------|--|---|
| Applicant/Owner: <u>U.S. Forest Service, Wallowa-Whitm</u> | an National Fo | rest | State: | Oregon Sampl | ling Point: MMW-5 |
| Investigator(s): | Section, Towns | ship, Rang | ge: <u>Sectio</u> | n 18, Township 8 South, Ra | ange 36 East |
| Landform (hillslope, terrace, etc.): Hillslope | Lo | cal relief (| concave, cor | ivex, none): Concave | Slope (%): <u>10</u> |
| Subregion (LRR): <u>E</u> | Lat: <u>N 44</u> ° | 51.629 | Long: | W 118° 21.234' | Datum: <u>NAD 1983</u> |
| Soil Map Unit Name: Elkhorn, Prouty, Hoffer (0991CS | | | | | |
| Are climatic / hydrologic conditions on the site typical for | | | | | |
| Are Vegetation X, Soil X, or Hydrology X | - | | | | |
| Are Vegetation, Soil, or Hydrology | | | | | |
| SUMMARY OF FINDINGS – Attach site maj | | | | | |
| Hydrophytic Vegetation Present? Yes X | No | | | | |
| Hydric Soil Present? Yes X | | | he Sampled | | N I. |
| Wetland Hydrology Present? Yes X | No | Wit | nın a vvetiar | nd? Yes X | NO |
| Remarks: | | | | | |
| Site conditions were altered significantly due to mining with tailings material containing high concentrations of a | practices that barsenic. | pegan in 1 | 870. The are | ea delineated includes two s | settling ponds from the mine |
| VEGETATION – Use scientific names of pla | ants. | | | | |
| | | | t Indicator | Dominance Test worksh | neet: |
| Tree Stratum (Plot size:) 1 | | | ? Status | Number of Dominant Spe That Are OBL, FACW, or | ecies FAC: <u>3</u> (A) |
| 2 | | | | Total Number of Dominar | nt |
| 3 | | | | Species Across All Strata | : <u>3</u> (B) |
| 4 | | | | Percent of Dominant Spe | |
| Sapling/Shrub Stratum (Plot size: 20-foot radius) | | = Total Co | over | That Are OBL, FACW, or | FAC: 100 (A/B) |
| 1. Alnus tenuifolia | 5 | No | FACW | Prevalence Index works | sheet: |
| 2 | | | | Total % Cover of: | Multiply by: |
| 3 | | | | OBL species | x 1 = |
| 4 | | | | FACW species | |
| 5 | | | | FAC species | |
| Herb Stratum (Plot size: _20-foot radius) | 5 | = Total C | over | FACU species | |
| 1. Alium validium | 30 | Yes | OBL | UPL species | |
| 2. Glyceria elata | 30 | Yes | FACW | Coldinii Totais. | (A) (D) |
| 3. Heracleum lanatum | <1 | No | FAC | | = B/A = |
| 4. Solidago canadensis | 5 | No | FACU | Hydrophytic Vegetation | |
| Saxifraga punctata | 10 | Yes | FAC | X Dominance Test is > | |
| 6. grass spp | | No | | Prevalence Index is s | |
| 7. Moss spp | | | | | ations ¹ (Provide supporting or on a separate sheet) |
| 8. Viola spp | | | <u></u> | Wetland Non-Vascula | ar Plants ¹ |
| Mimulus spp (moschatus)? Mertensia paniculata | _ | | FACW+ FACW | Problematic Hydroph | nytic Vegetation ¹ (Explain) |
| Mertensia paniculata Sandwort spp | | No | | | and wetland hydrology must |
| Th. Canawort spp | | = Total Co | | be present, unless disturb | ped or problematic. |
| Woody Vine Stratum (Plot size:) | | | | | |
| 1 | | | | Hydrophytic | |
| 2 | | | | Vegetation Present? Yes | X No |
| % Bare Ground in Herb Stratum11 | | = Total Co | over | | |
| Remarks: | | | | <u>I</u> | |
| | | | | | |
| | | | | | |

SOIL Sampling Point: MMW-5

| Profile Desc | ription: (Describe | to the depth | needed to document the indicator or cor | nfirm the abs | ence | of indicators.) |
|---------------|-----------------------|------------------|--|--|-------------|---|
| Depth | Matrix | | Redox Features | 2 - . | | 5 |
| (inches) | Color (moist) | % | Color (moist) % Type ¹ Loc | | | Remarks |
| 0-8" | 2.5YR 2.5/1 | 100 | | Clayey | <u>silt</u> | Black |
| 8-9" | 7.5YR 3/2 | 100 | | Clayey | <u>sand</u> | Brown |
| 9-18" | Gley 3/5G | 100 | | Clay | | Gleyed |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| 1- 0.0 | | | | | 2, | |
| | | | educed Matrix, CS=Covered or Coated San RRs, unless otherwise noted.) | | | ation: PL=Pore Lining, M=Matrix. rs for Problematic Hydric Soils ³ : |
| Histosol | | able to all Li | Sandy Redox (S5) | | | Muck (A10) |
| | ipedon (A2) | _ | Stripped Matrix (S6) | | | Parent Material (TF2) |
| Black His | | _ | Loamy Mucky Mineral (F1) (except MLR | —————————————————————————————————————— | | r (Explain in Remarks) |
| | n Sulfide (A4) | | Loamy Gleyed Matrix (F2) | | | (= |
| | Below Dark Surfac | ce (A11) | C Depleted Matrix (F3) | | | |
| Thick Da | rk Surface (A12) | | Redox Dark Surface (F6) | | | rs of hydrophytic vegetation and |
| | ucky Mineral (S1) | _ | _ Depleted Dark Surface (F7) | | | nd hydrology must be present, |
| | leyed Matrix (S4) | | _ Redox Depressions (F8) | | unles | s disturbed or problematic. |
| | ayer (if present): | | | | | |
| Type: | | | <u> </u> | | | |
| Depth (inc | , | | _ | Hydric | Soil | Present? Yes <u>X</u> No |
| Remarks: Po | ossible iron/reducing | g conditions fro | om 9-18". | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| HYDROLO | ev. | | | | | |
| | | _ | | | | |
| • | Irology Indicators | | check all that apply) | | Saaan | dany Indicators (2 or more required) |
| - | • | one requirea; o | *** | | | dary Indicators (2 or more required) |
| X Surface | ` , | | Water-Stained Leaves (B9) (except | MLKA _ | vv | ater-Stained Leaves (B9) (MLRA 1, 2, |
| _ | ter Table (A2) | | 1, 2, 4A, and 4B) | | - | 4A, and 4B) |
| X Saturation | ` ' | | Salt Crust (B11) | _ | | rainage Patterns (B10) |
| Water Ma | ` ' | | Aquatic Invertebrates (B13) | | | ry-Season Water Table (C2) |
| | nt Deposits (B2) | | Hydrogen Sulfide Odor (C1) | ·- | | aturation Visible on Aerial Imagery (C9) |
| Drift Dep | t or Crust (B4) | | Oxidized Rhizospheres along LivingPresence of Reduced Iron (C4) | | | nallow Aquitard (D3) |
| X Iron Dep | ` , | | Recent Iron Reduction in Tilled Soils | _ | | AC-Neutral Test (D5) |
| | Soil Cracks (B6) | | Stunted or Stressed Plants (D1) (LR | | | aised Ant Mounds (D6) (LRR A) |
| | on Visible on Aerial | Imagery (B7) | Other (Explain in Remarks) | | | ost-Heave Hummocks (D7) |
| | Vegetated Concav | | | - | — '' | ost ricave riaminooks (B1) |
| Field Observ | | C Canado (Bo | | | | |
| Surface Water | | res X No | Depth (inches): At surface | | | |
| Water Table | | | Depth (inches): | | | |
| Saturation Pr | | | | Watland Hudr | ology | Present? Yes X No |
| (includes cap | | 163 <u>X</u> NC | Deptif (inches). At surface | wedana nyai | ology | Tresent: Tes X NO |
| Describe Red | corded Data (stream | n gauge, moni | toring well, aerial photos, previous inspection | ons), if availab | le: A | erial Photos reviewed from 1956, 1971, |
| 1994 and 200 | | | | | | |
| Remarks: | | | | | | |
| | | | | | | |
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| Project/Site: USFS – Monumental Mine | City/County | r: 8 Miles N | NE of Grani | ite, Oregon San | npling Date: _ | 10/1/2009 |
|---|----------------------------------|-------------------|--------------------------|---|---------------------------|------------------|
| Applicant/Owner: U.S. Forest Service, Wallowa-Whit | tman National Fo | orest | State: | Oregon San | npling Point: _ | MMW-6 |
| Investigator(s): | Section, Town | ship, Range | : Sectio | n 18, Township 8 South, | Range 36 Eas | st |
| Landform (hillslope, terrace, etc.): Hillslope | Lo | ocal relief (co | oncave, cor | nvex, none): Concave | Slop | e (%): <u>25</u> |
| Subregion (LRR): E | Lat: N 44° | 51.621 | Long: | W 118° 21.240' | Datum: | NAD 1983 |
| Soil Map Unit Name: Elkhorn, Prouty, Hoffer (0991C | | | | | | |
| Are climatic / hydrologic conditions on the site typical for | | | | | | |
| Are Vegetation X, Soil X, or Hydrology | - | | | | | ∕es No > |
| Are Vegetation, Soil, or Hydrology | | | | | | |
| SUMMARY OF FINDINGS – Attach site m | | | | | | |
| Hydrophytic Vegetation Present? Yes | NoX | lo th | e Commind | | | |
| | No X | | e Sampled in a Wetlan | nd? Yes | No | Y |
| Wetland Hydrology Present? Yes | NoX | William | | <u> </u> | | <u>~</u> |
| Remarks: | | | | | | |
| Site conditions were altered significantly due to mining with tailings material containing high concentrations of | g practices that I f arsenic. | began in 187 | 70. The are | ea delineated includes tw | o settling pone | ds from the mine |
| VEGETATION – Use scientific names of p | | | | T | | |
| Tree Stratum (Plot size: _20-foot radius_) | | Dominant Species? | | Dominance Test worl | | |
| 1. Abies grandis | | | | Number of Dominant S That Are OBL, FACW, | | 0 (A) |
| 2. Pinus contorta | | | | Total Number of Domir | | |
| 3 | | | | Species Across All Stra | | 4 (B) |
| 4 | | | | Percent of Dominant S | inecies | |
| Sapling/Shrub Stratum (Plot size: 20-foot radius) | 45 | = Total Cov | er | That Are OBL, FACW, | | 0 (A/B) |
| Chimpaphila umbellata | 5 | No | | Prevalence Index wo | | |
| 2 | | | | Total % Cover of: | | |
| 3 | | | | OBL species | | |
| 4 | | | | FACW species | | |
| 5 | | = Total Cov | | FAC species | | |
| Herb Stratum (Plot size: 20-foot radius) | | _ = 10tal C0 | vei | UPL species | | |
| 1. Pyrolla secunda | 5 | No | FACU | Column Totals: | | |
| 2. Solidago canadensis | 10 | Yes | FACU | | | |
| 3. Fragaria virginiana | | | <u>UPL</u> | Prevalence Index | | |
| 4. Fescue idahoensis | | | | Hydrophytic Vegetati | | Œ. |
| 5. <u>Eroginum spp</u> | | | | Dominance Test is Prevalence Index | | |
| 6. Penstemon spp | | | | Morphological Ada | | wide supporting |
| 7 | | | | data in Remark | s or on a sepa | arate sheet) |
| 8 9 | | | | Wetland Non-Vaso | cular Plants ¹ | |
| 10 | | | | Problematic Hydro | | |
| 11. | | | | ¹ Indicators of hydric so be present, unless dist | | |
| | | = Total Cov | | be present, unless dist | urbed or probi | ematic. |
| Woody Vine Stratum (Plot size:) | | - | | | | |
| 1 | | | | Hydrophytic Vegetation | | |
| 2. | | | | | esN | o <u>X</u> |
| % Bare Ground in Herb Stratum66 | | = Total Cov | er | | | |
| Remarks: | | | | 1 | | |
| | | | | | | |
| | | | | | | |

SOIL Sampling Point: MMW-6

| Profile Desci | iption: (Describe | to the depth | needed to | document | the in | dicator o | r confirm | the absence | of indicators.) |
|-------------------------------|------------------------|-----------------|--------------|--------------------------|----------|------------------|------------------|-----------------------|---|
| Depth | Matrix | | | Redox Fe | atures | | | | |
| (inches) | Color (moist) | <u> </u> | Color (mo | ist) | <u>%</u> | Type' | Loc ² | Texture | Remarks |
| 0-4" | | · - | | | | · | | Duff/Litter | |
| 4-8" | 10YR 2/2 | 100 | | | | | | Loamy silt | Dark brown |
| 8-18" | 2,5YR 3/2 | 100 | | | | | | Loamy silt | Brown |
| 18" | | 100 | | | | | | Gravel | |
| | | | | | | | | | |
| | | · - | | | | | | | |
| | | · - | | | | - | | | |
| | | | | | | | | | |
| | | · - | | | | | | | |
| | ncentration, D=Depl | | | | | | d Sand Gr | | cation: PL=Pore Lining, M=Matrix. |
| - | ndicators: (Applica | | | | e noted | 1.) | | | ors for Problematic Hydric Soils ³ : |
| Histosol (| A1) pedon (A2) | _ | Sandy R | edox (S5) Matrix (S6) | | | | | m Muck (A10) d Parent Material (TF2) |
| Black His | | _ | | lucky Mine | | (excent | MIRA 1) | | er (Explain in Remarks) |
| | Sulfide (A4) | _ | | Bleyed Matr | , , | (OXOOPT | , | • | or (Explain in Romano) |
| | Below Dark Surface | e (A11) | X Deplete | - | ` ' | | | | |
| | rk Surface (A12) | _ | | ark Surface | ` ' | | | ³ Indicate | ors of hydrophytic vegetation and |
| | ucky Mineral (S1) | _ | | I Dark Surfa | |) | | | and hydrology must be present, |
| | eyed Matrix (S4) | _ | _ Redox D | epressions | (F8) | | | unles | ss disturbed or problematic. |
| | ayer (if present): | | | | | | | | |
| Type: Gi | | | | | | | | | |
| Depth (inc | nes): <u>18"</u> | | | | | | | Hydric Soil | I Present? Yes No X |
| Remarks: | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| HYDROLOG | SY | | | | | | | | |
| Wetland Hyd | rology Indicators: | | | | | | | | |
| _ | ators (minimum of o | ne required; | check all th | at apply) | | | | Seco | ndary Indicators (2 or more required) |
| | Vater (A1) | | | ter-Stained | Leaves | (B9) (ex | cept MLF | | Vater-Stained Leaves (B9) (MLRA 1, 2, |
| | er Table (A2) | | | 1, 2, 4A, an | | ` , ` | • | | 4A, and 4B) |
| Saturatio | | | Sal | Crust (B1 | 1) | | | 0 | Drainage Patterns (B10) |
| Water Ma | arks (B1) | | Aqı | atic Inverte | brates | (B13) | | 0 | Ory-Season Water Table (C2) |
| Sedimen | Deposits (B2) | | Hyd | lrogen Sulfi | de Odo | or (C1) | | s | Saturation Visible on Aerial Imagery (C9) |
| Drift Dep | osits (B3) | | Oxi | dized Rhizo | sphere | s along L | iving Roo | ots (C3) G | Geomorphic Position (D2) |
| Algal Mat | or Crust (B4) | | Pre | sence of R | educed | Iron (C4) |) | s | Shallow Aquitard (D3) |
| Iron Depo | osits (B5) | | Red | ent Iron Re | eduction | n in Tilled | Soils (C6 | i) F | FAC-Neutral Test (D5) |
| Surface S | Soil Cracks (B6) | | Stu | nted or Stre | essed P | lants (D1 |) (LRR A) |) <u> </u> | Raised Ant Mounds (D6) (LRR A) |
| | n Visible on Aerial II | 3 , , , | | er (Explain | in Rem | arks) | | F | Frost-Heave Hummocks (D7) |
| <u> </u> | Vegetated Concave | Surface (B8 | 3) | | | | | | |
| Field Observ | | | | | | | | | |
| Surface Wate | | es No | | | | | | | |
| Water Table I | | es No | | | | | | | |
| Saturation Pro | | es No | <u>X</u> De | epth (inches | s): | | _ Wetla | and Hydrolog | y Present? Yes No X |
| (includes cap Describe Rec | | gauge, mon | toring well | aerial photo | os, prev | /ious insr | ections) | if available: 4 | Aerial Photos reviewed from 1956, 1971, |
| 1994 and 200 | | Jacgo, 111011 | | | - 0, pio | | | a.anabio. F | |
| Remarks: | | | | | | | | | |
| | | | | | | | | | |

US Army Corps of Engineers

| Project/Site: <u>USFS – Monumental Mine</u> | City/County | : 8 Miles NE of Gran | ite, Oregon S | Sampling Date: 10/1/20 | 009 |
|---|--------------------|-------------------------------|------------------------------|--|--------------------|
| Applicant/Owner: <u>U.S. Forest Service, Wallowa-Whiti</u> | man National Fo | orest State | : Oregon S | Sampling Point: MMW | -7 |
| Investigator(s): | | | | | |
| Landform (hillslope, terrace, etc.): Hillslope | | - | | - | |
| Subregion (LRR): E | | | | | |
| Soil Map Unit Name: Elkhorn, Prouty, Hoffer (0991CS) | | | | | |
| Are climatic / hydrologic conditions on the site typical fo | | | | | • |
| | - | | | | No. N |
| Are Vegetation X, Soil X, or Hydrology | | | | | INU/ |
| Are Vegetation, Soil, or Hydrology | | | | | |
| SUMMARY OF FINDINGS – Attach site ma | ap snowing | sampling point ic | ocations, transec | ts, important feat | ures, etc. |
| | No <u>X</u> | Is the Sampled | l Area | | |
| | No X | within a Wetlan | nd? Yes | No X | _ |
| | No <u>X</u> | | | | |
| Remarks: | , prostings that I | nagan in 1970. The ar | oo dalisaatad isaludaa | tuo cattina nanda fran | m tha mina |
| Site conditions were altered significantly due to mining with tailings material containing high concentrations of | | began in 1870. The ar | ea delineated includes | two settling ponds from | n the mine |
| VEGETATION – Use scientific names of p | lants. | | | | |
| Total Objections (Phylorical Conference) | Absolute | | Dominance Test w | orksheet: | |
| Tree Stratum (Plot size: 20-foot radius) | | Species? Status | Number of Dominan | | (4) |
| 1. Abies lasiocarpa | | | That Are OBL, FAC | W, or FAC: 1 | (A) |
| Picea engelmannii Larix occidentalis | | <u>Yes FAC</u> <u>No FACU</u> | Total Number of Doi | | (D) |
| 4. Pinus contorta | | | Species Across All S | Strata: 2 | (B) |
| 4. Tillus contotta | | = Total Cover | Percent of Dominan | |) (A/D) |
| Sapling/Shrub Stratum (Plot size: 20-foot radius) | | = 10tai 00vci | That Are OBL, FAC | W, or FAC:50 | <u>)</u> (A/B) |
| 1. Vaccinium spp | <1 | No | Prevalence Index v | vorksheet: | |
| 2 | | | Total % Cover of | of: Multiply | by: |
| 3 | | | OBL species | x 1 = | |
| 4 | | | · · | x 2 = | |
| 5 | | | * | x 3 = | |
| Herb Stratum (Plot size: 20-foot radius) | 0 | = Total Cover | | x 4 = | |
| Pyrola secunda | 2 | No EACH | | x 5 = | |
| 2. | | | Column Totals: | (A) | (B) |
| 3. | | | Prevalence Inc | dex = B/A = | |
| 4. | | | Hydrophytic Veget | | |
| 5. | | | Dominance Tes | st is >50% | |
| 6. | | | Prevalence Inde | ex is ≤3.0 ¹ | |
| 7 | | | Morphological A data in Rema | Adaptations ¹ (Provide sarks or on a separate s | upporting heet) |
| 8 | | | Wetland Non-Va | ascular Plants ¹ | |
| 9 | | | Problematic Hyd | drophytic Vegetation ¹ (I | Explain) |
| 10. | | | | soil and wetland hydro | |
| 11 | | = Total Cover | be present, unless d | disturbed or problemation |). |
| Woody Vine Stratum (Plot size:) | | | | | |
| 1 | | | Hydrophytic | | |
| 2 | | | Vegetation Present? | Yes No <u>X</u> | |
| 9/ Poro Cround in Llorb Stratum CO | | = Total Cover | | <u></u> | |
| % Bare Ground in Herb Stratum 98 Remarks: | | | | | |
| | | | | | |
| | | | | | |

| SOIL | | | | | | | Sampling Point: MMW-7 | | |
|---|--|---------------------------------------|---|---|--|---|--|--|--|
| Profile Des | cription: (Describe | to the dep | th needed to docum | ent the indicator | or confire | m the absence | of indicators.) | | |
| Depth | Matrix | | | Features | . 2 | _ | | | |
| (inches) | Color (moist) | % | Color (moist) | <u>%</u> Type' | Loc ² | <u>Texture</u> | Remarks | | |
| 0-2" | | | | | | <u>Duff/Litter</u> | | | |
| 2-9 " | 2.5YR 3/2 | 100 | | | | Loamy silt | Brown | | |
| 9" | Refusal | | | | | · | | | |
| | - | | | | | | | | |
| | | | | | | | | | |
| ¹Type: C=C | Concentration D=Der | oletion. RM= | | | ed Sand G | irains. ² l oc | cation: PL=Pore Lining, M=Matrix. | | |
| | | | LRRs, unless otherv | | | | rs for Problematic Hydric Soils ³ : | | |
| Histosol (A1) | | | Sandy Redox (S | 5) | | 2 cn | 2 cm Muck (A10) | | |
| Histic Epipedon (A2) | | | Stripped Matrix (| • | | Red Parent Material (TF2) | | | |
| | listic (A3) | | | ineral (F1) (except | MLRA 1 |) Othe | er (Explain in Remarks) | | |
| | en Sulfide (A4) | - (0.4.4) | Loamy Gleyed M | | | | | | |
| Depleted Below Dark Surface (A11) | | | | | | ³ Indicators of hydrophytic vegetation and | | | |
| | Mucky Mineral (S1) | Depleted Dark S | , , | | | wetland hydrology must be present, | | | |
| | • ' ' | | Bopiotoa Bank o | arrado (i i j | | | na nyarology maor bo procent, | | |
| Sandy | Gleyed Matrix (S4) | | Redox Depression | ons (F8) | | | s disturbed or problematic. | | |
| | Gleyed Matrix (S4) Layer (if present): | | Redox Depression | ons (F8) | | | | | |
| Restrictive | | | Redox Depression | ons (F8) | | | | | |
| Restrictive Type: | Layer (if present): | | Redox Depression | ons (F8) | | | s disturbed or problematic. | | |
| Restrictive Type: | Layer (if present): Bedrock? | | Redox Depression | ons (F8) | | unles | s disturbed or problematic. | | |
| Type: Depth (in | Layer (if present): Bedrock? | | Redox Depression | ons (F8) | | unles | s disturbed or problematic. | | |
| Type: Depth (in | Layer (if present): Bedrock? | | Redox Depression | ons (F8) | | unles | s disturbed or problematic. | | |
| Type: Depth (in | Layer (if present): Bedrock? | | Redox Depression | ons (F8) | | unles | s disturbed or problematic. | | |
| Restrictive Type: Depth (ir Remarks: | Layer (if present): Bedrock? nches): 9" | | Redox Depression | ons (F8) | | unles | s disturbed or problematic. | | |
| Restrictive Type: Depth (in Remarks: | Bedrock? nches): 9" | | Redox Depression | ons (F8) | | unles | s disturbed or problematic. | | |
| Restrictive Type: Depth (ir Remarks: HYDROLO Wetland Hy | Layer (if present): Bedrock? nches): 9" OGY /drology Indicators: | | | | | Hydric Soil | s disturbed or problematic. Present? Yes NoX | | |
| Restrictive Type: Depth (ir Remarks: HYDROLO Wetland Hy Primary Ind | Layer (if present): Bedrock? nches): 9" OGY /drology Indicators: icators (minimum of common | | d; check all that apply |) | | Hydric Soil Secon | s disturbed or problematic. Present? Yes No _X ndary Indicators (2 or more required) | | |
| Restrictive Type: Depth (ir Remarks: HYDROLO Wetland Hy Primary Ind Surface | DGY vdrology Indicators: was water (A1) | | d; check all that apply |) ned Leaves (B9) (e | xcept ML | Hydric Soil Secon | Present? Yes No X Indicators (2 or more required) Vater-Stained Leaves (B9) (MLRA 1, 2, | | |
| Type: Depth (ir Remarks: | DGY /drology Indicators: icators (minimum of of the Water (A1) /drel (A2) | | d: check all that apply Water-Stair 1, 2, 4A, |) ned Leaves (B9) (e | xcept ML | Hydric Soil Secon | Present? Yes No X Manage of the second seco | | |
| Restrictive Type: Depth (ir Remarks: HYDROLO Wetland Hy Primary Ind Surface High W Saturate | DGY rdrology Indicators: icators (minimum of of the Water (A1) ater Table (A2) ion (A3) | | d; check all that apply — Water-Stair 1, 2, 4A, — Salt Crust (|) ned Leaves (B9) (e , and 4B) B11) | xcept ML | Hydric Soil | Present? Yes No X Adary Indicators (2 or more required) Vater-Stained Leaves (B9) (MLRA 1, 2, 4A, and 4B) rainage Patterns (B10) | | |
| Type: Depth (ir Remarks: | DGY /drology Indicators: e Water (A1) ater Table (A2) ion (A3) Marks (B1) | | d; check all that apply Water-Stair 1, 2, 4A, Salt Crust (I |) ned Leaves (B9) (e and 4B) B11) ertebrates (B13) | xcept ML | Hydric Soil | Present? Yes No X Maintain Ma | | |
| Type: Depth (ir Remarks: HYDROLO Wetland Hy Primary Ind Surface High W Saturat Water N Sedime | DGY /drology Indicators: icators (minimum of of water (A1) dater Table (A2) ion (A3) Marks (B1) ent Deposits (B2) | | d; check all that apply — Water-Stair 1, 2, 4A, — Salt Crust (I) — Aquatic Invo |) ned Leaves (B9) (e and 4B) B11) ertebrates (B13) Sulfide Odor (C1) | | Hydric Soil | Present? Yes No X Indary Indicators (2 or more required) Vater-Stained Leaves (B9) (MLRA 1, 2, 4A, and 4B) Trainage Patterns (B10) Try-Season Water Table (C2) Auturation Visible on Aerial Imagery (C9) | | |
| Restrictive Type: Depth (ir Remarks: HYDROLO Wetland Hy Primary Ind Surface High W | DGY vorology Indicators: icators (minimum of context) water (A1) icater Table (A2) ion (A3) Marks (B1) ent Deposits (B2) eposits (B3) | | d; check all that apply — Water-Stair 1, 2, 4A, — Salt Crust (I) — Aquatic Involution — Hydrogen S |) ned Leaves (B9) (e and 4B) B11) ertebrates (B13) Sulfide Odor (C1) nizospheres along | Living Ro | Hydric Soil | Present? Yes No X Indary Indicators (2 or more required) Vater-Stained Leaves (B9) (MLRA 1, 2, 4A, and 4B) rainage Patterns (B10) ry-Season Water Table (C2) aturation Visible on Aerial Imagery (C9) eomorphic Position (D2) | | |
| Restrictive Type: Depth (ir Remarks: HYDROLO Wetland Hy Primary Ind Surface High W Saturat Water N Sedime Drift De Algal M | DGY Address (if present): Bedrock? DGY Adrology Indicators: Cattors (minimum of cattors (minimum of cattors) Water (A1) Cattor (A3) Marks (B1) Cattor (B4) Cattor (B4) | | d; check all that apply Water-Stair 1, 2, 4A, Salt Crust (I Aquatic Invo Hydrogen S Oxidized RI Presence o | ned Leaves (B9) (en and 4B) B11) ertebrates (B13) Sulfide Odor (C1) nizospheres along f Reduced Iron (C- | Living Ro 4) | Hydric Soil | Present? Yes No _X Indary Indicators (2 or more required) Vater-Stained Leaves (B9) (MLRA 1, 2, 4A, and 4B) rainage Patterns (B10) ry-Season Water Table (C2) aturation Visible on Aerial Imagery (C9) eomorphic Position (D2) hallow Aquitard (D3) | | |
| Restrictive Type: Depth (ir Remarks: HYDROLO Wetland Hy Primary Ind Surface High W Saturat Water N Sedime Drift De Algal M Iron De | DGY Adrology Indicators: icators (minimum of of the Water (A1) idater Table (A2) ion (A3) Marks (B1) ent Deposits (B2) eposits (B3) lat or Crust (B4) eposits (B5) | | d; check all that apply Water-Stair 1, 2, 4A, Salt Crust (I Aquatic Invo Hydrogen S Oxidized RI Presence o Recent Iron | ned Leaves (B9) (e and 4B) B11) ertebrates (B13) Sulfide Odor (C1) nizospheres along f Reduced Iron (C4) Reduction in Tille | Living Ro 4) d Soils (C | Hydric Soil | Present? Yes NoX Indary Indicators (2 or more required) Vater-Stained Leaves (B9) (MLRA 1, 2, 4A, and 4B) rainage Patterns (B10) ry-Season Water Table (C2) aturation Visible on Aerial Imagery (C9) eomorphic Position (D2) hallow Aquitard (D3) AC-Neutral Test (D5) | | |
| Restrictive Type: Depth (ir Remarks: HYDROLO Wetland Hy Primary Ind Surface High W Saturat Water N Sedime Drift De Algal M Iron De Surface | DGY /drology Indicators: icators (minimum of of other) /drology Indicators: icators (minimum of other) /drology Indicators: /drolog | one required | d; check all that apply Water-Stair 1, 2, 4A, Salt Crust (I Aquatic Invo Hydrogen S Oxidized RI Presence o Recent Iron Stunted or S | ned Leaves (B9) (e and 4B) B11) ertebrates (B13) Sulfide Odor (C1) nizospheres along f Reduced Iron (C4) Reduction in Tille Stressed Plants (D | Living Ro 4) d Soils (C | Hydric Soil | Present? Yes No _X Indary Indicators (2 or more required) Vater-Stained Leaves (B9) (MLRA 1, 2, 4A, and 4B) rainage Patterns (B10) ry-Season Water Table (C2) aturation Visible on Aerial Imagery (C9) recomorphic Position (D2) hallow Aquitard (D3) AC-Neutral Test (D5) aised Ant Mounds (D6) (LRR A) | | |
| Restrictive Type: Depth (ir Remarks: HYDROLO Wetland Hy Primary Ind Surface High W Saturat Water N Sedime Drift De Algal M Iron De Surface Inundat | DGY Adrology Indicators: icators (minimum of of the Water (A1) idater Table (A2) ion (A3) Marks (B1) ent Deposits (B2) eposits (B3) lat or Crust (B4) eposits (B5) | one required | d; check all that apply Water-Stair 1, 2, 4A, Salt Crust (I Aquatic Invo Hydrogen S Oxidized RI Presence o Recent Iron Stunted or S Other (Expl | ned Leaves (B9) (e and 4B) B11) ertebrates (B13) Sulfide Odor (C1) nizospheres along f Reduced Iron (C4) Reduction in Tille Stressed Plants (D | Living Ro 4) d Soils (C | Hydric Soil | Present? Yes NoX Indary Indicators (2 or more required) Vater-Stained Leaves (B9) (MLRA 1, 2, 4A, and 4B) rainage Patterns (B10) ry-Season Water Table (C2) aturation Visible on Aerial Imagery (C9) eomorphic Position (D2) hallow Aquitard (D3) AC-Neutral Test (D5) | | |
| Restrictive Type: Depth (ir Remarks: HYDROLO Wetland Hy Primary Ind Surface High W Saturat Water N Sedime Drift De Algal M Iron De Surface Inundat | DGY Inches): 9" DGY Inches): 9" Inches): | one required | d; check all that apply Water-Stair 1, 2, 4A, Salt Crust (I Aquatic Invo Hydrogen S Oxidized RI Presence o Recent Iron Stunted or S Other (Expl | ned Leaves (B9) (e and 4B) B11) ertebrates (B13) Sulfide Odor (C1) nizospheres along f Reduced Iron (C4) Reduction in Tille Stressed Plants (D | Living Ro 4) d Soils (C | Hydric Soil | Present? Yes No _X Indary Indicators (2 or more required) Vater-Stained Leaves (B9) (MLRA 1, 2, 4A, and 4B) rainage Patterns (B10) ry-Season Water Table (C2) aturation Visible on Aerial Imagery (C9) recomorphic Position (D2) hallow Aquitard (D3) AC-Neutral Test (D5) aised Ant Mounds (D6) (LRR A) | | |
| Restrictive Type: Depth (ir Remarks: HYDROLO Wetland Hy Primary Ind Surface High W Saturat Water N Sedime Drift De Algal M Iron De Surface Inundat Sparse Field Obse | DGY Arches): 9" DGY Archology Indicators: icators (minimum of control of c | one required Imagery (B: e Surface (I | d: check all that apply Water-Stair 1, 2, 4A, Salt Crust (i Aquatic Invo Hydrogen S Oxidized RI Presence o Recent Iron Stunted or 3 Other (Expl | ned Leaves (B9) (en and 4B) B11) Britebrates (B13) Sulfide Odor (C1) Drizospheres along of Reduced Iron (C4) Reduction in Tille Stressed Plants (Dain in Remarks) | Living Ro 4) d Soils (C 1) (LRR A | Hydric Soil | Present? Yes No _X Indary Indicators (2 or more required) Vater-Stained Leaves (B9) (MLRA 1, 2, 4A, and 4B) rainage Patterns (B10) ry-Season Water Table (C2) aturation Visible on Aerial Imagery (C9) recomorphic Position (D2) hallow Aquitard (D3) AC-Neutral Test (D5) aised Ant Mounds (D6) (LRR A) | | |
| Restrictive Type: Depth (ir Remarks: HYDROLO Wetland Hy Primary Ind Surface High W Saturat Water N Sedime Drift De Algal M Iron De Surface Inundat Sparse Field Obse | DGY Inches): 9" DGY Inches): 9" DGY Inches): 9" DGY Inches): 9" Inches): 9" | Imagery (B' e Surface (I | d; check all that apply Water-Stair 1, 2, 4A, Salt Crust (I Aquatic Invo Hydrogen S Oxidized RI Presence o Recent Iron Stunted or S Other (Expl | ned Leaves (B9) (en and 4B) B11) ertebrates (B13) Sulfide Odor (C1) nizospheres along f Reduced Iron (C4) Reduction in Tille Stressed Plants (D) ain in Remarks) | Living Ro 4) d Soils (C 1) (LRR A | Hydric Soil | Present? Yes No _X Indary Indicators (2 or more required) Vater-Stained Leaves (B9) (MLRA 1, 2, 4A, and 4B) rainage Patterns (B10) ry-Season Water Table (C2) aturation Visible on Aerial Imagery (C9) recomorphic Position (D2) hallow Aquitard (D3) AC-Neutral Test (D5) aised Ant Mounds (D6) (LRR A) | | |

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available: Aerial Photos reviewed from 1956, 1971, 1994 and 2005.

Remarks:

(includes capillary fringe)

| Project/Site: USFS – Monumental Mine | City/County: | : 8 Miles | NE of Grani | te, Oregon Sar | Sampling Date: <u>10/1/2009</u> | | |
|--|----------------------------|---------------------|-------------------|---|--|--------------|--|
| Applicant/Owner: U.S. Forest Service, Wallowa-Wi | tman National Forest State | | | Oregon Sar | npling Point: MMW-8 | Point: MMW-8 | |
| Investigator(s): Tobias/Otis | Section, Towns | ship, Rang | je: <u>Sectio</u> | n 18, Township 8 South, | 3, Township 8 South, Range 36 East | | |
| Landform (hillslope, terrace, etc.): Hillslope | Lo | Slope (%): <u>0</u> | | | | | |
| Subregion (LRR): _E | Lat: N 44° | 51.643 | Long: | W 118° 21.251' Datum: NAD 1983 | | | |
| Soil Map Unit Name: Elkhorn, Prouty, Hoffer (09910 | | | | | | | |
| Are climatic / hydrologic conditions on the site typical | | | | | | | |
| Are Vegetation X, Soil X, or Hydrology _ | - | | | | | No | |
| Are Vegetation, Soil, or Hydrology | _ | - | | eded, explain any answe | | _ 140 | |
| SUMMARY OF FINDINGS – Attach site r | | | | | | es, etc. | |
| Hydrophytic Vegetation Present? Yes X | No | ls t | he Sampled | Area | | | |
| | No | | • | nd? Yes X No | | | |
| | No | | | | | | |
| Remarks: Site conditions were altered significantly due to min | ing practices that b | egan in 1 | 870. The are | ea delineated includes tw | vo settling ponds from th | e mine | |
| with tailings material containing high concentrations | of arsenic. | | | | | | |
| VEGETATION – Use scientific names of | - | | | | | | |
| Tree Stratum (Plot size:) 1 | | Species | | Dominance Test worksheet: Number of Dominant Species That Are OBL, FACW, or FAC:3(A) | | | |
| 2. | | | | | | _ (^) | |
| 3. | | | | Total Number of Domi | | (B) | |
| 4. | | | | | | _ (5) | |
| Sapling/Shrub Stratum (Plot size: 20-foot radius) | = Total Cover | | | Percent of Dominant S That Are OBL, FACW, | Species or FAC: 100 | _ (A/B) | |
| Saxifraga punctata | 5 | No | FACW | Prevalence Index wo | rksheet: | | |
| 2. Solidago cana | 5 | No | FACU | Total % Cover of: | Multiply by: | | |
| 3. Claytonia sibirica | 5 | No | FAC | | x 1 = | | |
| 4. Abies grandis | | No | | · · | x 2 = | | |
| 5 | | 1 | | - | x 3 = | | |
| Herb Stratum (Plot size: 20-foot radius) | 20 | _ = Total (| Cover | | x 4 = | | |
| 1. Moss spp | | | | | x 5 = | | |
| 2. Glyceria elata | 40 | Yes | FACW | Column Totals. | (A) | (B) | |
| 3. Heracleum lanatum | | Yes | FAC | Prevalence Index | x = B/A = | | |
| 4. Mimulus spp (moschatus)? | 10 | Yes | FACW+ | Hydrophytic Vegetati | on Indicators: | | |
| 5 | | | | X Dominance Test i | | | |
| 6 | | | | Prevalence Index | | | |
| 7 | | | | Morphological Ada | aptations ¹ (Provide supp ks or on a separate shee | orting | |
| 8 | | | | Wetland Non-Vas | • |) | |
| 9 | | | | | ophytic Vegetation ¹ (Exp | lain) | |
| 10 | | | | | oil and wetland hydrology | , | |
| 11 | | | | be present, unless dist | | , | |
| Woody Vine Stratum (Plot size:) | 65 | = Total Co | over | | | | |
| 1 | | | | Hydrophytic | | | |
| 2. | | | | Vegetation | | | |
| | | = Total Co | over | Present? Yes X No No | | | |
| % Bare Ground in Herb Stratum 35 | | | | | | | |
| Remarks: | | | | | | | |
| | | | | | | | |

SOIL Sampling Point: MMW-8

| Profile Desc | ription: (Describe | to the depth | needed to document the indicator or confi | rm the absen | ce of indicators.) |
|------------------------|----------------------|-----------------|---|--------------------|--|
| Depth (in the case) | Matrix | | Redox Features | | December 1 |
| (inches) | Color (moist) | % | Color (moist) % Type ¹ Loc ² | Texture | Remarks |
| 0-2" | 2.5YR 3/1 | 100 | | Peat | Organic/Black |
| 2-6" | 10YR 5/4 | 100 | | Coarse sa | nd Light brown |
| 6-12" | 2.5YR 2.5/1 | 100 | | Clayey silt | Black |
| 12-18" | 5YR 5/2 | 100 | | Tailings | Pink/brown/gray |
| | | | | <u> </u> | |
| | | | | | |
| | | | | _ | |
| | | | | _ | - |
| 1- 0.0 | | | | | |
| | | | educed Matrix, CS=Covered or Coated Sand (RRs, unless otherwise noted.) | | Location: PL=Pore Lining, M=Matrix. ators for Problematic Hydric Soils ³ : |
| • | | able to all Liv | • | | • |
| X Histosol X Histic Ep | ` ' | _ | _ Sandy Redox (S5) _ Stripped Matrix (S6) | | cm Muck (A10) led Parent Material (TF2) |
| Black His | | _ | _ Loamy Mucky Mineral (F1) (except MLRA 1 | | other (Explain in Remarks) |
| | n Sulfide (A4) | _ | Loamy Gleyed Matrix (F2) | | and (Explain in Normalite) |
| | Below Dark Surfac | e (A11) | Depleted Matrix (F3) | | |
| | rk Surface (A12) | ` ′ _ | Redox Dark Surface (F6) | ³ Indic | ators of hydrophytic vegetation and |
| X Sandy M | lucky Mineral (S1) | | Depleted Dark Surface (F7) | we | tland hydrology must be present, |
| Sandy G | leyed Matrix (S4) | <u> </u> | _ Redox Depressions (F8) | un | less disturbed or problematic. |
| Restrictive L | .ayer (if present): | | | | |
| Туре: | | | <u> </u> | | |
| Depth (inc | hes): | | <u> </u> | Hydric S | oil Present? Yes X No |
| Remarks: Co | ontaminated tailings | present at 12 | -18" | 1 | |
| | | | | | |
| | | | | | |
| | | | | | |
| | 0V | | | | |
| HYDROLO | | | | | |
| • | Irology Indicators | | | | |
| | • | one required; o | check all that apply) | | condary Indicators (2 or more required) |
| X Surface | Water (A1) | | Water-Stained Leaves (B9) (except M | LRA | Water-Stained Leaves (B9) (MLRA 1, 2, |
| _ | ter Table (A2) | | 1, 2, 4A, and 4B) | | 4A, and 4B) |
| X Saturation | | | Salt Crust (B11) | | Drainage Patterns (B10) |
| Water Ma | | | Aquatic Invertebrates (B13) | | Dry-Season Water Table (C2) |
| | nt Deposits (B2) | | Hydrogen Sulfide Odor (C1) | · | Saturation Visible on Aerial Imagery (C9) |
| | osits (B3) | | Oxidized Rhizospheres along Living Remarks | | |
| | t or Crust (B4) | | Presence of Reduced Iron (C4) | | Shallow Aquitard (D3) |
| Iron Dep | | | Recent Iron Reduction in Tilled Soils (0 | | FAC-Neutral Test (D5) |
| | Soil Cracks (B6) | | Stunted or Stressed Plants (D1) (LRR | | Raised Ant Mounds (D6) (LRR A) |
| | on Visible on Aerial | | Other (Explain in Remarks) | | Frost-Heave Hummocks (D7) |
| | Vegetated Concav | e Surface (B8 |) | | |
| Field Observ | | | | | |
| Surface Water | | res X No | Depth (inches): At surface | | |
| Water Table | Present? | /es <u>X</u> N | Depth (inches): 6" | | |
| Saturation Pr | | es X No | Depth (inches): At surface We | tland Hydrol | ogy Present? Yes X No |
| (includes cap | illary fringe) | n daude monit | toring well, aerial photos, previous inspections |) if available: | Aerial Photos reviewed from 1056, 1071 |
| 1994 and 200 | | r gauge, monii | toring well, derial photos, previous inspections |), ii avallable. | Actial Filotos reviewed from 1950, 1971, |
| Remarks: | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

| Project/Site: <u>USFS – Monumental Mine</u> | City/County | : 8 Miles NE of Gran | ite, Oregon Sa | ampling Date: <u>10/1/2009</u> | |
|---|---------------------|------------------------------------|--------------------------------------|--|-------|
| Applicant/Owner: <u>U.S. Forest Service, Wallowa-Whit</u> | man National Fo | orest State | : Oregon Sa | ampling Point: <u>MMW-9</u> | |
| Investigator(s):Tobias/Otis | Section, Town | ship, Range: Section | n 18, Township 8 South | ı, Range 36 East | |
| Landform (hillslope, terrace, etc.): Hillslope | Lo | ocal relief (concave, co | nvex, none): Concave | slope (%): <u>20</u> | |
| Subregion (LRR): E | Lat: N 44° | 51.634' Long: | W 118° 21.262' | Datum: <u>NAD 1983</u> | |
| Soil Map Unit Name: Elkhorn, Prouty, Hoffer (0991Cs | | | | | |
| Are climatic / hydrologic conditions on the site typical for | | | | | |
| Are Vegetation X, Soil X, or Hydrology | • | | | | lo) |
| Are Vegetation, Soil, or Hydrology | | | | | |
| SUMMARY OF FINDINGS – Attach site m | | | | | etc. |
| Hydrophytic Vegetation Present? Yes | NoX | Is the Sample | I Area | | |
| | NoX | within a Wetla | | No <u>X</u> | |
| | NoX | | | | |
| Remarks: | | h '- 4070 Th | and delicerate discolution | to a control of the c | • |
| Site conditions were altered significantly due to mining with tailings material containing high concentrations of | | began in 1870. The ar | ea delineated includes t | .wo settling ponds from the mi | ine |
| VEGETATION – Use scientific names of p | | | | | |
| Tree Stratum (Plot size: 20-foot radius) | Absolute % Cover | Dominant Indicator Species? Status | Dominance Test wo Number of Dominant | | |
| 1. Abies grandis | <u> </u> | | | V, or FAC:1 (| (A) |
| 2. Picea engelmannii | 50 | Yes FAC | Total Number of Dom | ninant | |
| 3 | | | Species Across All St | | (B) |
| 4 | | | Percent of Dominant | Species | |
| Sapling/Shrub Stratum (Plot size: 20-foot radius) | 50 | = Total Cover | | /, or FAC: | (A/B) |
| Chimpaphila umbellata | 5 | <u>No</u> | Prevalence Index w | | |
| 2 | | | | : Multiply by: | |
| 3 | | | | x 1 = | |
| 4 | | | · · | x 2 = 0 x 3 = 3 | |
| 5 | | = Total Cover | | x 4 = 4 | |
| Herb Stratum (Plot size: 20-foot radius) | | _ = Total Cover | | x 5 =0 | |
| Pyrola secunda | <1 | No FACU | | (A) <u>7</u> | (B) |
| 2 | | | | | |
| 3 | | | Hydrophytic Vegeta | ex = B/A = 3.5 | |
| 4 | | | X Dominance Test | | |
| 5 | | | Prevalence Index | | |
| 7 | | | Morphological Addata in Rema | daptations ¹ (Provide supportin | ng |
| 8 | | | Wetland Non-Va | · | |
| 9 | | | Problematic Hyd | rophytic Vegetation ¹ (Explain) |) |
| 10. | | | | soil and wetland hydrology mu | ıst |
| 11 | | = Total Cover | be present, unless di | sturbed or problematic. | |
| Woody Vine Stratum (Plot size:) | | 10.001 | | | |
| 1 | | | Hydrophytic | | |
| 2 | | | Vegetation Present? | res No <u>X</u> | |
| % Bare Ground in Herb Stratum 100 | | _= Total Cover | | | |
| Remarks: | | | | | |
| | | | | | |
| | | | | | |

| SOIL | | | | | | | Sampling Poir | nt· MM\/\/-Q |
|----------------|---------------------------------------|---------------|----------------------------------|--|------------------|------------------------|--|------------------------|
| | intion: (Describ | e to the der | oth needed to docum | nent the indicator | or confirm | the absence | | it. IVIIVIV O |
| Depth | Matrix | o 10 1110 dop | | x Features | 0. 00 | tille abcollec | or maroutorory | |
| (inches) | Color (moist) | % | Color (moist) | % Type ¹ | Loc ² | Texture | Remarks | i |
| 0-2" | | | | | | Duff/Litter | | |
| 2-18 " | 2.5YR 3/2 | 100 | | | | Loamy silt | Brown | _ |
| 2 10 | 2.011(0/2 | | | | | Louiny one | Diowii | |
| | | | | | | | | |
| | | | - | | | | - | |
| | - | | - | | | | | |
| | | | - | - <u> </u> | | | - | |
| | | | | | | | | |
| | | | | <u> </u> | | | | |
| ¹Type: C=Co | ncentration D-De | nletion RM | =Reduced Matrix, CS | S-Covered or Coate | ad Sand Gr | ains ² l or | cation: PL=Pore Lining, | M-Matriy |
| | | | LRRs, unless other | | d Garia Gr | | ors for Problematic Hyd | |
| Histosol (| | | Sandy Redox (S | | | 2 cn | n Muck (A10) | |
| Histic Epi | pedon (A2) | | Stripped Matrix | | | Red | Parent Material (TF2) | |
| Black His | stic (A3) | | | Mineral (F1) (except | t MLRA 1) | Oth | er (Explain in Remarks) | |
| | Sulfide (A4) | | Loamy Gleyed I | | | | | |
| | Below Dark Surfa | ace (A11) | Depleted Matrix | | | 3 In dianta | ors of hydrophytic vegeta | ation and |
| | rk Surface (A12) ucky Mineral (S1) | | Redox Dark Su Depleted Dark S | | | | nd hydrology must be p | |
| | eyed Matrix (S4) | | Redox Depress | ` ' | | | s disturbed or problema | |
| | ayer (if present): | | | (/ | | | , | |
| Type: | | | | | | | | |
| Depth (inc | hes): | | <u></u> | | | Hydric Soil | Present? Yes | No X |
| Remarks: | , - | | | | | | <u> </u> | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| UVDBOL O | | | | | | | | |
| HYDROLOG | | | | | | | | |
| _ | rology Indicators | | | | | _ | | |
| - | • | one require | d; check all that apply | * * | | | ndary Indicators (2 or mo | |
| · | Vater (A1) | | | ined Leaves (B9) (e | xcept MLF | RA W | Vater-Stained Leaves (B | 9) (MLRA 1, 2, |
| _ | er Table (A2) | | | A, and 4B) | | 5 | 4A, and 4B) | |
| Saturatio | | | Salt Crust | , , | | | rainage Patterns (B10) | (C2) |
| Water Ma | t Deposits (B2) | | | vertebrates (B13) Sulfide Odor (C1) | | · | ry-Season Water Table aturation Visible on Aeri | • • |
| Drift Dep | | | | Rhizospheres along | Living Poo | | seomorphic Position (D2 | • • • • |
| | t or Crust (B4) | | | of Reduced Iron (C | _ | | hallow Aquitard (D3) |) |
| Iron Depo | | | | n Reduction in Tille | | · | AC-Neutral Test (D5) | |
| | Soil Cracks (B6) | | | Stressed Plants (D | | | aised Ant Mounds (D6) | (LRR A) |
| | n Visible on Aeria | I Imagery (B | | plain in Remarks) | ., (=:::::, | | rost-Heave Hummocks | |
| | Vegetated Conca | | | , | | | | , |
| Field Observ | - | | ` , | | | | | |
| Surface Wate | r Present? | Yes | No X Depth (in | ches): | _ | | | |
| Water Table F | Present? | | No X Depth (in | | | | | |
| Saturation Pro | esent? | | No X Depth (in | | | and Hydrolog | y Present? Yes | No <u>X</u> |
| (includes capi | | | | | | | | |
| 1994 and 200 | | ııı gauge, m | omoning well, aerial p | priotos, previous ins | pections), | ıı avalladle: A | verial Photos reviewed fr | UIII 1956, 1971, |

Remarks:

Appendix C.

Ground Level Color Photographs



Photograph 1.

Wetland vegetation in the upper settling pond.



Photograph 2.

Sample Plot MMW-2.



Photograph 3.

Upland Plot MMW-3.



Photograph 4.

Plot MMW-5 within the channel of the unnamed tributary.



Photograph 5.

Perennial spring at headwaters of the unnamed tributary .

Appendix D.

Additional Tables of Information

Table 1. Summary of Precipitation for 2008-2009 Water Year
Forest Service Monumental Mine - DGA Wetland Delineation
Wallowa-Whitman National Forest, Grant County, Oregon

| Month | Recorded Precipitation ¹ | Normal | Departure from Normal | Percent of |
|-----------------------------|--|--------|--------------------------|---------------|
| | | inches | | Normal |
| October 2008 | 1.59 | 2.34 | -0.75 | 68% |
| November 2008 | 4.21 | 3.15 | 1.06 | 134% |
| December 2008 | 6.58 | 3.81 | 2.77 | 173% |
| January 2009 | 5.84 | 3.76 | 2.08 | 155% |
| February 2009 | 2.05 | 3.19 | -1.14 | 64% |
| March 2009 | 6.91 | 2.55 | 4.36 | 271% |
| April 2009 | 3.59 | 1.25 | 2.34 | 287% |
| May 2009 | 3.19 | 2.79 | 0.4 | 114% |
| June 2009 | 1.79 | 2.16 | -0.37 | 83% |
| July 2009 ² | 0.39 | 0.21 | 0.18 | 186% |
| August 2009 | 1.36 | 0.77 | 0.59 | 177% |
| September 2009 | Trace | 1.72 | 1.72 | 0% |
| Total Precipitation | 34.13 | 27.21 | 6.92 | 125% |
| Field Investigation and Pre | eceding Dates ² | | | |
| October 1, 2009 | 0.05 | | | |
| September 15-30, 2009 | Trace | | | |

NOTES

From the Meacham #2 (355394) weather station located approximately 60 miles north of the Monumental Mine at an elevation of
 4,055 feet msl. Data obtained from the National Oceanic and Atmospheric Administration (NOAA) website: www.weather.gov/climate
 Data obtained from the Weather Underground website: www.wunderground.com

² OAR 141-090-0035 requires precipitation data for the day of the investigation and preceding 1-2 weeks.

^{-- =} Not Measured

NOWData - NOAA Online Weather Data

MEACHAM #2 (355394) Monthly Totals/Averages Precipitation (inches) Year: 2009

Year Jan Feb Mar Apr May Jun Jul Aug Sep 0ct Nov Dec Annual 2009 5.84 2.05 6.91 3.59 3.19 1.79 1.36 0.00 3.04 2.60 3.76 34.13

Official data and data for additional locations and years are available from the Regional Climate Centers and the National Climatic Data Center.

Back to the clickable map Back to the data request form

Display Normals Display Records

<-- Prev Month Next Month -> <-- Prev Year Next Year ->

Observed Data for Meacham No 2 September 2008

| M M M M | M M M M | 0.00 0.00 0.00 0.00 | 0.0 | 0 0 0 | |
|------------------|---------------------------------------|---------------------------------------|--|--|---|
| М М М | M M M | 0.00 0.00 0.00 | 0.0 0.0 0.0 | 0 0 0 | |
| M M | M | 0.00 | 0.0 | 0 | |
| M | M | 0.00 | 0.0 | 0 | |
| | | | | | |
| | | | | | |
| | | 0.00 | | 0 | |
| M | M | 0.00 | 0.0 | 0 | |
| М | M | | | 0 | |
| M | M | | | Ō | |
| M | M | 0.00 | | 0 | |
| M | M | M | 0.0 | 0 | |
| M | M | M | 0.0 | Ó | |
| M | M | 0.00 | 0.0 | 0 | |
| M | M | 0.00 | 0.0 | O | |
| M | M | 0.00 | 0 - 0 | 0 | |
| M | M | 0.00 | 0.0 | O . | |
| M | M | 0.00 | 0.0 | 0 | |
| M | M | 0.00 | 0.0 | 0 | |
| M | M | 0.00 | 0.0 | 0 | |
| M | M | 0.00 | 0.0 | O. | |
| M | M | 0.00 | 0.0 | 0 | |
| M | M | 0.00 | 0.0 | 0 | |
| M | M | 0.00 | 0.0 | 0 | |
| M | M | 0.00 | 0.0 | 0 | |
| M | M | 0.00 | 0.0 | 0 | |
| M | M | 0.00 | 0.0 | 0 | |
| M | M | 0.00 | 0.0 | 0 | |
| M | M | 0.00 | 0.0 | Q | |
| M | M | 0.00 | 0.0 | O | |
| M | M | 0.00 | 0,0 | | |
| M | M | 0.00 | 0.0 | 0 | |
| Max | Min | Precip | Snow | Depth | |
| | M M M M M M M M M M M M M M M M M M M | M M M M M M M M M M M M M M M M M M M | M M 0.00 M M M 0.00 | M M 0.00 0.0 M M M 0.00 0.0 | M M 0.00 0.0 0 0 0 0 0 0 0 M M 0.00 0.0 0 0 0 |

Back to the clickable map Back to the data request form

Display Normals Display Records

<-- Prev Month Next Month --> <-- Prev Year Next Year -->

Observed Data for Meacham No 2 October 2008

| Day M | ax | Min | Precip | Snow | Depth |
|-------|----|-----|--------|------|-------|
| 1 | М | 34 | 0.00 | 0.0 | 0 |
| 2 | M | M | 0.00 | 0.0 | 0 |
| 3 | M | 74 | 0.62 | 0.0 | 0 |
| 4 | M | 14 | 0.23 | 0.0 | 0 |
| 5 | M | M | 0.13 | 0.0 | 0 |
| 6 | M | 14 | 0.03 | 0.0 | 0 |
| 7 | M | M | 0.02 | 0,0 | 0 |
| 8 | M | M | M | 0.0 | 0 |
| 9 | М | M | 0.13 | 0,0 | 0 |
| 0 | M | M | 0.21 | 2.7 | 2 |
| 1 | M | M | 0.00 | 0.0 | M |
| 2 | M | M | 0.00 | 0.0 | M |
| 3 | М | 14 | 0.00 | 0.0 | 0 |
| 4 | M | M | 0.00 | 0.0 | 0 |
| 5 | M | M | 0.00 | 0.0 | 0 |
| 6 | M | M | T | 0.0 | 0 |
| i | M | 14 | 0.00 | 0.0 | 0 |
| 3 | M | M | 0.03 | 0.0 | 0. |
| 9 | M | M | 0.00 | 0.0 | 0 |
| 0 | M | M | 0.00 | 0.0 | 0 |
| 1 | M | M | 0.19 | 0.0 | 0 |
| 2 | M | M | 0.00 | 0.0 | 0 |
| 3 | M | M | 0.00 | 0.0 | 0 |
| 4 | M | M | 0.00 | 0.,0 | 0 |
| 5 | M | M | 0.00 | 0.0 | 0 |
| 6 | M | 14 | 0.00 | 0.0 | 0 |
| 7 | M | M | 0.00 | 0.0 | 0 |
| 8 | M | M | 0.00 | 0.0 | 0 |
| 9 | M | M | 0.00 | 0.0 | 0 |
| 0 | M | M | 0.00 | 0.0 | 0 |
| 1 | M. | М | 0.00 | 0.0 | 0 |
| vg M | | M | 1.59 | 2.7 | _ |

Avg M M 1.59 2.7

Dep M M M M (Departure from climatological normals)

Back to the clickable map Back to the data request form

Display Normals Display Records

<-- Prev Month Next Month --> <-- Prev Year Next Year -->

Observed Data for Meacham No 2 November 2008

| Day | Max | Min | Precip | Snow | Depth | |
|-----|-----|-----|--------|------|------------------------------------|-------|
| 1 | М | М | 0.08 | 0.0 | 0 | |
| 1 2 | M | M | 0.02 | 0.0 | 0 | |
| 3 | M | 14 | 0.10 | 0.0 | 0 | |
| 4 | 1/1 | M | 0.05 | 0.0 | 0 | |
| 5 | M | M | 0.88 | 3.9 | 3 | |
| 5 | M | M | 0.02 | 0.0 | 2 | |
| 7 | M | M | 0.07 | 0.0 | 1 | |
| 8 | M | М | 0.01 | 0.0 | 0 | |
| 9 | M | M | 0.17 | 0.0 | Q | |
| 10 | M | М | 0.25 | 0.0 | 0 | |
| 11 | M | M | 0.04 | 0.0 | | |
| 12 | М | M | 1.28 | 0.0 | 0 | |
| 13 | 14 | M | 1.02 | 0.0 | o | |
| 14 | M | M | 0.00 | 0.0 | 0 | |
| 15 | M | M | 0.00 | 0.0 | 0 | |
| 16 | M | М | 0.00 | 0.0 | Ō | |
| 17 | M | M | 0.00 | 0,0 | 0 | |
| 18 | M | M | 0.00 | 0.0 | | |
| 19 | M | M | 0.00 | 0.0 | 0 | |
| 20 | M | 14 | 0.00 | 0.0 | Ō | |
| 21 | M | м | 0.13 | 0.7 | O . | |
| 22 | M | 14 | 0.00 | 0.0 | 0 | |
| 23 | M | M | 0.01 | T | 0 | |
| 24 | 7.4 | M | 0.00 | 0.0 | 0 | |
| 25 | M | M | 0.00 | 0.0 | 0 | |
| 26 | M | M | 0.00 | 0.0 | 0 | |
| 27 | M | M | 0.00 | 0.0 | 0 | |
| 28 | M | M | 0.02 | 0.0 | Ō | |
| 29 | M | M | 0.06 | 0.0 | Q | |
| 30 | M | М | 0.00 | 0.0 | Ö | |
| Avg | М | М | 4.21 | 4.6 | | |
| Dep | M | M | М | M | '(Departure from climatological no | inems |

Back to the clickable map Back to the data request form

Display Normals Display Records

<-- Prev Month Next Month --> <-- Prev Year Next Year -->

Observed Data for Meacham No 2 December 2008

| Day | Max | Min | Precip | Snow | Depth |
|-----|-----|-----|--------|------|-------|
| 1 | M | M | 0.00 | 0.0 | 0 |
| 2 | M | M | 0.36 | 0.0 | 0 |
| 3 | 141 | M | 0.04 | 0.0 | 0 |
| 3 | M | M | 0.00 | 0.0 | 0 |
| 5 | M | M | 0.00 | 0.0 | 0 |
| 6 | M | M | 0.00 | 0.0 | O |
| 7 | M | M | 0.00 | 0.0 | 0 |
| 8 | M | M | 1.48 | 4.2 | 4 |
| 9 | M | M | 0.02 | 0.0 | 4 |
| 10 | M | M | 0.00 | 0.0 | 3 |
| 11 | M | M | 0.00 | 0.0 | 2 |
| 12 | M | M | 0.00 | 0.0 | 2 |
| 13 | M | M | 0.41 | 3.4 | 5 |
| 14 | M | M | 0.86 | 15.3 | 18 |
| 15 | M | M | 0.07 | 1,2 | 17 |
| 16 | M | M | 0.01 | 0.4 | 17 |
| 17 | M | M | 0.00 | 0.0 | 15 |
| 18 | M | M | 0.04 | 0.6 | 13 |
| 19 | 14 | M | 0.51 | 8,4 | 23 |
| 20 | M | M | 0.15 | 2,3 | 20 |
| 21 | M | M | 0.17 | 2.8 | 21 |
| 22 | M | M | 0.36 | 5.5 | 23 |
| 23 | M | М | T | 0.2 | 21 |
| 24 | M | M | T | 0.5 | 20 |
| 25 | M | M | 0.24 | 3.6 | 22 |
| 26 | M | M | 0.02 | 0.4 | 20 |
| 27 | M | M | 0.96 | 8.2 | 28 |
| 28 | M | M | 0.22 | 2.7 | 24 |
| 29 | M | M | 0.46 | 0.3 | 20 |
| 30 | M | M | 0.18 | 1.1 | 19 |
| 31 | M | M | 0.02 | 0.2 | 18 |
| | | | | | |

Avg M M 6.58 61.3

^{&#}x27;(Departure from climatological normals)

Daily / Illianiae

NOWbata - NOAA Online Weather Date

MEACHAM #2 (355394)

Daily Almanac Date: Oct 1, 2009

| Daily Values | Observed | Normal | Record/Year | Prev Year |
|---------------------|-----------------|------------------|--------------|-----------|
| Max Temperature | - | - | - in 0 | |
| Min Temperature | - | - | - in 0 | 120 |
| Avg Temperature | <u>-</u> | - | - in 0 | |
| Precipitation | 0.05 | - - € | 2.00 in 2000 | 0.00 |
| New Snowfall | 0.0 | - | 0.0 in 2009+ | 0.0 |
| Snow Depth | 0 | = | 0 in 2009+ | 0 |
| HDD (base 65) | 120 | - | - in 0 | |
| CDD (base 65) | n== | (. | - in 0 | - |
| Month-To-Date | Observed | Normal | Record/Year | Prev Year |
| Avg Max Temperature | | = | - in 0 | - |
| Avg Min Temperature | 4. | - | - in 0 | - |
| Avg Temperature | | - | - in 0 | - A |
| Total Precipitation | 0.05 | >" | 2.00 in 2000 | 0.00 |
| Total Snowfall | 0.0 | = | 0.0 in 2009 | 0.0 |
| Avg Snow Depth | 0 | - | 0 in 2009 | 0 |
| Total HDD | - | · | - in 0 | ė i |
| Total CDD | - | - | - in 0 | |

⁺ indicates record also occurred in previous years (last occurrence listed).

Official data and data for additional locations and years are available from the Regional Climate Centers and the National Climatic Data Center.

GRANITE 4 WSW, OREGON (353430)

Period of Record Monthly Climate Summary

Period of Record: 7/2/1948 to 10/16/1967

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Annual |
|-----------------------------------|------|------|------|------|------|------|------|------|------|------|------|------|--------|
| Average Max. Temperature (F) | 30.3 | 36.4 | 40.1 | 49.0 | 58.0 | 66.2 | 77.5 | 76.2 | 68.9 | 55.8 | 40.0 | 32.2 | 52.6 |
| Average Min. Temperature (F) | 11.3 | 15.1 | 17.0 | 25.3 | 31.4 | 36.6 | 39.3 | 38.4 | 33.8 | 28.8 | 21,5 | 15.6 | 26.2 |
| Average Total Precipitation (in.) | 3.66 | 2.93 | 2.73 | 1.87 | 2.33 | 1.76 | 0.60 | 0.71 | 1.08 | 1.93 | 2.93 | 3.84 | 26.37 |
| Average Total SnowFall (in.) | 40.6 | 31.5 | 29.7 | 10.5 | 3.9 | 0.6 | 0.0 | 0.0 | 0.7 | 3.7 | 17.5 | 35.4 | 174.1 |
| Average Snow Depth (in.) | 28 | 35 | 35 | 16 | Ī | 0 | 0 | 0 | 0 | 0 | 3 | 14 | 11 |

Percent of possible observations for period of record.

Max. Temp.: 99.3% Min. Temp.: 99.2% Precipitation: 99.4% Snowfall: 99.1% Snow Depth: 98.6% Check Station Metadata or Metadata graphics for more detail about data completeness.

Western Regional Climate Center, wrcc@dri.edu

CoverPg: Basic Description of Assessment

| Site Name: | USFS - Monumental Mine |
|--|------------------------|
| Investigator Name: | Tobias |
| Date of Field Assessment: | 10/1/2009 |
| County: | Grant |
| Nearest Town: | Granite |
| Latitude (decimal degrees): | 44.8606 |
| Longitude (decimal degrees): | -118.354 |
| TRS, quarter/quarter section and tax lot(s) | T 8S, R 36E, Sec 18 |
| Approximate size of the Assessment Area (AA, in acres) | 0.1 |
| AA as percent of entire wetland (approx.) | |
| If delineated, DSL file number (WD #) if known | NJ- 1 |
| Soil Map Units within the AA (list these in approx. rank order by area, from WSS web site or published county survey; see manual) | 0991CS |
| Soil Map Units surrounding and contiguous to the AA (list all present in | 9413BO |
| approx. rank order by area; see manual) | 0988BS |
| , | 0990BS |
| | 0993CN |
| Cowardin Systems & Classes (indicate all present, based on field visit and/or aerial imagery): Systems: Palustrine =P, Riverine =R, Lacustrine =L, Estuarine =E | Р |
| <u>Classes</u> : Emergent =EM, Scrub-Shrub =SS, Forested =FO, Aquatic Bed (incl. SAV) =AB, Open Water =OW, Unconsolidated Bottom =UB, Unconsolidated Shore =US | EM |
| HGM Class (Scores worksheet will suggest a class; see manual section 2.4.2) | Slope |
| If tidal, the tidal phase during most of visit: | |
| What percent (approx.) of the wetland were you able to visit? | 100 |
| What percent (approx.) of the AA were you able to visit? | 100 |
| Have you attended an ORWAP training session? If so, indicate approximate month & year. | |
| How many wetlands have you assessed previously using ORWAP (approx.)? | |
| Comments about the site or this ORWAP assessment (attach extra page if desir | red): |
| | |
| | |
| | |
| | |

ORWAP SCORES SHEET. Version 2.0.

| Site Name: | USFS - Monumental Mine | |
|-----------------------------|---------------------------------------|------------|
| Investigator Name: | Tobias | |
| Date of Field Assessment: | | 10/1/2009 |
| Latitude (decimal degrees): | 44.86060 Longitude (decimal degrees): | -118.35400 |

Note: It is normal for some cells below to have non-zero values even when no data have been entered. This does not imply hidden weighting of those functions or values.

Please cite this method as: Adamus, P., J. Morlan, and K. Verble. 2009. Oregon Rapid Wetland Assessment Protocol (ORWAP): calculator spreadsheet, databases, and data forms. Oregon Dept. of State Lands, Salem, OR.

| SPECIFIC FUNCTIONS: | Relative Effectiveness of the Function | Relative Values of the Function | (click on cells in this column to see definitions of the wetland functions) |
|--|--|---------------------------------|---|
| Water Storage & Delay (WS) | 0.00 | 2.92 | |
| Sediment Retention & Stabilization (SR) | 7.17 | 2.94 | |
| Phosphorus Retention (PR) | 9.08 | 4.18 | |
| Nitrate Removal & Retention (NR) | 5.33 | 4.35 | |
| Thermoregulation (T) | 0.00 | 0.00 | |
| Carbon Sequestration (CS) | 4.19 | | |
| Organic Matter Export (OE) | 0.00 | | |
| Aquatic Invertebrate Habitat (INV) | 3.50 | 5.28 | |
| Anadromous Fish Habitat (FA) | 0.00 | 0.33 | |
| Non-anadromous Fish Habitat (FR) | 1.50 | 10.00 | |
| Amphibian & Reptile Habitat (AM) | 4.80 | 6.67 | |
| Waterbird Feeding Habitat (WBF) | 0.33 | 4.50 | |
| Waterbird Nesting Habitat (WBN) | 0.00 | 3.00 | |
| Songbird, Raptor, & Mammal Habitat (SBM) | 5.28 | 3.33 | |
| Pollinator Habitat (POL) | 4.95 | 5.00 | |
| Native Plant Diversity (PD) | 3.33 | 5,14 | |

| GROUPED SERVICES: | Group Scores (functions) | Group Scores (values) | |
|------------------------------------|--------------------------|-----------------------|--|
| Hydrologic Function (WS) | 0.00 | 2.92 | (identical to Water Storage and Delay function and value scores) |
| Water Quality Support Group (WQ) | 9.08 | 4.35 | (maximum of scores for SR, PR, NR, and T) |
| Carbon Sequestration Function (CS) | 4.19 | | (identical to Carbon Sequestration score above) |
| Fish Support Group (FISH) | 1.50 | 10.00 | (maximum of scores for FA and FR) |
| Aquatic Support Group (AQ) | 4.80 | | (maximum of scores for OE, AM, INV, WBF, and WBN) |
| Terrestrial Support Group (TERR) | 5.28 | 5.14 | (maximum of scores for PD, POL, and SBM) |
| Public Use & Recognition (PU) | | 0.83 | |
| Provisioning Services (PS) | | 0.00 | |

OTHER ATTRIBUTES:

| Wetland Ecological Condition | 5.73 (click on this cell to see this attribute defined) |
|------------------------------|---|
| Wetland Stressors | 6.44 (click on this cell to see this attribute defined) |
| Wetland Sensitivity | 5.07 (click on this cell to see this attribute defined) |

| HGM Class - Relative Probabilities | | |
|------------------------------------|------|--|
| Estuarine | 0.00 | |
| Riverine | 0.00 | |
| Slope | 3.15 | |
| Flat | 0.00 | |
| Depressional | 0.00 | |
| Lacustrine | 0.00 | |

Appendix B

Supplemental Site Investigation Report



Supplemental Site Investigation Report

Upper Granite Creek Watershed Mines Wallowa-Whitman National Forest, Oregon

Prepared for

United States Department of Agriculture Forest Service 1220 SW 3rd Avenue Portland, Oregon 97204

Prepared by

Terraphase Engineering Inc. 610 SW Broadway, Suite 405 Portland, Oregon 97205

February 3, 2025

Project Number 0031.005.002

This is a draft document and the information contained herein is subject to change. It should not be relied upon; consult the final document.

File: rpt-SSI-UpperGraniteCrkWatershed-0031-005-FDFCR



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Acronyms and Abbreviations

CES Cascade Environmental Sciences

EE/CA Engineering Evaluation/Cost Analysis

IVBA in-vitro bioavailability mg/kg milligrams per kilogram

ODEQ Oregon Department of Environmental Quality

ppm parts per million

RBA relative bioavailability adjustment

RBC Risk-Base Concentration

PRG preliminary remediation goal

QA quality assurance QC quality control

SAP Sampling and Analysis Plan

Site Upper Granite Creek Watershed Mines

Terraphase Engineering Inc.

UCL upper confidence level

USEPA Unite State Environmental Protection Agency

USDA United States Department of Agriculture

WRP waste rock piles
XRF x-ray fluorescence



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1 Introduction

Terraphase has prepared this *Supplemental Site Investigation Report* for the United States Department of Agriculture (USDA) Forest Service to describe sampling and analysis activities conducted at the Upper Granite Creek Watershed Mines (the "Site"; Figure 1) to support preparation of an updated Engineering Evaluation/Cost Analysis (EE/CA) for the Site, to which this document is an appendix.

The Site is comprised of the following nine mines (Figure 2):

- 1. Monumental Mine
- 2. Cap Martin Mine
- 3. Tillicum Mine
- 4. Sheridan Mine
- 5. Golden Fraction Mine

- 6. Central Mine
- 7. Granite Creek #5 Mine
- 8. Granite Creek #6 Mine
- 9. Granite Creek #7 Mine

All field work was performed in accordance with the *Sampling and Analysis Plan* (SAP) approved by the USDA Forest Service on September 23, 2024 (Terraphase 2024a). Additional background information, including detailed descriptions of each mine and the results of previous environmental investigations, can be found in the SAP and the updated EE/CA.

2 Investigation Activities

This section describes site investigation activities performed by Terraphase between October 1 and 5, 2024. Field notes for the site investigation are included in Appendix A.

2.1 Pre-Field Activities

Prior to conducting the site investigation, Terraphase prepared a site-specific *Health and Safety Plan* (2024b), which identifies potential hazards at the Site and identifies controls (i.e., personal protective equipment) and procedures to be used when conducting sampling work to minimize those hazards.

2.2 Mapping of Site Features

Terraphase documented observable features at each mine using an EOS Arrow 100 handheld GPS device. Points were recorded with a minimum accuracy of 30 inches. For waste rock piles (WRPs), tailing piles, placer deposits, and other areal features, Terraphase collected points around the perimeter of each feature. For trenches, former roadways, tributaries, and other linear features, Terraphase collected survey points along the visible extent of each feature. A total of 245 points, 73 areal features, and 48 linear features were recorded. When applicable, the shape and extent of features were corrected using



light detection and ranging (LIDAR) data obtained from the United States Geological Survey. ¹ Terraphase named the adits, shafts, WRPs, and tailings piles using a consistent format. All mapped features and sampling points are shown on Figures 2 through 15. Photographs of Site features are included in the field notes (Appendix A).

The cut-fill spatial analyst tool in ArcGIS Pro was used to calculate the volumes of each waste rock and tailings pile. This process involves creating a base surface within the extent of each pile polygon. The base surface has variable elevation, determined by interpolating the unique Z-value (elevation) assigned to each point along the perimeter of the waste rock or tailings pile polygon. The original surface elevations within the extent of each polygon were then compared to the corresponding base surface to calculate the pile's volume. Where the original surface elevations are higher than the base surface elevations, the difference is considered a "cut." Conversely, where the original surface elevations are lower than the base surface elevations, the difference is considered a "fill." These differences were summed within each waste rock or tailings pile polygon to calculate a total volume for each pile. Calculated and previously estimated waste rock and tailings piles volumes are included in Table 1.

2.3 X-Ray Fluorescence Waste Rock and Tailings Screening

Terraphase used a handheld Vanta C Series x-ray fluorescence (XRF) device to measure arsenic concentrations in waste rock and tailings piles, and in soil surrounding select piles, in accordance with the procedures outlined in the SAP. Measurements were made of select locations downslope of WRPs (samples designated with "-DS" suffix) to assess the potential for surficial erosion of the piles. All XRF measurements were taken of soil samples collected below rooting depth (i.e., from approximately 0.5 to 1 foot below ground surface) using clean plastic trowels. The samples were placed in bags prior to measurement. XRF measurements were recorded by taking readings from both sides of each bagged sample until the standard deviation of the samples was less than 30 or until 10 measurements were recorded, consistent with EPA guidance (EPA 2022a). A minimum of four readings were recorded for each sample. Overall, a total of 897 XRF measurements were recorded at 124 sample locations, with arsenic concentrations ranging from 5 to 18,300 milligrams per kilogram (mg/kg) or parts per million (ppm). XRF sample locations are shown on Figures 3 through 14.

2.4 Soil, Waste Rock, and Tailings Sampling

Samples of soil, waste rock, and tailings (when applicable) were collected from each mine for laboratory analysis. At each mine, samples were generally collected from locations with the highest XRF measurements. Again, all samples were collected from below the rooting depth (from approximately 0.5 to 1 foot below ground surface) using clean plastic trowels. Samples were also collected in the soil downslope of WRPs with high XRF measurements to assess the risk of surface erosion from the WRPs.

These samples were submitted to ALS Environmental in Kelso, Washington, following strict chain-of-custody procedures for analysis of arsenic using United States Environmental Protection Agency (USEPA) Method 6020B. Select samples were also analyzed for arsenic and lead in-vitro bioavailability (IVBA)

¹ https://apps.nationalmap.gov/downloader/

using USEPA Method 1340. Forty-two samples were submitted for arsenic analysis; 13 samples were submitted for IVBA analysis. Sample locations are shown on Figures 3 through 14.

2.5 Surface Water and Stream Sediment Sampling

Eight co-located surface water and sediment samples were collected at regular intervals within Granite Creek between Forest Service Road 73 and its headwaters near Monumental Mine. These surface water and sediment samples were collected to support overall characterization of metals in these environmental media to help initially evaluate potential ecological risk (Figure 15).

Samples were submitted to ALS Environmental following strict chain-of-custody procedures. The samples were analyzed for antimony, arsenic, cadmium, chromium, lead, silver, and zinc using USEPA Method 6020B and for mercury using USEPA Method 7470A (surface water) or 7471B (sediment). Surface water samples were also analyzed for hardness using USEPA Method SM 2340B.

2.6 Decontamination and Quality Assurance/Quality Control Sampling

The plastic trowels used to collect soil samples were decontaminated in between each sample collection to prevent cross-contamination. This was done by first cleaning each trowel with tap water, then scrubbing it with non-phosphate containing detergent (Alconox), and finally rinsing it with laboratory-supplied deionized water. Three equipment blanks were collected by pouring laboratory-supplied deionized water over the clean trowel and allowing it to fill the appropriate sample bottle. Equipment blanks were collected to assess the potential for cross-contamination. Duplicate samples were also collected at a rate of at 1 per 20 samples per media to evaluate sample variability.

2.7 Deviations from the SAP

The following summarizes completed tasks that varied from the SAP:

- Before visiting the Site, the extent to which WRPs could be identified as distinct from their surroundings was unknown and the SAP specified a procedure using the XRF to identify the extent of each pile over which soil concentrations were greater than preliminary remediation goals (PRGs). Upon visiting the Site, the WRPs were distinct. Terraphase verified using XRF that the visual edges of several piles represented different material than the surrounding material, but this was not done for every pile as stated in the SAP.
- The SAP proposed the collection of 10 co-located surface water and sediment samples to ensure the availability of a background sample (i.e., upstream of Monumental Mine, the first of the nine Site mines). However, after visiting Monumental Mine, it was apparent that the ground surface sloped away from Granite Creek and surface water/groundwater would be expected to flow to Cap Martin Creek instead, which enters Granite Creek between the Sheridan and Cap Martin Mines. Therefore, sample CS-1 was moved to the proposed location of sample CS-3 and all other sample names were adjusted accordingly. This change was approved by USDA Forest Service On-scene Coordinator Mario Isaias-Vera in the field.



- The SAP did not propose collecting samples for XRF measurement from the location of the WRPs along Granite Creek, identified in the previous EE/CA as Granite Creek Station 03. XRF arsenic concentrations were measured at the previously identified WRP (GC03-WRA) as well as one WRP observed upstream (GC03-WRB; Figure 6).
- The presence of shafts and WRPs uphill of Upper Monumental Mine Adit #2 were not recorded in previous investigations. Terraphase mapped and sampled this area (designated Upper-Upper Monumental Mine) and identified 9 shafts, 1 potential shaft, 10 WRPs, and 3 trenches. Arsenic concentrations determined via XRF measurements were taken at six WRPs and five samples were submitted for arsenic via laboratory analysis.

3 Results

This section summarizes the results of the site investigation. All soil sample locations are depicted on the relevant mine site map (Figures 3 through 14). Creek surface water and sediment sampling locations are depicted on Figure 15.

3.1 XRF Results

Table 2 lists XRF measurement by mine and WRP. Individual measurements are listed as X01 through X10 after the associated sample name. For example, the first XRF arsenic measurement from sample UMM-WRA-0.5-1 is listed as UMM-WRA-0.5-1-X01. The table includes calculated 95 upper confidence levels (UCLs) of the mean (UCLMs) for the readings taken from each sample (indicated by XUCL). For example, the UCLM from the 10 XRF readings made of sample LMM-WRA-0.5-3 is listed as LMM-WRA-0.5-3-XUCL. All UCLMs were calculated using ProUCL, Version 5.2.0 (USEPA 2022a). The output files from ProUCL, which include information regarding sample distribution and standard deviation, are included as Appendix B.

XRF measurements varied by mine and feature within the mine. Samples collected downslope and adjacent to WRPs generally had much lower concentrations than the WRPs, suggesting that erosion of the piles has not had a notable effect on surrounding soil. Exceptions to this are XRF measurements taken at locations between WRP A at Tillicum Mine and Granite Creek, which had similar concentrations to the WRP, and downslope of Golden Fraction Mine WRP D, which had generally low concentrations in both the WRP and the downslope sample. The following summarizes XRF arsenic measurements per mine and feature, as well as the associated downslope sample, where applicable:

• Monumental Mine (Upper Upper):

WRP A: 911–3,092 ppm; UCL downslope sample: 19–35 ppm

WRP B: 96–202 ppm

WRP C: 16–20 ppm

WRP D: 269–334 ppm

WRP E: 24–26 ppm

- WRP F: 290–786 ppm
- Monumental Mine (Upper):
 - Flotation Table: 18,300 ppm (one measurement)
 - Tailings pile A: 316–3,402 ppm
 - Tailings pile B: 221-3,822 ppm
 - Tailings pile C: 410–3,389 ppm
 - WRP A: 128–1,876 ppm; downslope samples: 30–68 ppm
 - WRP B: 453–16,020 ppm; downslope sample: 65–78 ppm
- Monumental Mine (Lower):
 - Tailings pile A: 461–17,380 ppm
 - WRP A: 38–2,991 ppm; downslope sample: 16–50 ppm
 - WRP B: 97–978 ppm; downslope sample: 14–19 ppm
- Granite Creek Aquatic Station 03:
 - WRA: 30-45 ppm
 - WRB: 75–485 ppm
- Cap Martin Mine:
 - Placer Spoils: 25–36 ppm
 - WRP A: 5–13 ppm
 - WRP B: 5–14 ppm
 - WRP C: 36–375 ppm
- Sheridan Mine:
 - WRP A: 9–21 ppm
 - WRP B: 19–66 ppm
 - WRP C: 12–21 ppm
- Granite Creek #6 Mine:
 - WRP A: 134–422 ppm
 - Wet Trench Pile: 5–16 ppm
- Granite Creek #7 Mine:
 - WRP A: 10-31 ppm
 - WRP B: 10–12 ppm



· Tillicum Mine:

WRP A: 131–438 ppm; downslope samples: 150–185 ppm

WRP B: 67–184 ppmWRP C: 99–205 ppm

Granite Creek #5 Mine:

WRP A: 54–446 ppm; downslope sample: 56–76 ppm

WRP B: 52–162 ppm

Golden Fraction Mine:

WRP A: 188–491 ppm

WRP B: 62–117 ppm

WRP C: 50–102 ppm

WRP D: 30–80 ppm, downslope sample: 31-62 ppm

Drain: 39–83 ppm

Central Mine:

WRP A: 37–264 ppm; downslope sample: 30–38 ppm

WRP B: 125–242 ppm
WRP C: 52–170 ppm
WRP D: 56–87 ppm

3.2 Soil and Waste Rock Laboratory Analytical Results

Table 3 presents laboratory analytical results for arsenic in soil and waste rock for each mine site and mine feature, including those from previous investigations. Soil analytical results were screened against:

- Oregon Department of Environmental Quality (ODEQ) ecological Risk-Based Concentrations (RBCs);²
- ODEQ human health RBCs for soil direct contact³ exposure of an excavation worker;
- ODEQ clean fill screening levels (Blue Mountains Province), which represent regional background concentrations;⁴
- PRGs developed for the SAP; and
- Refined PRGs developed with consideration for the IVBA results.

² https://www.oregon.gov/deq/Hazards-and-Cleanup/env-cleanup/Pages/ERA.aspx

³ Considers incidental ingestion of soil, dermal contact with soil, and inhalation of soil-derived particulates and vapors.

⁴ https://www.oregon.gov/deq/filtered%20library/imdcleanfill.pdf

Arsenic results are consistent with XRF measurements and generally show exceedances of ecological RBCs and PRGs. IVBA results and updated PRG calculations are discussed in Section 4.

3.3 Comparison of XRF to Laboratory Analytical Results

Arsenic concentrations measured via XRF, and those analyzed via USEPA Method 6020B, showed a strong correlation (R value of 0.98). Figure 16 is a plot of arsenic laboratory results versus arsenic XRF measurements. Figure 17 is a plot of each sample location on the x-axis with the laboratory result, the estimated arsenic concentration determined via XRF (based on UCLM), and the range of XRF measurements plotted on the y-axis. Most of the laboratory analytical results were within the range of concentrations measured via XRF. Figure 17 also shows total arsenic concentrations measured prior to IVBA extraction. These values are always greater than the associated non-IVBA total arsenic concentrations, which is likely because the IVBA total arsenic concentrations were measured after sieving the soil to a sample of material with a grain size less than 150 micrometers.

Combined XRF and laboratory analytical results, including laboratory analytical results of previous investigations, were used to calculate UCLMs for each waste rock and tailings pile. Table 4 lists the calculated UCLMs, as well as the sample distribution, maximum detected arsenic concentration, number of samples used to calculate UCLMs, and the number of sample locations on the features used for the samples. When six or more samples were available for a feature, the XRF UCLMs and analytical laboratory sample results were both used in the UCLM calculation. When less than six locations were associated with a recognized feature, individual XRF measurements were used in the UCLM calculation in lieu of XRF UCLs.

Terraphase reviewed the data distributions to infer if data were consistent within a Site feature. Data from 35 of the 40 features followed a normal distribution. When data did not follow a normal distribution, Terraphase evaluated the data and found that either the data represented two populations (WRPs SH-WRA, LMM-WRB, and UMM-WRB) and/or that an outlier skewed the distribution (WRP GF-WRC). For WRP GF-WRC, the outlier was from a previous consultant's sample, which based on its concentration may not have been collected from this WRP. As a result, a revised UCLM was calculated for WRP GF-WRC with this outlier removed (Table 4).

3.4 Sediment Analytical Results

Table 5 presents sediment analytical results, including those from previous investigations. Sediment analytical results were screened against:

- ODEQ ecological RBCs for freshwater sediment;
- USEPA Region IV ecological screening values; ⁵
- ODEQ clean fill screening levels (Blue Mountains Province);
- PRGs developed for the SAP; and

⁵ https://www.epa.gov/sites/default/files/2018-03/documents/era regional supplemental guidance report-march-2018 update.pdf



The PRG for tailings based on IVBA results (Section 4).

Concentrations of arsenic, cadmium, lead, silver, and zinc exceeded the ODEQ clean fill screening levels. Concentrations of arsenic, cadmium, mercury, and zinc exceeded the ecological RBC for freshwater sediment. Concentrations of arsenic, cadmium, mercury, silver, and zinc exceeded the ecological screening values. In general, samples CS-SD-7 and CS-SD-8, collected furthest downstream, had the highest metals concentrations, and samples CS-SD-1 and CS-SD-2, collected furthest upstream, had the lowest concentrations, showing the general contribution of the mines on sediment quality.

No concentrations exceeded the PRGs. The highest detected arsenic concentration of samples collected during this investigation was 35.2 mg/kg in sample CS-SD-8 collected downstream of all mines. These results are also relatively consistent with previously collected results presented in the prior EE/CA (Cascade Environmental Sciences [CES] 2011). Higher concentrations of arsenic and other metals were detected in sediment samples collected further downstream than the Site and likely reflect contribution from other non-site mines.

3.5 Surface Water Analytical Results

Table 6 presents surface water analytical results, including those from previous investigations. Surface water samples were screened against ODEQ ecological RBCs. There were no exceedances of ecological RBCs for samples collected during this investigation.

Figure 18 shows arsenic concentrations in surface water relative to the distance along Granite Creek. Concentrations increase with distance and provide an indication of the potential contribution from mine sites. The largest increase is between samples CS-SW-4 and CS-SW-5, likely associated with the contribution from Cap Martin Creek, a tributary that starts as a spring at Upper Monumental Mine and flows through settling ponds and tailings from Upper and Lower Monumental Mines.

The identification of concentrations below ecological RBCs suggests *de minimis* impact to aquatic receptors. This is consistent with previous sampling, which found that surface water sample metals concentrations were below ecological RBCs, except for lead at one sample location. Further downstream of the Site, there were two previous sampling locations with detected levels of mercury (2003 samples ST-SFW-53 and ST-SFW-54; Figure 15), but these are likely due to contribution of other non-site related mines.

Samples collected from adit seeps and surface water features at Cap Martin, Granite Creek #5, Golden Fraction, Lower Monumental, and Upper Monumental Mines had arsenic concentrations an order of magnitude higher than Granite Creek surface water samples. This suggests that the contribution of water from these features to Granite Creek is much less than other contributing springs and tributaries at and upstream of the Site.

3.6 Quality Assurance/Quality Control

Analyses were performed in accordance with the quality assurance (QA) and quality control (QC) procedures provided in the SAP.

Terraphase completed data validation after receiving the laboratory analytical reports. The data validation process included a review of chain-of-custody forms, holding times, laboratory analytical reports, method blanks, surrogate recoveries, matrix spike, matrix spike duplicates, and detection limits. The laboratory analytical reports are included as Appendix C, and the data validation reports are included as Appendix D. QA/QC information to note include the following:

- Data are considered usable and support the Work Plan objectives.
- All holding times were met, all sample preservation were appropriate, and all data were successfully
 verified against the electronic data deliverables and chain-of-custody form, with minor exceptions.
- Several laboratory flags related to laboratory QA/QC issues were reported. Flags were applied to sample results in cases where the estimated concentration was affected by the QA/QC issue.
- The relative percent difference for several laboratory duplicate samples were outside of the acceptable range. This is likely due to the heterogenous nature of the waste rock samples and not considered a significant issue.
- Arsenic was detected in all three equipment blanks collected during the investigation at
 concentrations of 0.64, 3.12, and 0.11 micrograms per liter. Arsenic concentrations detected in soil
 samples are more than five times these slight detections, and therefore, no data was qualified due
 to blank detections.
- All relative percent differences were considered acceptable (less than the 50 percent criteria
 established in the SAP) with the exception of the total IVBA lead analysis for sample UUMM-WRA-3DUP.

4 Preliminary Remediation Goals

PRGs were developed for the SAP (Terraphase 2024a) to reflect updated risk assessment science and site-specific exposure assumptions consistent with current and reasonably anticipated use of the Site (Terraphase 2024a). This *Supplemental Site Investigation Report* includes an update to the PRG for arsenic to account for site- and material-specific relative bioavailability adjustment (RBA) factors as determined by sampling and analysis of soil, waste rock, and tailings. Consistent with the CES EE/CA (2011) and Terraphase SAP (2024a), the PRGs are based on the assumed potential exposure of a receptor assumed to be engaged in hunting, hiking, and/or camping activities (generally referred to herein as "a trespasser/recreator"). As described in the SAP, the PRGs conservatively reflect exposure of an adolescent trespasser/recreator who could encounter metals in soil/waste rock and tailings at the Site.

Standard default exposure factors, which USEPA (1991, 2011, 2014, 2017) recommends for use in estimating reasonable maximum exposure, were used where available and appropriate. Where standard default exposure factors are not available or appropriate, similarly conservative exposure factors based

on site-specific considerations and professional judgement were used. Toxicity values used were based on USEPA's (2003) hierarchy of sources. RBCs for carcinogens and noncarcinogens were calculated at a target incremental excess cancer risk of 1×10^{-6} and a target noncancer hazard quotient of 1 (OAR 340-122). Finally, to account for background exposure, the proposed updated PRGs are representative of concentrations which are equal to the sum of the RBC and a background exposure concentration.

To calculate a site-specific RBA, arsenic was analyzed for IVBA. This method determines the fraction of a contaminant in soil (e.g., arsenic) that is solubilized following extraction and subsequently available for absorption, or rather, is bioaccessible. The RBA is then determined using a simple regression model (i.e., an in vivo-in vitro correlation) which predicts the in vivo oral RBA for arsenic in soil based on the measured IVBA (Interstate Technology & Regulatory Council 2017).

For in vivo-in vitro correlation, arsenic RBA is expressed as a function of arsenic IVBA, which is expressed as the following fraction:

$$IVBA_{Arsenic} = \frac{ ext{Bioaccessible Arsenic [mg/kg]} }{ ext{Total Soil Arsenic Content [mg/kg]} }$$

The preferred model for predicting arsenic RBA from arsenic IVBA is:

$$RBA_{arsenic} = (0.79 \cdot IVBA) + 0.03 [R^2 = 0.87]$$

Where RBA and IVBA are expressed as fractions (Interstate Technology & Regulatory Council 2017; USEPA 2017).

The resulting IVBA and RBA calculations are summarized in Table 7. Calculated RBAs for soil and waste rock samples were similar and the datasets were combined. The RBAs for tailings were much higher than the soil and waste rock; therefore, a separate PRG was developed to assess exposure to tailings. A UCL was calculated using the RBA results from the combined soil and waste rock arsenic data (nine samples total), resulting in an RBA of 0.077 that was used to calculate a PRG of 190 mg/kg. From the two tailing samples, the maximum RBA of 0.36 was used to calculate a PRG of 110 mg/kg for arsenic in tailings.

These PRGs are higher than the previously calculated PRG of 82 mg/kg for arsenic provided in the SAP (Terraphase 2024a). The soil/waste rock PRG is higher than the 2006 risk assessment⁹ PRG for arsenic of

⁶ Assumes that the trespasser/recreator could be present at the Site 2 days per month (24 days per year) over a 10-year period from the age of 6 until the age of 16.

⁷ https://oregon.public.law/rules/oar 340-122-0040

⁸ Background exposure concentrations for soil/waste rock and tailings were calculated using the available background sampling data. The exposure concentration is equal to the 90-percent UCLM.

⁹ Terraphase assessed the previously performed calculations, including the exposure assumptions and toxicity values presented in the 2006 risk assessment, and was unable to replicate the PRG of 143 mg/kg. As presented in Appendix B10 of CES' (2011) *Human Health and Ecological Risk Assessment*, the reasonable maximum exposure concentration for arsenic of 1,800 mg/kg resulted in an excess cancer risk of 3x10⁻⁵. By extension then, and using the same exposure assumptions and toxicity values for arsenic, a target excess cancer risk of 1x10⁻⁶ would result in an

143 mg/kg. Both previously calculated PRGs incorporated the use of the generic default RBA factor of 0.6 recommended by USEPA. ¹⁰ Consistent with the conclusions presented in the EE/CA (CES 2011) and SAP, a comparison of these updated PRGs to measured concentrations in waste rock/soil identified during prior and additional sampling of the Site demonstrates that arsenic in waste rock/soil represents the sole human health risk driver and primary chemical of concern for remedy decision-making.

While PRGs have not been calculated with consideration for ecological exposures, the outcome of this non-time-critical removal action, which is focused on eliminating potential unacceptable risks to human health, will also result in a reduction of potential risks to ecological receptors.

Figures 2 through 14 indicate the WRPs or tailings piles that have calculated UCLs above and below updated PRGs.

5 References

Cascade Environmental Sciences. 2011. Non-Time-Critical Removal Action Engineering Evaluation/Cost Analysis, Upper Granite Creek, Grant County, Oregon, Wallowa-Whitman National Forest. May.

Interstate Technology & Regulatory Council. 2017. *Bioavailability of Contaminants in Soil: Considerations for Human Health Risk Assessment. BCS-1.* Washington, D.C.: Interstate Technology & Regulatory Council, Bioavailability in Contaminated Soil Team. www.itrcweb.org.

State of Oregon Department of Environmental Quality (ODEQ). *Clean Fill Determinations*. https://www.oregon.gov/deq/filtered%20library/imdcleanfill.pdf.

Terraphase Engineering Inc. (Terraphase). 2024a. Sampling and Analysis Plan, Upper Granite Creek Watershed Mines, Wallow-Whitman National Forest, Oregon. September 20.

———. 2024b. Health and Safety Plan, Upper Granite Creek Watershed Mines, Integrated EE/CA, Wallow-Whitman National Forest, Oregon. August 20.

United States Environmental Protection Agency (USEPA). 2017. Release of Standard Operating Procedure for an In Vitro Bioaccessibility Assay for Lead and Arsenic in Soil and Validation Assessment of the In Vitro Arsenic Bioaccessibility Assay for Predicting Relative Bioavailability of Arsenic in Soils and Soil-like Materials at Superfund Sites. May 5.

———. 2022a. Superfund & Emergency Management X-Ray Fluorescence Field Operations Guide. July 19.

———. 2022b. ProUCL Version 5.2.0 Technical Guide. April.

 $^{^{10}}$ This is USEPA's recommended default value in the absence of site-specific information (2012).



RBC for arsenic of approximately 60 mg/kg—generally consistent with the RBC of 67 mg/kg estimated by Terraphase in preparing the PRG for the SAP.

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- 2 Summary of XRF Measurements
- 3 Summary of Soil Analytical Results
- 4 Waste Rock/Tailings Pile UCL Calculations
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- 7 In Vitro Bioaccessibility (IVBA) and Relative Bioavailability (RBA) Calculations



Table 1
Waste Rock and Tailings Piles Volumes
Supplemental Site Investigation Report
Upper Granite Creek Watershed Mines
Wallowa-Whitman National Forest, Oregon

| | | Previously Calculated | Previously Calculated |
|-----------------|---|---|--|
| | | Volume (cubic yards) | Volume (cubic yards) |
| Waste Rock Pile | (cubic yards) | (EA) | (CES) |
| WRA | 395 | | |
| WRB | 5 | | |
| WRC | 5 | | |
| WRD | 10 | | - |
| WRE | | | |
| WRF | 10 | | - |
| WRG | 10 | | - |
| WRH | 25 | | - |
| WRI | 5 | | - |
| WRJ | 15 | | |
| TLA | 125** | | 400 |
| TLB | 305 | | 900 |
| TLC | 10 | | 100 |
| WRA | 7,905 | 5,187 | 15,000* |
| WRB | 60 | 37 | 200 |
| TLA | 180 | | 1,200 |
| | | 6,874 | 18,500* |
| | | | 100 |
| | | | |
| | | | |
| | | 190 | |
| | | | |
| | | 128 | 1,000 |
| | | | 125 |
| | | | |
| | | | |
| | | | 30 |
| | | | 70 |
| | | | |
| | | | 200 |
| | | | 400 |
| | | | 600 |
| | | 51 | 300 |
| | | | 400 |
| | | | 20 |
| | | | |
| | | | 2,000 |
| | | | 120 |
| | | | 380 |
| | | | 350 |
| | | | 40 |
| | | | 60 |
| WRD | 25 | | 200 |
| | WRA WRB WRC WRD WRE WRF WRG WRH WRI WRJ TLA TLB TLC WRA WRB TLA WRA WRB WRA WRB WRA WRB WRA WRB WRA WRB WRC WRA WRB WRA WRB WRA WRB WRC WRA WRB WRA WRB WRC WRA WRB WRA WRB WRC WRA WRB | WRA 395 WRB 5 WRC 5 WRC 5 WRD 10 WRE 5 WRF 10 WRF 10 WRG 10 WRH 25 WRI 5 WRJ 15 TLA 125** TLB 305 TLC 10 WRA 7,905 WRB 60 TLA 180 WRA 5,560 WRB 170 WRA 15 WRA 370 WRB 80 WRA 370 WRB 10 WRA 65 WRB 10 WRC 735 WRB 30 WRC 5 WRB 125 WRA 195 WRB 125 WRA 205 WRB 145 WRA 295 WRB 10 WRA 295 WRB 105 WRA 295 WRB 145 WRC 295 WRD 1,105 | Waste Rock Pile Volume (cubic yards) Volume (EA) WRA 395 WRB 5 WRC 5 WRD 10 WRE 5 WRF 10 WRG 10 WRG 10 WRI 5 WRI 5 WRI 5 WRI 15 TLA 125** TLB 305 TLC 10 WRA 7,905 5,187 WRB 60 37 TLA 180 WRA 5,560 6,874 WRB 170 WRA 15 WRA 15 WRB 10 WRB 10 |

Notes:

^{-- =} not calculated

^{* =} volume based on survey data

^{** =} volume based on area multiplied by 4 feet (the maximum depth of tailings materials observed during the 2011 investigation performed by CES)

All Terraphase estimates have been rounded to the nearest 5 cubic yards, with 5 cubic yards being the minimum volume.

Table 2
Summary of XRF Measurements
Supplemental Site Investigation Report
Upper Granite Creek Watershed Mines
Wallowa-Whitman National Forest, Oregon

| | | | | | | Metals |
|------------|--------------------|---|---------------------------------|--------------------|------------------------|----------------|
| 401 | Location | Field Samula ID | Material | Collection Depth | Cample Date | Avaania |
| AOI | Location | Field Sample ID Tailings P | Material PRG | (ft bgs) | Sample Date | Arsenic 110 |
| | | Waste Rock/S | oil PRG | | | 190 |
| | CM-PS | CM-PS-0.5-XUCL | Waste Rock/Soil | 0.5 - 1 | 10/3/2024 | 36 |
| | CM-PS-1 CM-PS-2 | CM-PS-0.5-1-X01 CM-PS-0.5-2-X01 | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/3/2024 10/3/2024 | 38.61 36 |
| | CM-PS-3 | CM-PS-0.5-3-X01 | Waste Rock/Soil | 0.5 - 1 | 10/3/2024 | 33 |
| | CM-PS-4 | CM-PS-0.5-4-X01 | Waste Rock/Soil | 0.5 - 1 | 10/3/2024 | 25 |
| | | CM-WRA-0.5-1-X01 | Waste Rock/Soil | 0.5 - 1 | 10/3/2024 | 5 |
| | CNA NA/DA 1 | CM-WRA-0.5-1-X02 | Waste Rock/Soil | 0.5 - 1 | 10/3/2024 | 7 |
| | CM-WRA-1 | CM-WRA-0.5-1-X03 CM-WRA-0.5-1-X04 | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/3/2024 10/3/2024 | 9 7 |
| | | CM-WRA-0.5-1-XUCL | Waste Rock/Soil | 0.5 - 1 | 10/3/2024 | 8.92 |
| | | CM-WRA-0.5-2-X01 | Waste Rock/Soil | 0.5 - 1 | 10/3/2024 | 13 |
| | | CM-WRA-0.5-2-X02 | Waste Rock/Soil | 0.5 - 1 | 10/3/2024 | 12 |
| | CM-WRA-2 | CM-WRA-0.5-2-X03 | Waste Rock/Soil | 0.5 - 1 | 10/3/2024 | 12 11 |
| | | CM-WRA-0.5-2-X04 CM-WRA-0.5-2-XUCL | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/3/2024 10/3/2024 | 13 |
| | | CM-WRB-0.5-1-X01 | Waste Rock/Soil | 0.5 - 1 | 10/3/2024 | 11 |
| | | CM-WRB-0.5-1-X02 | Waste Rock/Soil | 0.5 - 1 | 10/3/2024 | 5 |
| | CM-WRB-1 | CM-WRB-0.5-1-X03 | Waste Rock/Soil | 0.5 - 1 | 10/3/2024 | 10 |
| | | CM-WRB-0.5-1-X04 | Waste Rock/Soil | 0.5 - 1 | 10/3/2024 | 8 |
| | | CM-WRB-0.5-1-XUCL CM-WRB-0.5-2-X01 | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/3/2024 10/3/2024 | 11.61 14 |
| | | CM-WRB-0.5-2-X02 | Waste Rock/Soil | 0.5 - 1 | 10/3/2024 | 11 |
| | CM-WRB-2 | CM-WRB-0.5-2-X03 | Waste Rock/Soil | 0.5 - 1 | 10/3/2024 | 11 |
| | | CM-WRB-0.5-2-X04 | Waste Rock/Soil | 0.5 - 1 | 10/3/2024 | 13 |
| Can Martin | | CM-WRB-0.5-2-XUCL | Waste Rock/Soil | 0.5 - 1 | 10/3/2024 | 14 |
| Cap Martin | CM-WRC-1 | CM-WRC-0.5-1-X01 CM-WRC-0.5-1-X02 | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/3/2024 10/3/2024 | 60 62 |
| | | CM-WRC-0.5-1-X03 | Waste Rock/Soil | 0.5 - 1 | 10/3/2024 | 81 |
| | | CM-WRC-0.5-1-X04 | Waste Rock/Soil | 0.5 - 1 | 10/3/2024 | 60 |
| | | CM-WRC-0.5-1-X05 | Waste Rock/Soil | 0.5 - 1 | 10/3/2024 | 77.76 |
| | | CM-WRC-0.5-2-X01 | Waste Rock/Soil | 0.5 - 1 | 10/3/2024 | 113 |
| | | CM-WRC-0.5-2-X02 CM-WRC-0.5-2-X03 | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/3/2024 10/3/2024 | 62 75 |
| | CM-WRC-2 | CM-WRC-0.5-2-X04 | Waste Rock/Soil | 0.5 - 1 | 10/3/2024 | 84 |
| | | CM-WRC-0.5-2-X05 | Waste Rock/Soil | 0.5 - 1 | 10/3/2024 | 86 |
| | | CM-WRC-0.5-2-XUCL | Waste Rock/Soil | 0.5 - 1 | 10/3/2024 | 101.9 |
| | CM-WRC-3 | CM-WRC-0.5-3-X01 | Waste Rock/Soil | 0.5 - 1 | 10/3/2024 | 36 |
| | | CM-WRC-0.5-3-X02 CM-WRC-0.5-3-X03 | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/3/2024 10/3/2024 | 63 39 |
| | | CM-WRC-0.5-3-X04 | Waste Rock/Soil | 0.5 - 1 | 10/3/2024 | 55 |
| | | CM-WRC-0.5-3-XUCL | Waste Rock/Soil | 0.5 - 1 | 10/3/2024 | 63.42 |
| | | CM-WRC-0.5-4-X01 | Waste Rock/Soil | 0.5 - 1 | 10/3/2024 | <u>309</u> |
| | CNA MAIDC A | CM-WRC-0.5-4-X02 | Waste Rock/Soil | 0.5 - 1 | 10/3/2024 | <u>375</u> |
| | CM-WRC-4 | CM-WRC-0.5-4-X03 CM-WRC-0.5-4-X04 | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/3/2024 10/3/2024 | 322 312 |
| | | CM-WRC-0.5-4-XUCL | Waste Rock/Soil | 0.5 - 1 | 10/3/2024 | 365.8 |
| | | CM-WRC-0.5-5-X01 | Waste Rock/Soil | 0.5 - 1 | 10/3/2024 | 106 |
| | | CM-WRC-0.5-5-X02 | Waste Rock/Soil | 0.5 - 1 | 10/3/2024 | 83 |
| | CM-WRC-5 | CM-WRC-0.5-5-X03 | Waste Rock/Soil | 0.5 - 1 | 10/3/2024 | 105 |
| | | CM-WRC-0.5-5-X04 CM-WRC-0.5-5-XUCL | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/3/2024 10/3/2024 | 77 110.3 |
| | | CEM-WRA-0.5-1-X01 | Waste Rock/Soil | 0.5 - 1 | 10/5/2024 | 58 |
| | | CEM-WRA-0.5-1-X02 | Waste Rock/Soil | 0.5 - 1 | 10/5/2024 | 51 |
| | CEM-WRA-1 | CEM-WRA-0.5-1-X03 | Waste Rock/Soil | 0.5 - 1 | 10/5/2024 | 64 |
| | | CEM-WRA-0.5-1-X04 | Waste Rock/Soil | 0.5 - 1 | 10/5/2024 | 52 |
| | | CEM-WRA-0.5-1-XUCL CEM-WRA-0.5-2-X01 | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/5/2024 10/5/2024 | 63.33 153 |
| | | CEM-WRA-0.5-2-X02 | Waste Rock/Soil | 0.5 - 1 | 10/5/2024 | 211 |
| | | CEM-WRA-0.5-2-X03 | Waste Rock/Soil | 0.5 - 1 | 10/5/2024 | 138 |
| | | CEM-WRA-0.5-2-X04 | Waste Rock/Soil | 0.5 - 1 | 10/5/2024 | <u>214</u> |
| Control | CENTIALDA O | CEM-WRA-0.5-2-X05 | Waste Rock/Soil | 0.5 - 1 | 10/5/2024 | 145 |
| Central | CEM-WRA-2 | CEM-WRA-0.5-2-X06 CEM-WRA-0.5-2-X07 | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/5/2024 10/5/2024 | 100 129 |
| | | CEM-WRA-0.5-2-X07 | Waste Rock/Soil | 0.5 - 1 | 10/5/2024 | 264 |
| | | CEM-WRA-0.5-2-X09 | Waste Rock/Soil | 0.5 - 1 | 10/5/2024 | 161 |
| | | CEM-WRA-0.5-2-X10 | Waste Rock/Soil | 0.5 - 1 | 10/5/2024 | 147 |
| | | CEM-WRA-0.5-2-XUCL | Waste Rock/Soil | 0.5 - 1 | 10/5/2024 | <u>194.5</u> |
| | | CEM-WRA-0.5-3-X01 | Waste Rock/Soil | 0.5 - 1 | 10/5/2024 | 43 |
| | CEM-WRA-3 | CEM-WRA-0.5-3-X02 CEM-WRA-0.5-3-X03 | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/5/2024 10/5/2024 | 44 40 |
| | CEIVI VVIIM-3 | CEM-WRA-0.5-3-X04 | Waste Rock/Soil | 0.5 - 1 | 10/5/2024 | 37 |
| | | CEM-WRA-0.5-3-XUCL | Waste Rock/Soil | 0.5 - 1 | 10/5/2024 | 44.72 |

Table 2
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Supplemental Site Investigation Report
Upper Granite Creek Watershed Mines
Wallowa-Whitman National Forest, Oregon

| | | | | | | Metals |
|-----------------|-----------------|--|---------------------------------|------------------------------|------------------------|-------------------|
| AOI | Location | Field Sample ID | Material | Collection Depth (ft bgs) | Sample Date | Arsenic |
| | | Tailings PF | | | | 110 |
| | | Waste Rock/So | | 0.5.1 | 10/5/2024 | 190 |
| | | CEM-WRA-0.5-4-X01 CEM-WRA-0.5-4-X02 | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/5/2024 10/5/2024 | 77 69 |
| | CEM-WRA-4 | CEM-WRA-0.5-4-X03 | Waste Rock/Soil | 0.5 - 1 | 10/5/2024 | 89 |
| | | CEM-WRA-0.5-4-X04 | Waste Rock/Soil | 0.5 - 1 | 10/5/2024 | 56 |
| | | CEM-WRA-0.5-4-XUCL | Waste Rock/Soil | 0.5 - 1 | 10/5/2024 | 89.07 |
| | | CEM-WRA-0.5-4-DS-X01 | Waste Rock/Soil | 0.5 - 1 | 10/5/2024 | 38 |
| | CEM-WRA-4-DS | CEM-WRA-0.5-4-DS-X02 CEM-WRA-0.5-4-DS-X03 | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/5/2024 10/5/2024 | 31 34 |
| | CEIVI WITH 4 D3 | CEM-WRA-0.5-4-DS-X04 | Waste Rock/Soil | 0.5 - 1 | 10/5/2024 | 30 |
| | | CEM-WRA-0.5-4-DS-XUCL | Waste Rock/Soil | 0.5 - 1 | 10/5/2024 | 37.48 |
| | CEM-WRB-1 | CEM-WRB-0.5-1-X01 | Waste Rock/Soil | 0.5 - 1 | 10/5/2024 | <u>187</u> |
| | - | CEM-WRB-0.5-1-X02 | Waste Rock/Soil | 0.5 - 1 | 10/5/2024 | <u>210</u> |
| | | CEM-WRB-0.5-1-X03 CEM-WRB-0.5-1-X04 | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/5/2024 10/5/2024 | 125 165 |
| | | CEM-WRB-0.5-1-X05 | Waste Rock/Soil | 0.5 - 1 | 10/5/2024 | 126 |
| | | CEM-WRB-0.5-1-X06 | Waste Rock/Soil | 0.5 - 1 | 10/5/2024 | 133 |
| | CEM-WRB-1 | CEM-WRB-0.5-1-X07 | Waste Rock/Soil | 0.5 - 1 | 10/5/2024 | <u>217</u> |
| | | CEM-WRB-0.5-1-X08 | Waste Rock/Soil | 0.5 - 1 | 10/5/2024 | <u>242</u> |
| | | CEM-WRB-0.5-1-X09 CEM-WRB-0.5-1-X10 | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/5/2024 10/5/2024 | 142 151 |
| Central | | CEM-WRB-0.5-1-XUCL | Waste Rock/Soil | 0.5 - 1 | 10/5/2024 | 194.1 |
| | | CEM-WRC-0.5-1-X01 | Waste Rock/Soil | 0.5 - 1 | 10/5/2024 | 123 |
| | | CEM-WRC-0.5-1-X02 | Waste Rock/Soil | 0.5 - 1 | 10/5/2024 | 187 |
| | | CEM-WRC-0.5-1-X03 | Waste Rock/Soil | 0.5 - 1 | 10/5/2024 | 94 |
| | | CEM-WRC-0.5-1-X04 CEM-WRC-0.5-1-X05 | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/5/2024 10/5/2024 | 104 121 |
| | CEM-WRC-1 | CEM-WRC-0.5-1-X06 | Waste Rock/Soil | 0.5 - 1 | 10/5/2024 | 109 |
| | | CEM-WRC-0.5-1-X07 | Waste Rock/Soil | 0.5 - 1 | 10/5/2024 | 170 |
| | | CEM-WRC-0.5-1-X08 | Waste Rock/Soil | 0.5 - 1 | 10/5/2024 | 136 |
| | | CEM-WRC-0.5-1-X09 | Waste Rock/Soil | 0.5 - 1 | 10/5/2024 | 102 |
| | | CEM-WRC-0.5-1-XUCL CEM-WRC-0.5-2-X01 | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/5/2024 10/5/2024 | 147.1 68 |
| | | CEM-WRC-0.5-2-X02 | Waste Rock/Soil | 0.5 - 1 | 10/5/2024 | 64 |
| | CEM-WRC-2 | CEM-WRC-0.5-2-X03 | Waste Rock/Soil | 0.5 - 1 | 10/5/2024 | 52 |
| | | CEM-WRC-0.5-2-X04 | Waste Rock/Soil | 0.5 - 1 | 10/5/2024 | 57 |
| | | CEM-WRC-0.5-2-XUCL | Waste Rock/Soil | 0.5 - 1 | 10/5/2024 | 68.65 |
| | CEM-WRD-1 | CEM-WRD-0.5-1-X01 CEM-WRD-0.5-1-X02 | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/5/2024 10/5/2024 | 62 56 |
| | | CEM-WRD-0.5-1-X03 | Waste Rock/Soil | 0.5 - 1 | 10/5/2024 | 61 |
| | | CEM-WRD-0.5-1-X04 | Waste Rock/Soil | 0.5 - 1 | 10/5/2024 | 87 |
| | | CEM-WRD-0.5-1-XUCL | Waste Rock/Soil | 0.5 - 1 | 10/5/2024 | 82.88 |
| | | GF-DR-0.5-1-X01 | Waste Rock/Soil | 0.5 - 1 | 10/5/2024 | 39 |
| | GF-DR-1 | GF-DR-0.5-1-X02 GF-DR-0.5-1-X03 | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/5/2024 10/5/2024 | 57 83 |
| | 0. 5 1 | GF-DR-0.5-1-X04 | Waste Rock/Soil | 0.5 - 1 | 10/5/2024 | 51 |
| | | GF-DR-0.5-1-XUCL | Waste Rock/Soil | 0.5 - 1 | 10/5/2024 | 79.36 |
| | | GF-WRA-0.5-1-X01 | Waste Rock/Soil | 0.5 - 1 | 10/5/2024 | <u>401</u> |
| | | GF-WRA-0.5-1-X02 | Waste Rock/Soil | 0.5 - 1 | 10/5/2024 | <u>372</u> |
| | | GF-WRA-0.5-1-X03 GF-WRA-0.5-1-X04 | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/5/2024 10/5/2024 | 352 491 |
| | | GF-WRA-0.5-1-X05 | Waste Rock/Soil | 0.5 - 1 | 10/5/2024 | 269 |
| | GF-WRA-1 | GF-WRA-0.5-1-X06 | Waste Rock/Soil | 0.5 - 1 | 10/5/2024 | 170 |
| | | GF-WRA-0.5-1-X07 | Waste Rock/Soil | 0.5 - 1 | 10/5/2024 | <u>460</u> |
| | | GF-WRA-0.5-1-X08 | Waste Rock/Soil | 0.5 - 1 | 10/5/2024 | <u>322</u> |
| | | GF-WRA-0.5-1-X09 GF-WRA-0.5-1-X10 | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/5/2024 10/5/2024 | <u>324</u> 322 |
| | | GF-WRA-0.5-1-XUCL | Waste Rock/Soil | 0.5 - 1 | 10/5/2024 | 401.7 |
| Golden Fraction | | GF-WRA-0.5-2-X01 | Waste Rock/Soil | 0.5 - 1 | 10/5/2024 | 188 |
| | | GF-WRA-0.5-2-X02 | Waste Rock/Soil | 0.5 - 1 | 10/5/2024 | <u>237</u> |
| | GF-WRA-2 | GF-WRA-0.5-2-X03 | Waste Rock/Soil | 0.5 - 1 | 10/5/2024 | <u>279</u> |
| | | GF-WRA-0.5-2-X04 GF-WRA-0.5-2-X05 | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/5/2024 10/5/2024 | 237 266 |
| | | GF-WRA-0.5-2-XUCL | Waste Rock/Soil | 0.5 - 1 | 10/5/2024 | 274.8 |
| | | GF-WRA-0.5-3-X01 | Waste Rock/Soil | 0.5 - 1 | 10/5/2024 | <u>299</u> |
| | | GF-WRA-0.5-3-X02 | Waste Rock/Soil | 0.5 - 1 | 10/5/2024 | <u>378</u> |
| | | GF-WRA-0.5-3-X03 | Waste Rock/Soil | 0.5 - 1 | 10/5/2024 | <u>275</u> |
| | | GF-WRA-0.5-3-X04 | Waste Rock/Soil | 0.5 - 1 | 10/5/2024 | <u>416</u> |
| | GF-WRA-3 | GF-WRA-0.5-3-X05 GF-WRA-0.5-3-X06 | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/5/2024 10/5/2024 | <u>250</u> 269 |
| | J. 111013 | GF-WRA-0.5-3-X07 | Waste Rock/Soil | 0.5 - 1 | 10/5/2024 | <u>203</u> 248 |
| | | GF-WRA-0.5-3-X08 | Waste Rock/Soil | 0.5 - 1 | 10/5/2024 | <u>269</u> |
| | | GF-WRA-0.5-3-X09 | Waste Rock/Soil | 0.5 - 1 | 10/5/2024 | <u>224</u> |
| | | GF-WRA-0.5-3-X10 | Waste Rock/Soil | 0.5 - 1 | 10/5/2024 | <u>296</u> |
| | | GF-WRA-0.5-3-XUCL | Waste Rock/Soil | 0.5 - 1 | 10/5/2024 | <u>327.2</u> |

Table 2
Summary of XRF Measurements
Supplemental Site Investigation Report
Upper Granite Creek Watershed Mines
Wallowa-Whitman National Forest, Oregon

| | | | Collection Depth | | |
|-------------|---|---------------------------------------|--|---------------|---------------------------------------|
| Location | Field Sample ID | Material RG | (ft bgs) | Sample Date | Arsenic 110 |
| | | | | | 190 |
| | GF-WRB-0.5-1-X01 | Waste Rock/Soil | 0.5 - 1 | 10/5/2024 | 117 |
| | GF-WRB-0.5-1-X02 | Waste Rock/Soil | 0.5 - 1 | 10/5/2024 | 112 |
| GF-WRB-1 | | · | | | 144 103 |
| | | , | | | 139.8 |
| | GF-WRB-0.5-2-X01 | Waste Rock/Soil | 0.5 - 1 | 10/5/2024 | 87 |
| | GF-WRB-0.5-2-X02 | Waste Rock/Soil | 0.5 - 1 | 10/5/2024 | 68 |
| GF-WRB-2 | | | | | 75 |
| | | | | | 82 87.75 |
| | GF-WRB-0.5-3-X01 | Waste Rock/Soil | 0.5 - 1 | 10/5/2024 | 75 |
| | GF-WRB-0.5-3-X02 | Waste Rock/Soil | 0.5 - 1 | 10/5/2024 | 62 |
| GF-WRB-3 | GF-WRB-0.5-3-X03 | Waste Rock/Soil | | | 87 |
| | | · · · · · · · · · · · · · · · · · · · | | | 60 58.79 |
| | | | | | 81 |
| | GF-WRC-0.5-1-X02 | Waste Rock/Soil | 0.5 - 1 | 10/5/2024 | 79 |
| GF-WRC-1 | GF-WRC-0.5-1-X03 | Waste Rock/Soil | 0.5 - 1 | 10/5/2024 | 102 |
| | | • | | | 78 |
| | | | | | 98.42 85 |
| GF-WRC-2 | GF-WRC-0.5-2-X02 | | 0.5 - 1 | 10/5/2024 | 75 |
| | GF-WRC-0.5-2-X03 | Waste Rock/Soil | 0.5 - 1 | 10/5/2024 | 100 |
| GF-WRC-2 | GF-WRC-0.5-2-X04 | Waste Rock/Soil | 0.5 - 1 | 10/5/2024 | 88 |
| | | · | | | 99.11 50 |
| | | , | | | 47 |
| GF-WRC-3 | GF-WRC-0.5-3-X03 | Waste Rock/Soil | 0.5 - 1 | 10/5/2024 | 41 |
| | GF-WRC-0.5-3-X04 | Waste Rock/Soil | 0.5 - 1 | 10/5/2024 | 46 |
| | GF-WRC-0.5-3-XUCL | Waste Rock/Soil | 0.5 - 1 | 10/5/2024 | 50.4 |
| | | | | | 67 42 |
| GF-WRC-4 | GF-WRC-0.5-4-X03 | , | | | 58 |
| | GF-WRC-0.5-4-X04 | Waste Rock/Soil | 0.5 - 1 | 10/5/2024 | 54 |
| | GF-WRC-0.5-4-XUCL | Waste Rock/Soil | 0.5 - 1 | 10/5/2024 | 67.45 |
| GF-WRD-1 | | | | | 59 60 |
| | | | | | 69 |
| | GF-WRD-0.5-1-X04 | Waste Rock/Soil | 0.5 - 1 | 10/5/2024 | 60 |
| | GF-WRD-0.5-1-XUCL | Waste Rock/Soil | 0.5 - 1 | 10/5/2024 | 67.52 |
| | GF-WRD-0.5-2-X01 | | | | 30 |
| GF-WRD-2 | | | | | 42 44 |
| OF WIND 2 | | | 0.5 - 1 | | 38 |
| | GF-WRD-0.5-2-XUCL | Waste Rock/Soil | 0.5 - 1 | 10/5/2024 | 45.79 |
| | GF-WRD-0.5-3-X01 | Waste Rock/Soil | 0.5 - 1 | 10/5/2024 | 62 |
| GE WRD 2 | | · . | | | 55 74 |
| GI-WND-3 | | | | | 56 |
| | GF-WRD-0.5-3-X05 | Waste Rock/Soil | 0.5 - 1 | 10/5/2024 | 72.02 |
| | GF-WRD-0.5-4-X01 | Waste Rock/Soil | 0.5 - 1 | 10/5/2024 | 57 |
| CE WDD 4 | GF-WRD-0.5-4-X02 | Waste Rock/Soil | | | 49 |
| GF-WKD-4 | | | | | 42 55 |
| | GF-WRD-0.5-4-XUCL | Waste Rock/Soil | | | 58.69 |
| | GF-WRD-0.5-4-DS-X01 | Waste Rock/Soil | 0.5 - 1 | 10/5/2024 | 31 |
| 05.1105.1 | GF-WRD-0.5-4-DS-X02 | Waste Rock/Soil | 0.5 - 1 | 10/5/2024 | 62 |
| GF-WRD-4-DS | | Waste Rock/Soil | | | 54 46 |
| | | , | | | 63.81 |
| | GF-WRD-0.5-5-X01 | Waste Rock/Soil | 0.5 - 1 | 10/5/2024 | 52 |
| | GF-WRD-0.5-5-X02 | Waste Rock/Soil | 0.5 - 1 | 10/5/2024 | 55 |
| GF-WRD-5 | GF-WRD-0.5-5-X03 | Waste Rock/Soil | 0.5 - 1 | 10/5/2024 | 55 |
| | | · | | | 62 60.99 |
| | | | | | 51 |
| | GF-WRD-0.5-6-X02 | Waste Rock/Soil | | | 80 |
| GF-WRD-6 | GF-WRD-0.5-6-X03 | Waste Rock/Soil | 0.5 - 1 | 10/5/2024 | 53 |
| SI WIND U | GF-WRD-0.5-6-X04 | Waste Rock/Soil | 0.5 - 1 | 10/5/2024 | 52 |
| | GF-WRB-1 GF-WRC-1 GF-WRC-2 GF-WRC-3 GF-WRD-1 GF-WRD-1 GF-WRD-3 GF-WRD-3 | GF-WRB-0.5-1-X01 | ### Tailings PRG ### Waste Rock/Soil PRG GF-WRB-0.5-1-X01 Waste Rock/Soil GF-WRB-0.5-1-X02 Waste Rock/Soil GF-WRB-0.5-1-X03 Waste Rock/Soil GF-WRB-0.5-1-X03 Waste Rock/Soil GF-WRB-0.5-1-X04 Waste Rock/Soil GF-WRB-0.5-2-XUCL Waste Rock/Soil GF-WRB-0.5-2-XUCL Waste Rock/Soil GF-WRB-0.5-2-X01 Waste Rock/Soil GF-WRB-0.5-2-X02 Waste Rock/Soil GF-WRB-0.5-2-X04 Waste Rock/Soil GF-WRB-0.5-2-X04 Waste Rock/Soil GF-WRB-0.5-2-XUCL Waste Rock/Soil GF-WRB-0.5-3-X01 Waste Rock/Soil GF-WRB-0.5-3-X01 Waste Rock/Soil GF-WRB-0.5-3-X02 Waste Rock/Soil GF-WRB-0.5-3-X02 Waste Rock/Soil GF-WRB-0.5-3-X04 Waste Rock/Soil GF-WRB-0.5-3-X04 Waste Rock/Soil GF-WRB-0.5-3-X04 Waste Rock/Soil GF-WRB-0.5-3-X04 Waste Rock/Soil GF-WRC-0.5-1-X02 Waste Rock/Soil GF-WRC-0.5-1-X02 Waste Rock/Soil GF-WRC-0.5-1-X02 Waste Rock/Soil GF-WRC-0.5-1-X02 Waste Rock/Soil GF-WRC-0.5-1-X03 Waste Rock/Soil GF-WRC-0.5-1-X04 Waste Rock/Soil GF-WRC-0.5-1-X04 Waste Rock/Soil GF-WRC-0.5-1-X04 Waste Rock/Soil GF-WRC-0.5-1-X05 Waste Rock/Soil GF-WRC-0.5-1-X04 Waste Rock/Soil GF-WRC-0.5-1-X04 Waste Rock/Soil GF-WRC-0.5-2-X03 Waste Rock/Soil GF-WRC-0.5-2-X04 Waste Rock/Soil GF-WRC-0.5-3-X04 Waste Rock/Soil GF-WRD-0.5-4-X02 Waste Rock/Soil GF-WRD-0.5-4-X02 Waste Rock/Soil GF-WRD-0.5-4-X04 Waste Rock/Soil GF-WRD-0.5-4-X04 Waste Rock/Soil GF-WRD-0.5-4-X04 Waste Rock/Soil GF-WRD-0.5-4-X04 Waste Rock/Soil GF- | Frailings PRG | ### Tailings PRG #### Waste Rock/Soil |

Table 2
Summary of XRF Measurements
Supplemental Site Investigation Report
Upper Granite Creek Watershed Mines
Wallowa-Whitman National Forest, Oregon

| | | | | | | Metals |
|------------------|--------------|---|---------------------------------|--------------------|------------------------|-------------------|
| | | | | Collection Depth | | _ |
| AOI | Location | Field Sample ID Tailings PI | Material RG | (ft bgs) | Sample Date | Arsenic 110 |
| | | Waste Rock/So | | | | 190 |
| | | GC5-WRA-0.5-1-X01 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 86 |
| | GC5-WRA-1 | GC5-WRA-0.5-1-X02 GC5-WRA-0.5-1-X03 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 90 89 |
| | GC3-WKA-1 | GC5-WRA-0.5-1-X04 | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/4/2024 10/4/2024 | 133 |
| | | GC5-WRA-0.5-1-XUCL | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 125.9 |
| | | GC5-WRA-0.5-2-X01 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 54 |
| | GC5-WRA-2 | GC5-WRA-0.5-2-X02 GC5-WRA-0.5-2-X03 | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/4/2024 10/4/2024 | 71 81 |
| | GCS WITH Z | GC5-WRA-0.5-2-X04 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 70 |
| | | GC5-WRA-0.5-2-XUCL | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 82.14 |
| | | GC5-WRA-0.5-3-X01 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | <u>416</u> |
| | | GC5-WRA-0.5-3-X02 GC5-WRA-0.5-3-X03 | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/4/2024 10/4/2024 | <u>356</u> 296 |
| | | GC5-WRA-0.5-3-X04 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | <u>364</u> |
| | | GC5-WRA-0.5-3-X05 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | <u>253</u> |
| | GC5-WRA-3 | GC5-WRA-0.5-3-X06 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | <u>273</u> |
| | | GC5-WRA-0.5-3-X07 GC5-WRA-0.5-3-X08 | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/4/2024 10/4/2024 | <u>399</u> 346 |
| | | GC5-WRA-0.5-3-X09 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 446 |
| | | GC5-WRA-0.5-3-X10 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | <u>327</u> |
| | | GC5-WRA-0.5-3-XUCL | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | <u>383.7</u> |
| | | GC5-WRA-0.5-4-X01 GC5-WRA-0.5-4-X02 | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/4/2024 10/4/2024 | 112 230 |
| Granite Creek #5 | | GC5-WRA-0.5-4-X03 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 99 |
| | | GC5-WRA-0.5-4-X04 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 136 |
| | | GC5-WRA-0.5-4-X05 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 163 |
| | GC5-WRA-4 | GC5-WRA-0.5-4-X06 GC5-WRA-0.5-4-X07 | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/4/2024 10/4/2024 | 81 101 |
| | | GC5-WRA-0.5-4-X08 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 167 |
| | | GC5-WRA-0.5-4-X09 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | <u>302</u> |
| | | GC5-WRA-0.5-4-X10 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 106 |
| - | | GC5-WRA-0.5-4-XUCL GC5-WRA-0.5-4-DS-X01 | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/4/2024 10/4/2024 | 189.9 74 |
| | | GC5-WRA-0.5-4-DS-X02 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 76 |
| | GC5-WRA-4-DS | GC5-WRA-0.5-4-DS-X03 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 56 |
| | | GC5-WRA-0.5-4-DS-X04 GC5-WRA-0.5-4-DS-XUCL | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/4/2024 10/4/2024 | 65 78.55 |
| - | GC5-WRB-1 | GC5-WRB-0.5-1-X01 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 133 |
| - | | GC5-WRB-0.5-1-X02 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 162 |
| | GC5-WRB-1 | GC5-WRB-0.5-1-X03 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 129 |
| | | GC5-WRB-0.5-1-X04 GC5-WRB-0.5-1-XUCL | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/4/2024 10/4/2024 | 132 157.2 |
| - | | GC5-WRB-0.5-2-X01 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 52 |
| | | GC5-WRB-0.5-2-X02 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 82 |
| | GC5-WRB-2 | GC5-WRB-0.5-2-X03 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 86 |
| | | GC5-WRB-0.5-2-X04 GC5-WRB-0.5-2-XUCL | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/4/2024 10/4/2024 | 120 117.8 |
| | | GC6-WRA-0.5-1-X01 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 172 |
| | | GC6-WRA-0.5-1-X02 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 189 |
| | GC6-WRA-1 | GC6-WRA-0.5-1-X03 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 179 |
| | | GC6-WRA-0.5-1-X04 GC6-WRA-0.5-1-X05 | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/4/2024 10/4/2024 | 239 193 |
| | | GC6-WRA-0.5-1-XUCL | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | <u>219.4</u> |
| | | GC6-WRA-0.5-2-X01 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | <u>257</u> |
| | | GC6-WRA-0.5-2-X02 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 185 156 |
| | | GC6-WRA-0.5-2-X03 GC6-WRA-0.5-2-X04 | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/4/2024 10/4/2024 | 378 |
| | | GC6-WRA-0.5-2-X05 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 134 |
| | GC6-WRA-2 | GC6-WRA-0.5-2-X06 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | <u>422</u> |
| Granite Creek #6 | | GC6-WRA-0.5-2-X07 GC6-WRA-0.5-2-X08 | Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/4/2024 10/4/2024 | <u>201</u> 270 |
| Granite Creek #0 | | GC6-WRA-0.5-2-X08 GC6-WRA-0.5-2-X09 | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | <u>270</u> 173 |
| | | GC6-WRA-0.5-2-X10 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | <u>235</u> |
| | | GC6-WRA-0.5-2-XUCL | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | <u>296</u> |
| | | GC6-WTP-0.5-1-X01 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 10 7 |
| | GC6-WTP-1 | GC6-WTP-0.5-1-X02 GC6-WTP-0.5-1-X03 | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/4/2024 10/4/2024 | 7 |
| | - | GC6-WTP-0.5-1-X04 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 5 |
| <u> </u> | | GC6-WTP-0.5-1-XUCL | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 9.676 |
| | | GC6-WTP-0.5-2-X01 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 11 |
| | GC6-WTP-2 | GC6-WTP-0.5-2-X02 GC6-WTP-0.5-2-X03 | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/4/2024 10/4/2024 | 11 16 |
| | - | GC6-WTP-0.5-2-X04 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 14 |
| <u> </u> | | | | | | |

Table 2
Summary of XRF Measurements
Supplemental Site Investigation Report
Upper Granite Creek Watershed Mines
Wallowa-Whitman National Forest, Oregon

| | | | | | | Metals |
|------------------|--------------------------|--|---------------------------------|-------------------------|------------------------|------------------------------|
| | | | | Collection Depth | | |
| AOI | Location | Field Sample ID | Material | (ft bgs) | Sample Date | Arsenic |
| | | Tailings P Waste Rock/S | | | | 110 190 |
| | | GC6-WTP-0.5-3-X01 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 6 |
| | 000 14/77 2 | GC6-WTP-0.5-3-X02 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 7 |
| Granite Creek #6 | GC6-WTP-3 | GC6-WTP-0.5-3-X03 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 6 |
| | | GC6-WTP-0.5-3-X04 GC6-WTP-0.5-3-XUCL | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/4/2024 10/4/2024 | 7 7.179 |
| | | GC7-WRA-0.5-1-X01 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 13 |
| | | GC7-WRA-0.5-1-X02 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 15 |
| | GC7-WRA-1 | GC7-WRA-0.5-1-X03 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 17 |
| | | GC7-WRA-0.5-1-X04 GC7-WRA-0.5-1-XUCL | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/4/2024 10/4/2024 | 15 16.92 |
| | | GC7-WRA-0.5-2-X01 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 10.32 |
| | | GC7-WRA-0.5-2-X02 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 11 |
| | GC7-WRA-2 | GC7-WRA-0.5-2-X03 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 14 |
| | | GC7-WRA-0.5-2-X04 GC7-WRA-0.5-2-XUCL | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/4/2024 10/4/2024 | 15 15.3 |
| Granite Creek #7 | | GC7-WRA-0.5-3-X01 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 31 |
| | | GC7-WRA-0.5-3-X02 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 19 |
| | GC7-WRA-3 | GC7-WRA-0.5-3-X03 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 27 |
| | | GC7-WRA-0.5-3-X04 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 30 |
| - | | GC7-WRA-0.5-3-XUCL GC7-WRB-0.5-1-X01 | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/4/2024 10/4/2024 | 33.15 10 |
| | | GC7-WRB-0.5-1-X02 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 10 |
| | GC7-WRB-1 | GC7-WRB-0.5-1-X03 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 16 |
| | | GC7-WRB-0.5-1-X04 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 11 |
| | | GC7-WRB-0.5-1-XUCL GC7-WRB-0.5-2-X01 | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/4/2024 10/4/2024 | 15.13 11 |
| | | GC7-WRB-0.5-2-X02 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 12 |
| Granite Creek #7 | GC7-WRB-2 | GC7-WRB-0.5-2-X03 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 10 |
| | | GC7-WRB-0.5-2-X04 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 11 |
| | CCO3 W/BA | GC7-WRB-0.5-2-XUCL GC03-WRA-0.5-XUCL | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 11.96 |
| | GC03-WRA GC03-WRA-1 | GC03-WRA-0.5-X0CL | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/3/2024 10/3/2024 | 43.57 36 |
| Ī | GC03-WRA-2 | GC03-WRA-0.5-2-X01 | Waste Rock/Soil | 0.5 - 1 | 10/3/2024 | 30 |
| | GC03-WRA-3 | GC03-WRA-0.5-3-X01 | Waste Rock/Soil | 0.5 - 1 | 10/3/2024 | 31 |
| - | GC03-WRA-4 GC03-WRB | GC03-WRA-0.5-4-X01 GC03-WRB-0.5-XUCL | Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/3/2024 | 45 303.7 |
| Granite Creek | GC03-WRB-1 | GC03-WRB-0.5-1-X01 | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 | 10/3/2024 10/3/2024 | 150 |
| Aq. St. 3 | GC03-WRB-2 | GC03-WRB-0.5-2-X01 | Waste Rock/Soil | 0.5 - 1 | 10/3/2024 | 142 |
| | GC03-WRB-3 | GC03-WRB-0.5-3-X01 | Waste Rock/Soil | 0.5 - 1 | 10/3/2024 | <u>304</u> |
| - | GC03-WRB-4 | GC03-WRB-0.5-4-X01 | Waste Rock/Soil | 0.5 - 1 | 10/3/2024 | 141 |
| - | GC03-WRB-5 GC03-WRB-6 | GC03-WRB-0.5-5-X01 GC03-WRB-0.5-6-X01 | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/3/2024 10/3/2024 | 75 222 |
| - | GC03-WRB-7 | GC03-WRB-0.5-7-X01 | Waste Rock/Soil | 0.5 - 1 | 10/3/2024 | 222 |
| | GC03-WRB-8 | GC03-WRB-0.5-8-X01 | Waste Rock/Soil | 0.5 - 1 | 10/3/2024 | 485 |
| | | LMM-TLA-0.5-1-X01 | Tailings | 0.5 - 1 | 10/3/2024 | <u>3805</u> |
| | | LMM-TLA-0.5-1-X02 LMM-TLA-0.5-1-X03 | Tailings | 0.5 - 1 0.5 - 1 | 10/3/2024 10/3/2024 | 3054 3451 |
| | LMM-TLA-1 | LMM-TLA-0.5-1-X04 | Tailings Tailings | 0.5 - 1 | 10/3/2024 | 3424 |
| | | LMM-TLA-0.5-1-X05 | Tailings | 0.5 - 1 | 10/3/2024 | 4114 |
| | | LMM-TLA-0.5-1-X06 | Tailings | 0.5 - 1 | 10/3/2024 | 4841 |
| | | LMM-TLA-0.5-1-X07 | Tailings | 0.5 - 1 | 10/3/2024 | <u>4155</u> |
| | LMM-TLA-1 | LMM-TLA-0.5-1-X08 LMM-TLA-0.5-1-X09 | Tailings Tailings | 0.5 - 1 0.5 - 1 | 10/3/2024 10/3/2024 | <u>4046</u> 4066 |
| | | LMM-TLA-0.5-1-X10 | Tailings | 0.5 - 1 | 10/3/2024 | 3775 |
| <u> </u> | | LMM-TLA-0.5-1-XUCL | Tailings | 0.5 - 1 | 10/3/2024 | <u>4160</u> |
| | | LMM-TLA-0.5-2-X01 | Tailings | 0.5 - 1 | 10/3/2024 | 6591 7810 |
| Lwr Mon'tl | | LMM-TLA-0.5-2-X02 LMM-TLA-0.5-2-X03 | Tailings Tailings | 0.5 - 1 0.5 - 1 | 10/3/2024 10/3/2024 | 7810 4263 |
| 2.00.0.1 (1 | | LMM-TLA-0.5-2-X04 | Tailings | 0.5 - 1 | 10/3/2024 | <u>5524</u> |
| | | LMM-TLA-0.5-2-X05 | Tailings | 0.5 - 1 | 10/3/2024 | 9330 |
| | LMM-TLA-2 | LMM-TLA-0.5-2-X06 | Tailings | 0.5 - 1 | 10/3/2024 | <u>8150</u> |
| | | LMM-TLA-0.5-2-X07 LMM-TLA-0.5-2-X08 | Tailings | 0.5 - 1 | 10/3/2024 | 8540 10034 |
| | | LMM-TLA-0.5-2-X09 | Tailings Tailings | 0.5 - 1 0.5 - 1 | 10/3/2024 10/3/2024 | <u>10034</u> <u>10428</u> |
| | | LMM-TLA-0.5-2-X10 | Tailings | 0.5 - 1 | 10/3/2024 | <u>17380</u> |
| | | LMM-TLA-0.5-2-XUCL | Tailings | 0.5 - 1 | 10/3/2024 | 10884 |
| | | LMM-TLA-0.5-3-X01 | Tailings | 0.5 - 1 | 10/3/2024 | 10 |
| | ΜΜ-ΤΙ Δ-2 | LMM-TLA-0.5-3-X02 LMM-TLA-0.5-3-X03 | Tailings Tailings | 0.5 - 1 0.5 - 1 | 10/3/2024 10/3/2024 | 12 13 |
| | LMM-TLA-3 | F141141 1 FU-017-7-V02 | | | | |
| | | LMM-TLA-0.5-3-X04 | Tailings | 0.5 - 1 | 10/3/2024 | 11 |

Table 2
Summary of XRF Measurements
Supplemental Site Investigation Report
Upper Granite Creek Watershed Mines
Wallowa-Whitman National Forest, Oregon

| | | | | | | Metals |
|------------|------------------|--|---------------------------------|--------------------|------------------------|---------------------------|
| 401 | Location | Field Semule ID | Material | Collection Depth | Cample Date | Ausania |
| AOI | Location | Field Sample ID Tailings PI | Material RG | (ft bgs) | Sample Date | Arsenic 110 |
| | | Waste Rock/So | | | | 190 |
| | | LMM-TLA-0.5-4-X01 | Tailings | 0.5 - 1 | 10/3/2024 | <u>1097</u> |
| | | LMM-TLA-0.5-4-X02 LMM-TLA-0.5-4-X03 | Tailings Tailings | 0.5 - 1 0.5 - 1 | 10/3/2024 10/3/2024 | <u>1213</u> <u>732</u> |
| | | LMM-TLA-0.5-4-X04 | Tailings | 0.5 - 1 | 10/3/2024 | 493 |
| | | LMM-TLA-0.5-4-X05 | Tailings | 0.5 - 1 | 10/3/2024 | <u>738</u> |
| | LMM-TLA-4 | LMM-TLA-0.5-4-X06 | Tailings | 0.5 - 1 | 10/3/2024 | <u>461</u> |
| | | LMM-TLA-0.5-4-X07 LMM-TLA-0.5-4-X08 | Tailings Tailings | 0.5 - 1 0.5 - 1 | 10/3/2024 10/3/2024 | <u>555</u> 570 |
| | | LMM-TLA-0.5-4-X09 | Tailings | 0.5 - 1 | 10/3/2024 | 476 |
| | | LMM-TLA-0.5-4-X10 | Tailings | 0.5 - 1 | 10/3/2024 | <u>496</u> |
| | | LMM-TLA-0.5-4-XUCL | Tailings | 0.5 - 1 | 10/3/2024 | <u>838.9</u> |
| | | LMM-WRA-0.5-1-X01 LMM-WRA-0.5-1-X02 | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/3/2024 10/3/2024 | <u>423</u> 192 |
| | | LMM-WRA-0.5-1-X03 | Waste Rock/Soil | 0.5 - 1 | 10/3/2024 | <u>192</u> 283 |
| | | LMM-WRA-0.5-1-X04 | Waste Rock/Soil | 0.5 - 1 | 10/3/2024 | <u>256</u> |
| | | LMM-WRA-0.5-1-X05 | Waste Rock/Soil | 0.5 - 1 | 10/3/2024 | 185 |
| | LMM-WRA-1 | LMM-WRA-0.5-1-X06 | Waste Rock/Soil | 0.5 - 1 | 10/3/2024 | <u>232</u> |
| | | LMM-WRA-0.5-1-X07 LMM-WRA-0.5-1-X08 | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/3/2024 10/3/2024 | <u>271</u> 281 |
| | | LMM-WRA-0.5-1-X09 | Waste Rock/Soil | 0.5 - 1 | 10/3/2024 | 95 |
| | | LMM-WRA-0.5-1-X10 | Waste Rock/Soil | 0.5 - 1 | 10/3/2024 | 170 |
| | | LMM-WRA-0.5-1-XUCL | Waste Rock/Soil | 0.5 - 1 | 10/3/2024 | 289.8 |
| | | LMM-WRA-0.5-2-X01 LMM-WRA-0.5-2-X02 | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/3/2024 10/3/2024 | 318 299 |
| | | LMM-WRA-0.5-2-X03 | Waste Rock/Soil | 0.5 - 1 | 10/3/2024 | 239 |
| | | LMM-WRA-0.5-2-X04 | Waste Rock/Soil | 0.5 - 1 | 10/3/2024 | 209 |
| | | LMM-WRA-0.5-2-X05 | Waste Rock/Soil | 0.5 - 1 | 10/3/2024 | <u>280</u> |
| | LMM-WRA-2 | LMM-WRA-0.5-2-X06 LMM-WRA-0.5-2-X07 | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/3/2024 10/3/2024 | 330 531 |
| | | LMM-WRA-0.5-2-X07 | Waste Rock/Soil | 0.5 - 1 | 10/3/2024 | 457 |
| | | LMM-WRA-0.5-2-X09 | Waste Rock/Soil | 0.5 - 1 | 10/3/2024 | 213 |
| | | LMM-WRA-0.5-2-X10 | Waste Rock/Soil | 0.5 - 1 | 10/3/2024 | <u>329</u> |
| | | LMM-WRA-0.5-2-XUCL | Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/3/2024 | 380.3 49 |
| | LMM-WRA-3 | LMM-WRA-0.5-3-X01 LMM-WRA-0.5-3-X02 | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 | 10/3/2024 10/3/2024 | 95 |
| Lwr Mon'tl | | LMM-WRA-0.5-3-X03 | Waste Rock/Soil | 0.5 - 1 | 10/3/2024 | 134 |
| | | LMM-WRA-0.5-3-X04 | Waste Rock/Soil | 0.5 - 1 | 10/3/2024 | 63 |
| | | LMM-WRA-0.5-3-X05 | Waste Rock/Soil | 0.5 - 1 | 10/3/2024 | 107 |
| | | LMM-WRA-0.5-3-X06 LMM-WRA-0.5-3-X07 | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/3/2024 10/3/2024 | 97 38 |
| | | LMM-WRA-0.5-3-X08 | Waste Rock/Soil | 0.5 - 1 | 10/3/2024 | 46 |
| | | LMM-WRA-0.5-3-X09 | Waste Rock/Soil | 0.5 - 1 | 10/3/2024 | 48 |
| | | LMM-WRA-0.5-3-X10 | Waste Rock/Soil | 0.5 - 1 | 10/3/2024 | 69 |
| | | LMM-WRA-0.5-3-XUCL LMM-WRA-0.5-3-DS-X01 | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/3/2024 10/3/2024 | 93.12 47 |
| | | LMM-WRA-0.5-3-DS-X02 | Waste Rock/Soil | 0.5 - 1 | 10/3/2024 | 42 |
| | LMM-WRA-3-DS | LMM-WRA-0.5-3-DS-X03 | Waste Rock/Soil | 0.5 - 1 | 10/3/2024 | 50 |
| | | LMM-WRA-0.5-3-DS-X04 | Waste Rock/Soil | 0.5 - 1 | 10/3/2024 | 16 |
| | | LMM-WRA-0.5-3-DS-XUCL LMM-WRA-0.5-4-X01 | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/3/2024 10/3/2024 | 57.01 1750 |
| | | LMM-WRA-0.5-4-X02 | Waste Rock/Soil | 0.5 - 1 | 10/3/2024 | 2465 |
| | | LMM-WRA-0.5-4-X03 | Waste Rock/Soil | 0.5 - 1 | 10/3/2024 | <u>1445</u> |
| | | LMM-WRA-0.5-4-X04 | Waste Rock/Soil | 0.5 - 1 | 10/3/2024 | 2149 |
| | LMM-WRA-4 | LMM-WRA-0.5-4-X05 | Waste Rock/Soil | 0.5 - 1 | 10/3/2024 | <u>2991</u> |
| | LIVIIVI-VV NA-4 | LMM-WRA-0.5-4-X06 LMM-WRA-0.5-4-X07 | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/3/2024 10/3/2024 | <u>1437</u> 815 |
| | | LMM-WRA-0.5-4-X08 | Waste Rock/Soil | 0.5 - 1 | 10/3/2024 | 1453 |
| | | LMM-WRA-0.5-4-X09 | Waste Rock/Soil | 0.5 - 1 | 10/3/2024 | <u>697</u> |
| | | LMM-WRA-0.5-4-X10 | Waste Rock/Soil | 0.5 - 1 | 10/3/2024 | 735 |
| | | LMM-WRA-0.5-4-XUCL LMM-WRB-0.5-1-X01 | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/3/2024 10/3/2024 | <u>2037</u> 735 |
| | | LMM-WRB-0.5-1-X02 | Waste Rock/Soil | 0.5 - 1 | 10/3/2024 | 869 |
| | LMM-WRB-1 | LMM-WRB-0.5-1-X03 | Waste Rock/Soil | 0.5 - 1 | 10/3/2024 | <u>864</u> |
| | | LMM-WRB-0.5-1-X04 | Waste Rock/Soil | 0.5 - 1 | 10/3/2024 | <u>738</u> |
| | | LMM-WRB-0.5-1-X05 LMM-WRB-0.5-1-X06 | Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/3/2024 | 978 645 |
| | | LMM-WRB-0.5-1-X06 | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 | 10/3/2024 10/3/2024 | <u>645</u> 923 |
| | LMM-WRB-1 | LMM-WRB-0.5-1-X08 | Waste Rock/Soil | 0.5 - 1 | 10/3/2024 | <u>898</u> |
| | FIAIIAI-AA K Q-T | LMM-WRB-0.5-1-X09 | Waste Rock/Soil | 0.5 - 1 | 10/3/2024 | 964 |
| ŀ | | LMM-WRB-0.5-1-X10 | Waste Rock/Soil | 0.5 - 1 | 10/3/2024 | 827 |

Table 2
Summary of XRF Measurements
Supplemental Site Investigation Report
Upper Granite Creek Watershed Mines
Wallowa-Whitman National Forest, Oregon

| | | | | Collection Daniel | | Meta |
|------------|----------------|--|---------------------------------|------------------------------|------------------------|-------------|
| AOI | Location | Field Sample ID | Material | Collection Depth (ft bgs) | Sample Date | Arsen |
| | | Tailings PI Waste Rock/So | | | | 110 190 |
| | | LMM-WRB-0.5-2-X01 | Waste Rock/Soil | 0.5 - 1 | 10/3/2024 | 284 |
| | | LMM-WRB-0.5-2-X02 | Waste Rock/Soil | 0.5 - 1 | 10/3/2024 | 186 |
| | | LMM-WRB-0.5-2-X03 | Waste Rock/Soil | 0.5 - 1 | 10/3/2024 | 174 |
| | | LMM-WRB-0.5-2-X04 | Waste Rock/Soil | 0.5 - 1 | 10/3/2024 | <u>196</u> |
| | | LMM-WRB-0.5-2-X05 | Waste Rock/Soil | 0.5 - 1 | 10/3/2024 | 221 |
| | LMM-WRB-2 | LMM-WRB-0.5-2-X06 | Waste Rock/Soil | 0.5 - 1 | 10/3/2024 | 236 184 |
| | | LMM-WRB-0.5-2-X07 LMM-WRB-0.5-2-X08 | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/3/2024 10/3/2024 | 142 |
| | | LMM-WRB-0.5-2-X09 | Waste Rock/Soil | 0.5 - 1 | 10/3/2024 | 148 |
| | | LMM-WRB-0.5-2-X10 | Waste Rock/Soil | 0.5 - 1 | 10/3/2024 | 182 |
| Lwr Mon'tl | | LMM-WRB-0.5-2-XUCL | Waste Rock/Soil | 0.5 - 1 | 10/3/2024 | <u>219.</u> |
| | | LMM-WRB-0.5-3-X01 | Waste Rock/Soil | 0.5 - 1 | 10/3/2024 | 112 |
| | LMM-WRB-3 | LMM-WRB-0.5-3-X02 | Waste Rock/Soil | 0.5 - 1 | 10/3/2024 | 97 |
| | LIVIIVI-VVKB-3 | LMM-WRB-0.5-3-X03 LMM-WRB-0.5-3-X04 | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/3/2024 10/3/2024 | 149 92 |
| | | LMM-WRB-0.5-3-XUCL | Waste Rock/Soil | 0.5 - 1 | 10/3/2024 | 142. |
| | | LMM-WRB-0.5-3-DS-X01 | Waste Rock/Soil | 0.5 - 1 | 10/3/2024 | 18 |
| | | LMM-WRB-0.5-3-DS-X02 | Waste Rock/Soil | 0.5 - 1 | 10/3/2024 | 14 |
| | LMM-WRB-3-DS | LMM-WRB-0.5-3-DS-X03 | Waste Rock/Soil | 0.5 - 1 | 10/3/2024 | 19 |
| | | LMM-WRB-0.5-3-DS-X04 | Waste Rock/Soil | 0.5 - 1 | 10/3/2024 | 19 |
| | | LMM-WRB-0.5-3-DS-XUCL SH-WRA-0.5-1-X01 | Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/3/2024 10/4/2024 | 20.3 12 |
| | | SH-WRA-0.5-1-X02 | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 9 |
| | SH-WRA-1 | SH-WRA-0.5-1-X03 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 13 |
| | | SH-WRA-0.5-1-X04 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 12 |
| | | SH-WRA-0.5-1-XUCL | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 13.5 |
| | SH-WRA-2 | SH-WRA-0.5-2-X01 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 12 |
| | | SH-WRA-0.5-2-X02 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 21 |
| | | SH-WRA-0.5-2-X03 SH-WRA-0.5-2-X04 | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/4/2024 10/4/2024 | 15 13 |
| | | SH-WRA-0.5-2-XUCL | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 19.9 |
| | | SH-WRB-0.5-1-X01 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 30 |
| | | SH-WRB-0.5-1-X02 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 23 |
| | SH-WRB-1 | SH-WRB-0.5-1-X03 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 19 |
| | | SH-WRB-0.5-1-X04 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 26 |
| Sheridan | | SH-WRB-0.5-1-XUCL | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 29.8 59 |
| | SH-WRB-2 | SH-WRB-0.5-2-X01 SH-WRB-0.5-2-X02 | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/4/2024 10/4/2024 | 65 |
| | | SH-WRB-0.5-2-X03 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 66 |
| | | SH-WRB-0.5-2-X04 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 62 |
| | | SH-WRB-0.5-2-XUCL | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 66.7 |
| | | SH-WRC-0.5-1-X01 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 14 |
| | CH MDC 4 | SH-WRC-0.5-1-X02 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 12 |
| | SH-WRC-1 | SH-WRC-0.5-1-X03 SH-WRC-0.5-1-X04 | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/4/2024 10/4/2024 | 21 21 |
| | | SH-WRC-0.5-1-XUCL | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 22.5 |
| | | SH-WRC-0.5-2-X01 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 21 |
| | | SH-WRC-0.5-2-X02 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 14 |
| | SH-WRC-2 | SH-WRC-0.5-2-X03 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 16 |
| | | SH-WRC-0.5-2-X04 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 21 |
| | | SH-WRC-0.5-2-XUCL | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 22.1 |
| | | TL-WRA-0.5-1-X01 TL-WRA-0.5-1-DUP-X01 | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/4/2024 10/4/2024 | 131 165 |
| | | TL-WRA-0.5-1-X02 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 176 |
| | | TL-WRA-0.5-1-DUP-X02 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 157 |
| | TL-WRA-1 | TL-WRA-0.5-1-X03 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 155 |
| | I F- AALVW-T | TL-WRA-0.5-1-DUP-X03 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 183 |
| | | TL-WRA-0.5-1-X04 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 152 |
| | | TL-WRA-0.5-1-DUP-X04 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 133 |
| | | TL-WRA-0.5-1-XUCL TL-WRA-0.5-1-DUP-XUCL | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/4/2024 10/4/2024 | 175 182 |
| Tillicum | | TL-WRA-0.5-1-D0P-X0CL | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 185 |
| | | TL-WRA-0.5-1-DS-X02 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 175 |
| | TL-WRA-1-DS | TL-WRA-0.5-1-DS-X03 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 156 |
| | | TL-WRA-0.5-1-DS-X04 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 150 |
| | | TL-WRA-0.5-1-DS-XUCL | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 185. |
| | | TL-WRA-0.5-1-DS-2-X01 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 185 |
| | TL-WRA-1-DS-2 | TL-WRA-0.5-1-DS-2-X02 TL-WRA-0.5-1-DS-2-X03 | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/4/2024 10/4/2024 | 161 178 |
| | 15 MIVU-1-D2-5 | TL-WRA-0.5-1-DS-2-X04 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 177 |
| | | 0.0 1 D0 2 A04 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 187. |

Table 2
Summary of XRF Measurements
Supplemental Site Investigation Report
Upper Granite Creek Watershed Mines
Wallowa-Whitman National Forest, Oregon

| | | | | | | Metals |
|------------|--------------|---|---------------------------------|--------------------|------------------------|--------------------------|
| | | | | Collection Depth | | |
| AOI | Location | Field Sample ID Tailings P | Material | (ft bgs) | Sample Date | Arsenic 110 |
| | | Waste Rock/S | | | | 190 |
| | | TL-WRA-0.5-2-X01 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | <u>253</u> |
| | TI 14/DA 2 | TL-WRA-0.5-2-X02 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | <u>299</u> |
| | TL-WRA-2 | TL-WRA-0.5-2-X03 TL-WRA-0.5-2-X04 | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/4/2024 10/4/2024 | <u>261</u> 299 |
| | | TL-WRA-0.5-2-XUCL | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 306.8 |
| | | TL-WRA-0.5-3-X01 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | <u>367</u> |
| | TL-WRA-3 | TL-WRA-0.5-3-X02 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | <u>335</u> |
| | - | TL-WRA-0.5-3-X03 TL-WRA-0.5-3-X04 | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/4/2024 10/4/2024 | <u>394</u> 438 |
| | | TL-WRA-0.5-3-X05 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 408 |
| | | TL-WRA-0.5-3-X06 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | <u>347</u> |
| | | TL-WRA-0.5-3-X07 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | <u>371</u> |
| | TL-WRA-3 | TL-WRA-0.5-3-X08 TL-WRA-0.5-3-X09 | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/4/2024 10/4/2024 | <u>376</u> <u>321</u> |
| | | TL-WRA-0.5-3-X10 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 353 |
| | | TL-WRA-0.5-3-XUCL | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | <u>391.4</u> |
| | | TL-WRA-0.5-4-X01 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 147 |
| | T. 14/DA 4 | TL-WRA-0.5-4-X02 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 125 |
| | TL-WRA-4 | TL-WRA-0.5-4-X03 TL-WRA-0.5-4-X04 | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/4/2024 10/4/2024 | 171 193 |
| | | TL-WRA-0.5-4-XUCL | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 193.6 |
| | | TL-WRB-0.5-1-X01 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 67 |
| | | TL-WRB-0.5-1-X02 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 73 |
| | TL-WRB-1 | TL-WRB-0.5-1-X03 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 67 |
| | | TL-WRB-0.5-1-X04 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 72 52 |
| | | TL-WRB-0.5-1-XUCL TL-WRB-0.5-2-X01 | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/4/2024 10/4/2024 | 73.52 129 |
| Tillicum | | TL-WRB-0.5-2-X02 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 126 |
| | TL-WRB-2 | TL-WRB-0.5-2-X03 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 157 |
| | | TL-WRB-0.5-2-X04 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 106 |
| | | TL-WRB-0.5-2-XUCL | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 154.2 |
| | | TL-WRB-0.5-3-X01 TL-WRB-0.5-3-X02 | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/4/2024 10/4/2024 | 119 138 |
| | TL-WRB-3 | TL-WRB-0.5-3-X03 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 113 |
| | | TL-WRB-0.5-3-X04 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 128 |
| | | TL-WRB-0.5-3-XUCL | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 137.3 |
| | | TL-WRB-0.5-4-X01 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 105 |
| | | TL-WRB-0.5-4-X02 TL-WRB-0.5-4-X03 | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/4/2024 10/4/2024 | 184 113 |
| | | TL-WRB-0.5-4-X04 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 170 |
| | TL-WRB-4 | TL-WRB-0.5-4-X05 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 179 |
| | | TL-WRB-0.5-4-X06 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 161 |
| | | TL-WRB-0.5-4-X07 TL-WRB-0.5-4-X08 | Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/4/2024 10/4/2024 | 182 131 |
| | | TL-WRB-0.5-4-XUCL | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 174.6 |
| | | TL-WRC-0.5-1-X01 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 145 |
| | | TL-WRC-0.5-1-X02 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 145 |
| | TL-WRC-1 | TL-WRC-0.5-1-X03 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 142 |
| | | TL-WRC-0.5-1-X04 TL-WRC-0.5-1-XUCL | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/4/2024 10/4/2024 | 99 159.3 |
| | | TL-WRC-0.5-2-X01 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 203 |
| | | TL-WRC-0.5-2-X02 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 204 |
| | TL-WRC-2 | TL-WRC-0.5-2-X03 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 188 |
| | | TL-WRC-0.5-2-X04 | Waste Rock/Soil | 0.5 - 1 | 10/4/2024 | 205 |
| | UMM-FLT | TL-WRC-0.5-2-XUCL UMM-FLT-0-1 | Waste Rock/Soil Tailings | 0.5 - 1 0.5 - 1 | 10/4/2024 10/2/2024 | <u>209.5</u> 18300 |
| | 0.0 | UMM-TLA-0.5-1-X01 | Tailings | 0.5 - 1 | 10/2/2024 | 104 |
| | | UMM-TLA-0.5-1-X02 | Tailings | 0.5 - 1 | 10/2/2024 | 72 |
| | UMM-TLA-1 | UMM-TLA-0.5-1-X03 | Tailings | 0.5 - 1 | 10/2/2024 | 53 |
| | | UMM-TLA-0.5-1-X04 | Tailings | 0.5 - 1 | 10/2/2024 | 95 |
| | | UMM-TLA-0.5-1-X05 UMM-TLA-0.5-1-XUCL | Tailings Tailings | 0.5 - 1 0.5 - 1 | 10/2/2024 10/2/2024 | 96 104.1 |
| | | UMM-TLA-0.5-2-X01 | Tailings | 0.5 - 1 | 10/2/2024 | 322 |
| | | UMM-TLA-0.5-2-X02 | Tailings | 0.5 - 1 | 10/2/2024 | <u>317</u> |
| | UMM-TLA-2 | UMM-TLA-0.5-2-X03 | Tailings | 0.5 - 1 | 10/2/2024 | <u>316</u> |
| Hor Mon't | | UMM-TLA-0.5-2-X04 | Tailings | 0.5 - 1 | 10/2/2024 | 388 376.0 |
| Upr Mon'tl | | UMM-TLA-0.5-2-XUCL UMM-TLA-0.5-3-X01 | Tailings Tailings | 0.5 - 1 0.5 - 1 | 10/2/2024 10/2/2024 | <u>376.9</u> 100 |
| | 1 | UMM-TLA-0.5-3-X01 | Tailings | 0.5 - 1 | 10/2/2024 | 104 |
| | | UMM-TLA-0.5-3-X03 | Tailings | 0.5 - 1 | 10/2/2024 | <u>147</u> |
| | | UMM-TLA-0.5-3-X04 | Tailings | 0.5 - 1 | 10/2/2024 | 55 |
| | LINANA TIA 2 | UMM-TLA-0.5-3-X05 | Tailings | 0.5 - 1 | 10/2/2024 | 63 |
| | UMM-TLA-3 | UMM-TLA-0.5-3-X06 UMM-TLA-0.5-3-X07 | Tailings Tailings | 0.5 - 1 0.5 - 1 | 10/2/2024 10/2/2024 | <u>144</u> 11 |
| | | UMM-TLA-0.5-3-X07 | Tailings | 0.5 - 1 | 10/2/2024 | 13 |
| | | UMM-TLA-0.5-3-X09 | Tailings | 0.5 - 1 | 10/2/2024 | 13 |
| | 1 | UMM-TLA-0.5-3-X10 | Tailings | 0.5 - 1 | 10/2/2024 | <u>152</u> |
| | | UMM-TLA-0.5-3-XUCL | Tailings | 0.5 - 1 | 10/2/2024 | <u>113.3</u> |

Table 2
Summary of XRF Measurements
Supplemental Site Investigation Report
Upper Granite Creek Watershed Mines
Wallowa-Whitman National Forest, Oregon

| | | | | 1 | | Metals |
|------------|------------------|---|----------------------|--------------------|------------------------|----------------------------|
| | | | | Collection Depth | | - Wickers |
| AOI | Location | Field Sample ID | Material | (ft bgs) | Sample Date | Arsenic |
| | | Tailings PRO Waste Rock/Soi | | | | 110 190 |
| | | UMM-TLA-0.5-4-X01 | Tailings | 0.5 - 1 | 10/2/2024 | 72 |
| | | UMM-TLA-0.5-4-DUP-X01 | Tailings | 0.5 - 1 | 10/2/2024 | 81 |
| | | UMM-TLA-0.5-4-X02 | Tailings | 0.5 - 1 | 10/2/2024 | 59 |
| | | UMM-TLA-0.5-4-DUP-X02 | Tailings Tailings | 0.5 - 1 0.5 - 1 | 10/2/2024 | 72 85 |
| | UMM-TLA-4 | UMM-TLA-0.5-4-X03 UMM-TLA-0.5-4-DUP-X03 | Tailings | 0.5 - 1 | 10/2/2024 10/2/2024 | 64 |
| | | UMM-TLA-0.5-4-X04 | Tailings | 0.5 - 1 | 10/2/2024 | 86 |
| | | UMM-TLA-0.5-4-DUP-X04 | Tailings | 0.5 - 1 | 10/2/2024 | 73 |
| | | UMM-TLA-0.5-4-XUCL | Tailings | 0.5 - 1 | 10/2/2024 | 90.46 |
| | | UMM-TLA-0.5-4-DUP-XUCL UMM-TLA-0.5-5-X01 | Tailings Tailings | 0.5 - 1 0.5 - 1 | 10/2/2024 10/2/2024 | 80.68 38 |
| | | UMM-TLA-0.5-5-DUP-X01 | Tailings | 0.5 - 1 | 10/2/2024 | 33 |
| | | UMM-TLA-0.5-5-X02 | Tailings | 0.5 - 1 | 10/2/2024 | 39 |
| | UMM-TLA-5 | UMM-TLA-0.5-5-DUP-X02 | Tailings | 0.5 - 1 | 10/2/2024 | 47 |
| | | UMM-TLA-0.5-5-X03 UMM-TLA-0.5-5-DUP-X03 | Tailings Tailings | 0.5 - 1 0.5 - 1 | 10/2/2024 10/2/2024 | 46 44 |
| | | UMM-TLA-0.5-5-X04 | Tailings | 0.5 - 1 | 10/2/2024 | 31 |
| | | UMM-TLA-0.5-5-DUP-X04 | Tailings | 0.5 - 1 | 10/2/2024 | 35 |
| | UMM-TLA-5 | UMM-TLA-0.5-5-XUCL | Tailings | 0.5 - 1 | 10/2/2024 | 45.72 |
| | | UMM-TLA-0.5-5-DUP-XUCL | Tailings | 0.5 - 1 | 10/2/2024 | 47.75 |
| | | UMM-TLA-0.5-6-X01 UMM-TLA-0.5-6-X02 | Tailings Tailings | 0.5 - 1 0.5 - 1 | 10/2/2024 10/2/2024 | <u>2576</u> 3177 |
| | | UMM-TLA-0.5-6-X03 | Tailings | 0.5 - 1 | 10/2/2024 | 3357 |
| | | UMM-TLA-0.5-6-X04 | Tailings | 0.5 - 1 | 10/2/2024 | <u>3096</u> |
| | | UMM-TLA-0.5-6-X05 | Tailings | 0.5 - 1 | 10/2/2024 | <u>3018</u> |
| | UMM-TLA-6 | UMM-TLA-0.5-6-X06 UMM-TLA-0.5-6-X07 | Tailings Tailings | 0.5 - 1 0.5 - 1 | 10/2/2024 10/2/2024 | <u>2930</u> <u>3402</u> |
| | | UMM-TLA-0.5-6-X08 | Tailings | 0.5 - 1 | 10/2/2024 | 2821 |
| | | UMM-TLA-0.5-6-X09 | Tailings | 0.5 - 1 | 10/2/2024 | 3293 |
| | | UMM-TLA-0.5-6-X10 | Tailings | 0.5 - 1 | 10/2/2024 | <u>3070</u> |
| | | UMM-TLA-0.5-6-XUCL | Tailings | 0.5 - 1 | 10/2/2024 | <u>3221</u> |
| | | UMM-TLB-0.5-1-X01 UMM-TLB-0.5-1-X02 | Tailings Tailings | 0.5 - 1 0.5 - 1 | 10/2/2024 10/2/2024 | 2731 2881 |
| | | UMM-TLB-0.5-1-X03 | Tailings | 0.5 - 1 | 10/2/2024 | 3414 |
| | | UMM-TLB-0.5-1-X04 | Tailings | 0.5 - 1 | 10/2/2024 | <u>3611</u> |
| | LINANA TI D 4 | UMM-TLB-0.5-1-X05 | Tailings | 0.5 - 1 | 10/2/2024 | <u>3164</u> |
| Upr Mon'tl | UMM-TLB-1 | UMM-TLB-0.5-1-X06 UMM-TLB-0.5-1-X07 | Tailings Tailings | 0.5 - 1 0.5 - 1 | 10/2/2024 10/2/2024 | 3822 2765 |
| Opi Won ti | | UMM-TLB-0.5-1-X08 | Tailings | 0.5 - 1 | 10/2/2024 | 2889 |
| | | UMM-TLB-0.5-1-X09 | Tailings | 0.5 - 1 | 10/2/2024 | 2806 |
| | | UMM-TLB-0.5-1-X10 | Tailings | 0.5 - 1 | 10/2/2024 | <u>3115</u> |
| | | UMM-TLB-0.5-1-XUCL | Tailings | 0.5 - 1 | 10/2/2024 | 3341 |
| | | UMM-TLB-0.5-2-X01 UMM-TLB-0.5-2-X02 | Tailings Tailings | 0.5 - 1 0.5 - 1 | 10/2/2024 10/2/2024 | <u>519</u> 510 |
| | | UMM-TLB-0.5-2-X03 | Tailings | 0.5 - 1 | 10/2/2024 | 2130 |
| | | UMM-TLB-0.5-2-X04 | Tailings | 0.5 - 1 | 10/2/2024 | <u>2073</u> |
| | LINANA TID O | UMM-TLB-0.5-2-X05 | Tailings | 0.5 - 1 | 10/2/2024 | <u>2865</u> |
| | UMM-TLB-2 | UMM-TLB-0.5-2-X06 UMM-TLB-0.5-2-X07 | Tailings Tailings | 0.5 - 1 0.5 - 1 | 10/2/2024 10/2/2024 | <u>606</u> 676 |
| | | UMM-TLB-0.5-2-X08 | Tailings | 0.5 - 1 | 10/2/2024 | 271 |
| | | UMM-TLB-0.5-2-X09 | Tailings | 0.5 - 1 | 10/2/2024 | <u>221</u> |
| | | UMM-TLB-0.5-2-X10 | Tailings | 0.5 - 1 | 10/2/2024 | 467 |
| | - | UMM-TLB-0.5-2-XUCL UMM-TLB-0.5-3-X01 | Tailings Tailings | 0.5 - 1 0.5 - 1 | 10/2/2024 10/2/2024 | <u>2473</u> 471 |
| | | UMM-TLB-0.5-3-X02 | Tailings | 0.5 - 1 | 10/2/2024 | <u>471</u> 674 |
| | | UMM-TLB-0.5-3-X03 | Tailings | 0.5 - 1 | 10/2/2024 | <u>526</u> |
| | | UMM-TLB-0.5-3-X04 | Tailings | 0.5 - 1 | 10/2/2024 | <u>504</u> |
| | UMM-TLB-3 | UMM-TLB-0.5-3-X05 | Tailings | 0.5 - 1 0.5 - 1 | 10/2/2024 | <u>730</u> 377 |
| | O IVIIVI- I LD-3 | UMM-TLB-0.5-3-X06 UMM-TLB-0.5-3-X07 | Tailings Tailings | 0.5 - 1 | 10/2/2024 10/2/2024 | 3// 1143 |
| | | UMM-TLB-0.5-3-X08 | Tailings | 0.5 - 1 | 10/2/2024 | 1098 |
| | | UMM-TLB-0.5-3-X09 | Tailings | 0.5 - 1 | 10/2/2024 | 401 |
| | | UMM-TLB-0.5-3-X10 | Tailings | 0.5 - 1 | 10/2/2024 | <u>367</u> |
| | | UMM-TLB-0.5-3-XUCL UMM-TLB-0.5-4-X01 | Tailings Tailings | 0.5 - 1 0.5 - 1 | 10/2/2024 10/2/2024 | <u>794.4</u> 2033 |
| | | UMM-TLB-0.5-4-X02 | Tailings | 0.5 - 1 | 10/2/2024 | <u>2033</u> <u>1571</u> |
| | | UMM-TLB-0.5-4-X03 | Tailings | 0.5 - 1 | 10/2/2024 | 1251 |
| | | UMM-TLB-0.5-4-X04 | Tailings | 0.5 - 1 | 10/2/2024 | 1374 |
| | UMM-TLB-4 | UMM-TLB-0.5-4-X05 | Tailings | 0.5 - 1 | 10/2/2024 | 1777 1254 |
| | UIVIIVI-1LB-4 | UMM-TLB-0.5-4-X06 UMM-TLB-0.5-4-X07 | Tailings Tailings | 0.5 - 1 0.5 - 1 | 10/2/2024 10/2/2024 | <u>1354</u> <u>1334</u> |
| | | UMM-TLB-0.5-4-X08 | Tailings | 0.5 - 1 | 10/2/2024 | 1127 |
| | | UMM-TLB-0.5-4-X09 | Tailings | 0.5 - 1 | 10/2/2024 | <u>1211</u> |
| | | UMM-TLB-0.5-4-X10 | Tailings | 0.5 - 1 | 10/2/2024 | <u>1713</u> |
| | | UMM-TLB-0.5-4-XUCL | Tailings | 0.5 - 1 | 10/2/2024 | <u>1642</u> |

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Supplemental Site Investigation Report
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Wallowa-Whitman National Forest, Oregon

| | | | | | | Metals |
|------------|-------------------|---|---------------------------------|-------------------------|------------------------|---------------------------|
| | | | | Collection Depth | | |
| AOI | Location | Field Sample ID | Material | (ft bgs) | Sample Date | Arsenic |
| | | Tailings PF Waste Rock/So | | | | 110 190 |
| | | UMM-TLC-0.5-1-X01 | Tailings | 0.5 - 1 | 10/2/2024 | <u>987</u> |
| | | UMM-TLC-0.5-1-X02 | Tailings | 0.5 - 1 | 10/2/2024 | <u>746</u> |
| | | UMM-TLC-0.5-1-X03 | Tailings | 0.5 - 1 | 10/2/2024 | <u>897</u> |
| | | UMM-TLC-0.5-1-X04 UMM-TLC-0.5-1-X05 | Tailings Tailings | 0.5 - 1 0.5 - 1 | 10/2/2024 10/2/2024 | <u>410</u> <u>1366</u> |
| | UMM-TLC-1 | UMM-TLC-0.5-1-X06 | Tailings | 0.5 - 1 | 10/2/2024 | 1347 |
| | | UMM-TLC-0.5-1-X07 | Tailings | 0.5 - 1 | 10/2/2024 | 1403 |
| | | UMM-TLC-0.5-1-X08 | Tailings | 0.5 - 1 | 10/2/2024 | <u>1969</u> |
| | | UMM-TLC-0.5-1-X09 | Tailings | 0.5 - 1 | 10/2/2024 | <u>960</u> |
| | | UMM-TLC-0.5-1-X10 UMM-TLC-0.5-1-XUCL | Tailings Tailings | 0.5 - 1 0.5 - 1 | 10/2/2024 10/2/2024 | <u>643</u> 1336 |
| | | UMM-TLC-0.5-2-X01 | Tailings | 0.5 - 1 | 10/2/2024 | 2564 |
| | | UMM-TLC-0.5-2-X02 | Tailings | 0.5 - 1 | 10/2/2024 | 2682 |
| | | UMM-TLC-0.5-2-X03 | Tailings | 0.5 - 1 | 10/2/2024 | <u>2880</u> |
| | | UMM-TLC-0.5-2-X04 | Tailings | 0.5 - 1 | 10/2/2024 | <u>3389</u> |
| | UMM-TLC-2 | UMM-TLC-0.5-2-X05 UMM-TLC-0.5-2-X06 | Tailings Tailings | 0.5 - 1 0.5 - 1 | 10/2/2024 10/2/2024 | <u>2771</u> 2930 |
| | OIVIIVI-1EC-2 | UMM-TLC-0.5-2-X07 | Tailings | 0.5 - 1 | 10/2/2024 | 2642 |
| | | UMM-TLC-0.5-2-X08 | Tailings | 0.5 - 1 | 10/2/2024 | 2125 |
| | | UMM-TLC-0.5-2-X09 | Tailings | 0.5 - 1 | 10/2/2024 | <u>1794</u> |
| | | UMM-TLC-0.5-2-X10 | Tailings | 0.5 - 1 | 10/2/2024 | <u>2435</u> |
| | | UMM-TLC-0.5-2-XUCL UMM-WRA-0.5-1-X01 | Tailings Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/2/2024 10/2/2024 | 2877 1127 |
| | | UMM-WRA-0.5-1-X02 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | 654 |
| | LINANA NA/DA 4 | UMM-WRA-0.5-1-X03 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | 661 |
| | UMM-WRA-1 | UMM-WRA-0.5-1-X04 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | <u>597</u> |
| | | UMM-WRA-0.5-1-X05 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | <u>1876</u> |
| | | UMM-WRA-0.5-1-X06 | Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/2/2024 10/2/2024 | <u>712</u> 672 |
| | | UMM-WRA-0.5-1-X07 UMM-WRA-0.5-1-X08 | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | 604 |
| | UMM-WRA-1 | UMM-WRA-0.5-1-X09 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | <u>1234</u> |
| | | UMM-WRA-0.5-1-X10 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | 922 |
| | | UMM-WRA-0.5-1-XUCL | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | <u>1143</u> |
| Upr Mon'tl | | UMM-WRA-0.5-1-DS-X01 | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/2/2024 | 44 30 |
| | | UMM-WRA-0.5-1-DS-X02 UMM-WRA-0.5-1-DS-X03 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 10/2/2024 | 65 |
| | LINANA VA/DA 1 DC | UMM-WRA-0.5-1-DS-X04 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | 45 |
| | UMM-WRA-1-DS | UMM-WRA-0.5-1-DS-X05 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | 75 |
| | | UMM-WRA-0.5-1-DS-X06 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | 61 |
| | | UMM-WRA-0.5-1-DS-X07 UMM-WRA-0.5-1-DS-XUCL | Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/2/2024 10/2/2024 | 44 63.38 |
| | | UMM-WRA-0.5-2-X01 | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | 768 |
| | | UMM-WRA-0.5-2-X02 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | 306 |
| | | UMM-WRA-0.5-2-X03 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | <u>357</u> |
| | | UMM-WRA-0.5-2-X04 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | <u>310</u> |
| | UMM-WRA-2 | UMM-WRA-0.5-2-X05 UMM-WRA-0.5-2-X06 | Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/2/2024 | <u>409</u> 352 |
| | OTVITVE VVICA-2 | UMM-WRA-0.5-2-X07 | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 | 10/2/2024 10/2/2024 | 252 |
| | | UMM-WRA-0.5-2-X08 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | <u>279</u> |
| | | UMM-WRA-0.5-2-X09 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | <u>409</u> |
| | | UMM-WRA-0.5-2-X10 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | <u>509</u> |
| | | UMM-WRA-0.5-2-XUCL UMM-WRA-0.5-2-DS-X01 | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/2/2024 10/2/2024 | <u>482.6</u> 58 |
| | | UMM-WRA-0.5-2-DS-X02 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | 51 |
| | UMM-WRA-2-DS | UMM-WRA-0.5-2-DS-X03 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | 68 |
| | | UMM-WRA-0.5-2-DS-X04 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | 52 |
| | | UMM-WRA-0.5-2-DS-XUCL | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | 66.43 |
| | | UMM-WRA-0.5-3-X01 UMM-WRA-0.5-3-X02 | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/2/2024 10/2/2024 | <u>1142</u> 735 |
| | | UMM-WRA-0.5-3-X02 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | 978 |
| | | UMM-WRA-0.5-3-X04 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | <u>1093</u> |
| | | UMM-WRA-0.5-3-X05 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | <u>1287</u> |
| | UMM-WRA-3 | UMM-WRA-0.5-3-X06 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | <u>1376</u> |
| | | UMM-WRA-0.5-3-X07 | Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/2/2024 | <u>894</u> 128 |
| | | UMM-WRA-0.5-3-X08 UMM-WRA-0.5-3-X09 | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 | 10/2/2024 10/2/2024 | 716 |
| | | UMM-WRA-0.5-3-X10 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | <u>710</u> <u>1282</u> |
| | | UMM-WRA-0.5-3-XUCL | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | 1178 |

Table 2
Summary of XRF Measurements
Supplemental Site Investigation Report
Upper Granite Creek Watershed Mines
Wallowa-Whitman National Forest, Oregon

| | | | | | | Metals |
|------------|--------------|--|---------------------------------|--------------------|------------------------|----------------------------|
| | | | | Collection Depth | | |
| AOI | Location | Field Sample ID | Material | (ft bgs) | Sample Date | Arsenic |
| | | Tailings PF Waste Rock/So | | | | 110 190 |
| | | UMM-WRA-0.5-4-X01 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | 320 |
| | | UMM-WRA-0.5-4-X02 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | <u>256</u> |
| | UMM-WRA-4 | UMM-WRA-0.5-4-X03 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | <u>310</u> |
| | | UMM-WRA-0.5-4-X04 UMM-WRA-0.5-4-X05 | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/2/2024 10/2/2024 | <u>246</u> 278 |
| | | UMM-WRA-0.5-4-XUCL | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | 313 |
| | | UMM-WRA-0.5-4-DS-X01 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | 53 |
| | | UMM-WRA-0.5-4-DS-X02 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | 58 |
| | UMM-WRA-4-DS | UMM-WRA-0.5-4-DS-X03 UMM-WRA-0.5-4-DS-X04 | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/2/2024 10/2/2024 | 60 57 |
| | | UMM-WRA-0.5-4-DS-XUCL | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | 60.46 |
| | | UMM-WRA-0.5-5-X01 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | 76 |
| | | UMM-WRA-0.5-5-X02 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | 53 |
| | UMM-WRA-5 | UMM-WRA-0.5-5-X03 UMM-WRA-0.5-5-X04 | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/2/2024 10/2/2024 | 67 58 |
| | | UMM-WRA-0.5-5-XUCL | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | 75.44 |
| | | UMM-WRA-0.5-6-X01 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | 1119 |
| | | UMM-WRA-0.5-6-X02 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | <u>679</u> |
| | | UMM-WRA-0.5-6-X03 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | <u>572</u> |
| | | UMM-WRA-0.5-6-X04 UMM-WRA-0.5-6-X05 | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/2/2024 10/2/2024 | <u>669</u> 905 |
| | UMM-WRA-6 | UMM-WRA-0.5-6-X06 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | <u>304</u> |
| | | UMM-WRA-0.5-6-X07 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | 419 |
| | | UMM-WRA-0.5-6-X08 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | <u>657</u> |
| | | UMM-WRA-0.5-6-X09 UMM-WRA-0.5-6-X10 | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/2/2024 10/2/2024 | 483 905 |
| | | UMM-WRA-0.5-6-XUCL | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | <u>303</u> 815 |
| | | UMM-WRA-0.5-7-X01 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | <u>975</u> |
| | | UMM-WRA-0.5-7-X02 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | <u>447</u> |
| | UMM-WRA-7 | UMM-WRA-0.5-7-X03 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | <u>566</u> |
| | | UMM-WRA-0.5-7-X04 UMM-WRA-0.5-7-X05 | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/2/2024 10/2/2024 | <u>490</u> 326 |
| | | UMM-WRA-0.5-7-X06 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | <u>506</u> |
| | | UMM-WRA-0.5-7-X07 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | <u>506</u> |
| | | UMM-WRA-0.5-7-X08 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | <u>422</u> |
| | | UMM-WRA-0.5-7-X09 UMM-WRA-0.5-7-X10 | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/2/2024 10/2/2024 | 608 434 |
| | | UMM-WRA-0.5-7-XUCL | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | 629.8 |
| Upr Mon'tl | UMM-WRA-8 | UMM-WRA-0.5-8-X01 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | 601 |
| | | UMM-WRA-0.5-8-X02 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | <u>873</u> |
| | | UMM-WRA-0.5-8-X03 UMM-WRA-0.5-8-X04 | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/2/2024 10/2/2024 | <u>549</u> 532 |
| | | UMM-WRA-0.5-8-X05 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | 634 |
| | | UMM-WRA-0.5-8-X06 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | 807 |
| | | UMM-WRA-0.5-8-X07 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | <u>593</u> |
| | | UMM-WRA-0.5-8-X08 UMM-WRA-0.5-8-X09 | Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/2/2024 | <u>672</u> 593 |
| | UMM-WRA-8 | UMM-WRA-0.5-8-X10 | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 | 10/2/2024 10/2/2024 | 602 |
| | | UMM-WRA-0.5-8-XUCL | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | 709.8 |
| | | UMM-WRB-0.5-1-X01 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | <u>12620</u> |
| | | UMM-WRB-0.5-1-X02 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | 9000 |
| | | UMM-WRB-0.5-1-X03 UMM-WRB-0.5-1-X04 | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/2/2024 10/2/2024 | 16800 11060 |
| | | UMM-WRB-0.5-1-X05 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | 13550 |
| | UMM-WRB-1 | UMM-WRB-0.5-1-X06 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | <u>13770</u> |
| | | UMM-WRB-0.5-1-X07 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | <u>8550</u> |
| | | UMM-WRB-0.5-1-X08 UMM-WRB-0.5-1-X09 | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/2/2024 10/2/2024 | <u>16020</u> 13720 |
| | | UMM-WRB-0.5-1-X10 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | 10030 |
| | | UMM-WRB-0.5-1-XUCL | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | 14142 |
| | | UMM-WRB-0.5-2-X01 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | <u>2151</u> |
| | | UMM-WRB-0.5-2-X02 UMM-WRB-0.5-2-X03 | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/2/2024 10/2/2024 | <u>1862</u> 1412 |
| | | UMM-WRB-0.5-2-X04 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | 2565 |
| | | UMM-WRB-0.5-2-X05 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | <u>1692</u> |
| | UMM-WRB-2 | UMM-WRB-0.5-2-X06 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | <u>1422</u> |
| | | UMM-WRB-0.5-2-X07 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | <u>1474</u> |
| | | UMM-WRB-0.5-2-X08 UMM-WRB-0.5-2-X09 | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/2/2024 10/2/2024 | <u>1744</u> <u>1326</u> |
| | | UMM-WRB-0.5-2-X10 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | 1911 |
| | | UMM-WRB-0.5-2-XUCL | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | <u>1980</u> |
| | | UMM-WRB-0.5-2-DS-X01 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | 67 |
| | | UMM-WRB-0.5-2-DS-X02 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | 66 |
| | UMM-WRB-2-DS | | | | | |
| | UMM-WRB-2-DS | UMM-WRB-0.5-2-DS-X03 UMM-WRB-0.5-2-DS-X04 | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/2/2024 10/2/2024 | 78 65 |

Table 2
Summary of XRF Measurements
Supplemental Site Investigation Report
Upper Granite Creek Watershed Mines
Wallowa-Whitman National Forest, Oregon

| | | | | | | Metals |
|----------------|------------------|---|---------------------------------|------------------------------|------------------------|---------------------|
| AOI | Location | Field Sample ID | Material | Collection Depth (ft bgs) | Sample Date | Arsenic |
| AUI | Location | Tailings PF | | (it bgs) | Sample Date | 110 |
| | | Waste Rock/So | oil PRG | | | 190 |
| | | UMM-WRB-0.5-3-X01 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | <u>711</u> |
| | | UMM-WRB-0.5-3-X02 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | <u>862</u> |
| | | UMM-WRB-0.5-3-X03 UMM-WRB-0.5-3-X04 | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/2/2024 10/2/2024 | <u>1206</u> 765 |
| | | UMM-WRB-0.5-3-X05 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | 943 |
| Upr Mon'tl | UMM-WRB-3 | UMM-WRB-0.5-3-X06 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | 683 |
| | | UMM-WRB-0.5-3-X07 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | <u>859</u> |
| | | UMM-WRB-0.5-3-X08 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | <u>992</u> |
| | | UMM-WRB-0.5-3-X09 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | <u>1011</u> |
| | | UMM-WRB-0.5-3-X10 UMM-WRB-0.5-3-XUCL | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/2/2024 10/2/2024 | <u>753</u> 972.7 |
| | | UMM-WRB-0.5-4-X01 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | 586 |
| | | UMM-WRB-0.5-4-X02 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | 453 |
| | | UMM-WRB-0.5-4-X03 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | <u>523</u> |
| | | UMM-WRB-0.5-4-X04 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | <u>743</u> |
| | LINANA NA/DD 4 | UMM-WRB-0.5-4-X05 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | <u>686</u> |
| | UMM-WRB-4 | UMM-WRB-0.5-4-X06 UMM-WRB-0.5-4-X07 | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/2/2024 10/2/2024 | <u>891</u> 729 |
| | | UMM-WRB-0.5-4-X08 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | 531 |
| | | UMM-WRB-0.5-4-X09 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | <u>818</u> |
| | | UMM-WRB-0.5-4-X10 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | <u>643</u> |
| | | UMM-WRB-0.5-4-XUCL | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | <u>741.1</u> |
| | | UUMM-WRA-0.5-1-X01 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | <u>911</u> |
| | | UUMM-WRA-0.5-1-X02 UUMM-WRA-0.5-1-X03 | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/2/2024 10/2/2024 | <u>975</u> 1067 |
| | | UUMM-WRA-0.5-1-X04 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | 1270 |
| | | UUMM-WRA-0.5-1-X05 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | 1230 |
| | UUMM-WRA-1 | UUMM-WRA-0.5-1-X06 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | 1190 |
| | | UUMM-WRA-0.5-1-X07 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | <u>1114</u> |
| | | UUMM-WRA-0.5-1-X08 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | <u>981</u> |
| | | UUMM-WRA-0.5-1-X09 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | <u>1160</u> |
| | | UUMM-WRA-0.5-1-X10 UUMM-WRA-0.5-1-XUCL | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/2/2024 10/2/2024 | <u>1124</u> 1170 |
| | | UUMM-WRA-0.5-2-X01 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | 2693 |
| | | UUMM-WRA-0.5-2-X02 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | 1872 |
| | | UUMM-WRA-0.5-2-X03 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | <u>3092</u> |
| | | UUMM-WRA-0.5-2-X04 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | <u>2717</u> |
| | 11110404 14/04 2 | UUMM-WRA-0.5-2-X05 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | <u>2058</u> |
| | UUMM-WRA-2 | UUMM-WRA-0.5-2-X06 UUMM-WRA-0.5-2-X07 | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/2/2024 10/2/2024 | <u>2077</u> 1447 |
| | | UUMM-WRA-0.5-2-X08 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | 1538 |
| Upr Upr Mon'tl | | UUMM-WRA-0.5-2-X09 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | 2066 |
| | | UUMM-WRA-0.5-2-X10 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | <u>1549</u> |
| | | UUMM-WRA-0.5-2-XUCL | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | <u>2435</u> |
| | | UUMM-WRA-0.5-3-X01 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | <u>1490</u> |
| | | UUMM-WRA-0.5-3-X02 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | 1442 |
| | | UUMM-WRA-0.5-3-X03 UUMM-WRA-0.5-3-X04 | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/2/2024 10/2/2024 | <u>1557</u> 1816 |
| | | UUMM-WRA-0.5-3-X05 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | 1409 |
| | UUMM-WRA-3 | UUMM-WRA-0.5-3-X06 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | <u>1673</u> |
| | | UUMM-WRA-0.5-3-X07 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | <u>1402</u> |
| | | UUMM-WRA-0.5-3-X08 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | <u>1730</u> |
| | | UUMM-WRA-0.5-3-X09 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | 1937 |
| | | UUMM-WRA-0.5-3-X10 UUMM-WRA-0.5-3-XUCL | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/2/2024 10/2/2024 | <u>1382</u> 1697 |
| | UUMM-WRA-3-DS | UUMM-WRA-0.5-3-X0CL | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | 21 |
| | | UUMM-WRA-0.5-3-DS-X02 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | 35 |
| | UUMM-WRA-3-DS | UUMM-WRA-0.5-3-DS-X03 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | 22 |
| | OOMINI-WIKA-3-D3 | UUMM-WRA-0.5-3-DS-X04 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | 19 |
| L | | UUMM-WRA-0.5-3-DS-XUCL | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | 32.81 |
| | | UUMM-WRB-0.5-1-X01 UUMM-WRB-0.5-1-X02 | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/2/2024 10/2/2024 | 103 135 |
| | | UUMM-WRB-0.5-1-X03 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | 96 |
| | | UUMM-WRB-0.5-1-X04 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | 202 |
| | | UUMM-WRB-0.5-1-X05 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | 147 |
| | UUMM-WRB-1 | UUMM-WRB-0.5-1-X06 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | 109 |
| | | UUMM-WRB-0.5-1-X07 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | 173 |
| | | UUMM-WRB-0.5-1-X08 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | 184 |
| | | UUMM-WRB-0.5-1-X09 UUMM-WRB-0.5-1-X10 | Waste Rock/Soil Waste Rock/Soil | 0.5 - 1 0.5 - 1 | 10/2/2024 10/2/2024 | 123 106 |
| | Ī | OCIALIAI-AAIVD-0'2-T-VTO | Waste NUCK/SUII | 0.5 - 1 | 10/2/2024 | 100 |

Table 2 **Summary of XRF Measurements** Supplemental Site Investigation Report

Upper Granite Creek Watershed Mines Wallowa-Whitman National Forest, Oregon

| | | | | | | Metals |
|------------------|------------|---------------------|-----------------|------------------|-------------|--------------|
| | | | | Collection Depth | | |
| AOI | Location | Field Sample ID | Material | (ft bgs) | Sample Date | Arsenic |
| | | Tailings PF | RG | | | 110 |
| | | Waste Rock/So | oil PRG | | | 190 |
| | | UUMM-WRC-0.5-1-X01 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | 20 |
| | | UUMM-WRC-0.5-1-X02 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | 18 |
| | UUMM-WRC-1 | UUMM-WRC-0.5-1-X03 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | 16 |
| | | UUMM-WRC-0.5-1-X04 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | 17 |
| | | UUMM-WRC-0.5-1-XUCL | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | 19.76 |
| | | UUMM-WRD-0.5-1-X01 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | <u> 269</u> |
| | | UUMM-WRD-0.5-1-X02 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | <u>282</u> |
| | UUMM-WRD-1 | UUMM-WRD-0.5-1-X03 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | <u>279</u> |
| Jpr Upr Mon'tl | | UUMM-WRD-0.5-1-X04 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | <u>334</u> |
| | | UUMM-WRD-0.5-1-XUCL | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | <u>325.4</u> |
| | | UUMM-WRE-0.5-1-X01 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | 24 |
| | | UUMM-WRE-0.5-1-X02 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | 25 |
| | UUMM-WRE-1 | UUMM-WRE-0.5-1-X03 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | 24 |
| opi opi ivion ti | | UUMM-WRE-0.5-1-X04 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | 26 |
| | | UUMM-WRE-0.5-1-XUCL | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | 25.88 |
| | | UUMM-WRF-0.5-1-X01 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | <u>786</u> |
| | | UUMM-WRF-0.5-1-X02 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | <u>430</u> |
| | | UUMM-WRF-0.5-1-X03 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | <u>372</u> |
| | | UUMM-WRF-0.5-1-X04 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | <u>551</u> |
| | | UUMM-WRF-0.5-1-X05 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | <u>640</u> |
| | UUMM-WRF-1 | UUMM-WRF-0.5-1-X06 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | <u>454</u> |
| | | UUMM-WRF-0.5-1-X07 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | <u>290</u> |
| | | UUMM-WRF-0.5-1-X08 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | <u>468</u> |
| | | UUMM-WRF-0.5-1-X09 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | <u>569</u> |
| | | UUMM-WRF-0.5-1-X10 | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | <u>534</u> |
| | | UUMM-WRF-0.5-1-XUCL | Waste Rock/Soil | 0.5 - 1 | 10/2/2024 | <u>590.8</u> |

Note:

- All concentrations reported in mg/kg (ppm); detection limits in parentheses.
 Underlined concentrations for results from Tailings exceed the Tailings PRG.
- 3. Underlined concentrations for results from Waste Rock/Soil exceed the Waste Rock/Soil PRG.

Aq = Aquatic

Mon'tl = Monumental

PRG = Preliminary Remediation Goal

St = Station

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Table 3
Summary of Soil Analytical Results
Supplemental Site Investigation Report
Upper Granite Creek Watershed Mines
Wallowa-Whitman National Forest, Oregon

| | | | Collection | | | | | | | | Me | tals | | | | | | |
|---------------|------------|------------------------|------------|------------------------|----------------|---------------|--------------------|------------|------------|------------|-------------|------------|--------------|------------|------------|------------|----------------|-------------|
| | | | Depth | Sample | | | | Arsenic. | Arsenic. | | | | | Chromium | | | | |
| AOI | Company | Location | (ft bgs) | Date | Aluminum | Antimony | Arsenic | IVBA | Total IVBA | Barium | Beryllium | Cadmium | Calcium | (total) | Cobalt | Copper | Iron | Lead |
| | PR | G for SAP | | | | 4895 | 82 | | | | 24468 | 9113 | | | 3681 | 489424 | | |
| | Tai | lings PRG | | | | | 110 | | | | | | | | | | | |
| | | Rock/Soil PRG | | | | | 190 | | | | | | | | | | 1 | |
| ODE | Q Blue Mou | ntain Region Clea | n Fill | | | 1.3 | 14 | | | 950 | 2.6 | 0.69 | | 190 | | 120 | | 21 |
| OD | EQ Eco RBC | Plant Direct Toxic | ity | | | 11 | 18 | | | 110 | 2.5 | 32 | | | 13 | 70 | 1 | 120 |
| ODE | Q Eco RBC | Inverts Direct Toxi | city | | | 78 | 6.8 | | | 330 | 40 | 140 | | | | 80 | | 1700 |
| | ODEQ | Eco RBC Bird | | | | | 15 | | | 630 | | 0.29 | | 23 | 76 | 14 | | 11 |
| | ODEQ Ec | o RBC Mammal | | | | 0.27 | 19 | | | 1800 | 21 | 0.27 | | 34 | 230 | 42 | 1 | 56 |
| | ODEQ Excav | ation Worker RCB | } | | | | 420 | | | | 19000 | 9700 | | | | 390000 | | 800 |
| | | BG-SSS-19 | 0.5 | 7/19/2003 | 24400 | 0.84 J | 4.5 | NA | NA | 288 | 1.2 | 0.43 J | 1830 | 31.3 | 11.3 | 30.7 | 24600 | 8.4 |
| | EA | BG-SSS-34 | 0.5 | 7/15/2003 | 26400 | ND (0.38) | 3.4 | NA | NA | 187 | 0.72 | 0.35 J | 1130 | 5.7 | 5.5 | 8.9 | 10800 | 3.8 |
| | LA | BG-SSS-35 | 0.5 | 7/15/2003 | 31200 | ND (0.4) | 5.5 | NA | NA | 268 | 1 | 0.54 | 2110 | 6.2 | 6.7 | 15.4 | 12400 | 5.9 |
| | | BG-SSS-36 | 0.5 | 7/15/2003 | 19400 | ND (0.33) | 11.4 | NA | NA | 319 | 0.55 | ND (0.026) | 2080 | 27.4 | 10.2 | 11 | 17700 | 6.3 |
| | | BGS-01 | | 6/26/2007 | NA | ND (0.2) | 6.2 | NA | NA | NA | 0.6 J | 1.1 | NA | 12 | NA | 8 | 22900 | 8.04 |
| Background | | BGS-02 | | 6/26/2007 | NA | ND (0.2) | 7.8 | NA | NA | NA | 0.6 J | 1.45 | NA | 7 | NA | 10 | 13600 | 5.98 |
| Jaong. Jan. a | | BGS-03 | | 6/26/2007 | NA | 0.2 J | 5.4 | NA | NA | NA | 0.4 J | 0.39 | NA | 11 | NA | 8 | 20300 | 4.58 |
| | CES | BGS-04 | | 6/26/2007 | NA | ND (0.2) | 9 | NA | NA | NA | 0.8 J | 2.03 | NA | 15 | NA | 24 | 16800 | 7.62 |
| | | BGS-05 | | 6/26/2007 | NA | 0.3 J | 11.8 | NA | NA | NA | 0.9 J | 1.85 | NA | 7 | NA | 31 | 13400 | 7.92 |
| | | BGS-06 | | 6/27/2007 | NA | 0.2 J | 15.3 | NA | NA | NA | 0.4 J | 0.51 | NA | 15 | NA | 5 | 29800 | 4.86 |
| | | BGS-07 | 0.5 - 1 | 6/27/2007 | NA | ND (0.2) | 5 | NA | NA | NA | 0.6 J | 1.01 | NA | 12 | NA | 30 | 13600 | 5.93 |
| | | BGS-08 | | 6/27/2007 | NA 13500 | 0.3 J | 43.5 | NA | NA | NA 155 | 0.4 J | 1.11 | NA 1040 | 70 | NA | 67 | 35300 | 7.3 |
| | | TA-SUS-22 | | 7/15/2003 | 12500 | 0.68 J | 6.3 | NA NA | NA | 155 | 0.38 J | ND (0.03) | 1940 2850 | 5.2 | 8 | 3.3 5.5 | 16300 | 2.8 |
| | EA | WP-SUS-20 WP-SUS-21 | 4 2.5 | 7/15/2003 7/15/2003 | 15600 10400 | 0.38 J 2 J | 10.1 <u>198</u> | NA NA | NA NA | 180 177 | 0.48 0.5 | ND (0.027) | 6320 | 8.4 5.5 | 9.1 7.4 | 43.5 | 19700 20700 | 3.6 44.1 |
| | | WP-SUS-21 WP-SUS-39 | | 7/15/2003 | 14900 | 0.61 J | 198 17.5 | NA NA | NA NA | 167 | 0.5 | ND (0.025) | 905 | 9.7 | 9.6 | 43.5 | 19600 | 44.1 |
| | | CM-WR1-1 | | 6/21/2007 | NA | 0.013 | 19.6 | NA NA | NA NA | NA | ND (0.2) | 0.17 J | NA | 11 | NA | 4 J | 20500 | 5.71 |
| Cap Martin | | CM-WR2-1 | | 6/21/2007 | NA NA | ND (0.2) | 9.7 | NA NA | NA NA | NA NA | ND (0.2) | 0.33 | NA NA | 9 | NA NA | 3 J | 15500 | 4.26 |
| | CES | CM-WR2-2 | | 6/21/2007 | NA | ND (0.2) | 26.5 | NA NA | NA | NA | ND (0.2) | 0.2 J | NA | 11 | NA | 4 J | 12400 | 4.68 |
| | | CM-WR3-1 | | 6/21/2007 | NA | 0.9 J | 131 | NA | NA | NA | 0.7 J | 0.27 J | NA | 3 J | NA | 3 | 16800 | 12.9 |
| | | CM-WR4-1 | 0.5 | 6/21/2007 | NA | ND (1) | 257 | NA | NA | NA | 0.3 J | 8.48 | NA | 6 | NA | 12 | 28800 | 105 |
| | TEI | CM-WRC-4 | 0.5 - 1 | 10/3/2024 | NA | NA | 292 (0.42) | 33.1 (1.9) | 650 (4.9) | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | TA-SUS-33 | | 7/10/2003 | 11100 | 1.3 J | 27.4 | NA | NA | 124 | 0.2 J | 0.36 J | 1380 | 9.8 | 7.2 | 12.6 | 16900 | 9.9 |
| | EA | WP-SSS-31 | 0.5 | 7/10/2003 | 11100 | 5.9 J | <u>295</u> | NA | NA | 223 | 0.28 J | 3.4 | 2110 | 10.4 | 8.5 | 56.2 | 31400 | 358 |
| | EA | WP-SUS-31 | 4.5 | 7/10/2003 | 10900 | 2.3 J | <u>150</u> | NA | NA | 179 | 0.29 J | 2.2 | 2270 | 8.4 | 8.1 | 30.6 | 26500 | 53 |
| Central | | WP-SUS-32 | | 7/10/2003 | 17600 | 1.8 J | <u>106</u> | NA | NA | 225 | 0.3 J | 1.1 | 1900 | 13.3 | 9.9 | 16.3 | 28200 | 22.9 |
| Cellulai | | CEM-WRA-2 | 0.5 - 1 | 10/5/2024 | NA | NA | <u>299 (8.3)</u> | 44.5 (2) | 794 (5) | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | TEI | CEM-WRA-4-DS | 0.5 - 1 | 10/2/2024 | NA | NA | 32.6 (0.4) | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | '- | CEM-WRB-1 | 0.5 - 1 | 10/5/2024 | NA | NA | <u>151 (8.6)</u> | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | CEM-WRC-1 | 0.5 - 1 | 10/5/2024 | NA | NA | <u>110 (8)</u> | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |

Table 3
Summary of Soil Analytical Results
Supplemental Site Investigation Report
Upper Granite Creek Watershed Mines
Wallowa-Whitman National Forest, Oregon

| | | | Collection | | | | | | | | Me | tals | | | | | | |
|----------------------------|-----------|------------------------|--------------------|-----------|----------|----------|--------------------------------------|----------------|-----------------|----------|-----------|----------------|----------|----------|----------|----------|----------|------------|
| | | | Depth | Sample | | | | Arsenic, | Arsenic, | | | | | Chromium | | | | |
| AOI | Company | Location | (ft bgs) | Date | Aluminum | Antimony | Arsenic | IVBA | Total IVBA | Barium | Beryllium | Cadmium | Calcium | (total) | Cobalt | Copper | Iron | Lead |
| | | G for SAP | , , | ı | | 4895 | 82 | | | | 24468 | 9113 | | | 3681 | 489424 | | |
| | Та | ilings PRG | | | | | 110 | | | | | | | | | | | |
| | Waste | Rock/Soil PRG | | | | | 190 | | | | | | | | | | | |
| ODEQ | Blue Mo | untain Region Clear | n Fill | | | 1.3 | 14 | | | 950 | 2.6 | 0.69 | | 190 | | 120 | | 21 |
| ODE | Q Eco RB | C Plant Direct Toxici | ity | | | 11 | 18 | | | 110 | 2.5 | 32 | | | 13 | 70 | | 120 |
| ODEC | Q Eco RBC | Inverts Direct Toxio | city | | | 78 | 6.8 | | | 330 | 40 | 140 | | | | 80 | | 1700 |
| | ODEQ | Eco RBC Bird | | | | | 15 | | | 630 | | 0.29 | | 23 | 76 | 14 | | 11 |
| | ODEQ E | o RBC Mammal | | | | 0.27 | 19 | | | 1800 | 21 | 0.27 | | 34 | 230 | 42 | | 56 |
| 0 | DEQ Exca | vation Worker RCB | | | | | 420 | | | | 19000 | 9700 | | | | 390000 | | 800 |
| | | GF-WR-01 | 1 | 6/25/2007 | NA | 0.6 J | 28.7 | NA | NA | NA | 0.3 J | 1 | NA | 20 | NA | 12 | 26300 | 14.8 |
| | CES | GF-WR-2 | 0.5 | 6/25/2007 | NA | 30 J | <u>1340</u> | NA | NA | NA | ND (0.2) | 1.36 | NA | 6 | NA | 114 | 97300 | 2430 |
| | CES | GF-WR2-1 | 0.5 | 6/21/2007 | NA | 3.1 | <u>141</u> | NA | NA | NA | 0.3 J | 4.07 | NA | 12 | NA | 22 | 30500 | 143 |
| Golden Fraction | | GF-WR-3 | 0.5 | 6/25/2007 | NA | 1.5 | <u>89</u> | NA | NA | NA | 0.3 J | 0.85 | NA | 18 | NA | 15 | 35600 | 4.89 |
| Golden Fraction | | GF-DR-1 | 0.5 - 1 | 10/5/2024 | NA | NA | 58.3 (8.4) | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | TEI | GF-WRA-1 | 0.5 - 1 | 10/5/2024 | NA | NA | <u>332 (7.8)</u> | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | '-' | GF-WRD-4-DS | 0.5 - 1 | 10/5/2024 | NA | NA | 55.2 (8.5) | 12.3 (2) | 137 (4.9) | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | GF-WRD-6 | 0.5 - 1 | 10/5/2024 | NA | NA | 66.6 (7.9) | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | CES | GC5-WR-01 | 0.5 | 6/26/2007 | NA | 1.4 | <u>155</u> | NA | NA | NA | 0.3 J | 3.35 | NA | 13 | NA | 34 | 27300 | 35.8 |
| | | GC5-WR-02 | 0.5 | 6/26/2007 | NA | 2.4 | <u>170</u> | NA | NA | NA | 0.4 J | 4.77 | NA | 18 | NA | 61 | 30600 | 88.5 |
| Granite Creek #5 | | GC5-WRA-3 | 0.5 - 1 | 10/4/2024 | NA | NA | <u>421 (8)</u> | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | TEI | GC5-WRA-4 | 0.5 - 1 | 10/4/2024 | NA | NA | <u>160 (7.8)</u> | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | GC5-WRA-4-DS | 0.5 - 1 | 10/4/2024 | NA | NA | 81.3 (7.9) | 10.4 (1.9) | 221 (5) | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | GC6-WR-01 | 0.5 | 6/24/2007 | NA | ND (0.2) | 9.3 | NA | NA | NA | ND (0.2) | 0.21 | NA | 9 | NA | 14 | 20700 | 1.49 |
| Constitution Constitution | CES | GC6-WR-02 | 0.5 | 6/24/2007 | NA | ND (0.2) | 6.6 | NA | NA | NA | 0.3 J | 0.24 | NA | 10 | NA NA | 6 | 21400 | 3.37 |
| Granite Creek #6 | | GC6-WR-03 | 0.5 | 6/24/2007 | NA | ND (0.2) | 1.7 | NA | NA | NA | ND (0.2) | 0.29 J | NA | ND (1) | NA | 4 J | 2650 | 0.85 |
| | TEI | GC6-WRA-1 GC6-WRA-2 | 0.5 - 1 0.5 - 1 | 10/4/2024 | NA NA | NA NA | <u>257 (8.5)</u> 504 (8.5) | NA 29.3 (2) | NA 759 (4.9) | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA |
| | | GC6-WRA-2 GC7-WR-01 | | 6/24/2007 | | 19 | | 29.3 (2) NA | 759 (4.9) NA | NA NA | 0.4 J | 1.84 | NA NA | 6 | NA NA | 120 | 22600 | 81.7 |
| | | GC7-WR-01 GC7-WR-02 | 0.5 0.5 | 6/24/2007 | NA NA | 2.5 | <u>185</u> 142 | NA NA | NA NA | NA NA | 0.4 J | 0.5 | NA NA | 7 | NA NA | 17 | 28500 | 19 |
| Granite Creek 7 | CES | GC7-WR-02 GC7-WR-03 | 0.5 | 6/24/2007 | NA NA | 7.6 | <u>142</u> 220 | NA NA | NA NA | NA NA | 0.6 J | 0.76 | NA NA | 3 | NA NA | 66 | 25100 | 17.1 |
| | | GC7-WR-03 | 0.5 | 6/24/2007 | NA NA | 0.4 J | 22.9 | NA NA | NA NA | NA NA | 0.8 J | 0.76 0.27 J | NA NA | 9 | NA NA | 9 | 22500 | 4.94 |
| | | GC7-WR-04 | 0.5 - 1 | 10/4/2024 | NA NA | NA | 26.9 (8.5) | NA NA | NA NA | NA NA | NA | NA | NA NA | NA | NA NA | NA | NA | 4.94 NA |
| | TEI | GC7-WRA-3 | 0.5 - 1 | 10/4/2024 | NA NA | NA NA | 7.43 (0.43) | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA |
| Granite Creek Aq. St. 3 | CES | GC3-WR-01 | 0.5 | 6/24/2007 | NA NA | 7.2 | 337 | NA NA | NA NA | NA NA | 0.3 J | 7.97 | NA NA | 7 | NA NA | 57 | 29900 | 152 |
| 5. ate 6/ cett / tq. 5t. 5 | 0.0 | 303 7777 01 | 0.5 | 5,21,2007 | 1471 | 7.12 | <u>557</u> | 1471 | 1471 | 1471 | 0.53 | 7.57 | 147. | | 1471 | | 23300 | 132 |

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Table 3
Summary of Soil Analytical Results
Supplemental Site Investigation Report
Upper Granite Creek Watershed Mines
Wallowa-Whitman National Forest, Oregon

| | | | Collection | | | | | | | | Me | tals | | | | | | |
|------------|---------|----------------------|--------------------|------------------------|----------|----------|----------------------------------|------------|------------|----------|-----------|------------|----------|----------|----------|----------|----------|----------|
| | | | Depth | Sample | | | | Arsenic, | Arsenic, | | | | | Chromium | | | | |
| AOI | Company | Location | (ft bgs) | Date | Aluminum | Antimony | Arsenic | IVBA | Total IVBA | Barium | Beryllium | Cadmium | Calcium | (total) | Cobalt | Copper | Iron | Lead |
| 7.6. | | G for SAP | (10.083) | Dute | | 4895 | 82 | | | | 24468 | 9113 | | | 3681 | 489424 | | |
| | | ilings PRG | | | | | 110 | | | | | | | | | | | |
| | | Rock/Soil PRG | | | | | 190 | | | | | | | | | | | |
| ODE | | ıntain Region Clear | ı Fill | | | 1.3 | 14 | | | 950 | 2.6 | 0.69 | | 190 | | 120 | | 21 |
| | - | Plant Direct Toxici | | | | 11 | 18 | | | 110 | 2.5 | 32 | | | 13 | 70 | | 120 |
| | | Inverts Direct Toxic | | | | 78 | 6.8 | | | 330 | 40 | 140 | | | | 80 | | 1700 |
| | | Eco RBC Bird | | | | | 15 | | | 630 | | 0.29 | | 23 | 76 | 14 | | 11 |
| | | o RBC Mammal | | | | 0.27 | 19 | | | 1800 | 21 | 0.27 | | 34 | 230 | 42 | | 56 |
| | | vation Worker RCB | | | | | 420 | | | | 19000 | 9700 | | | | 390000 | | 800 |
| | | ML-SSS-38 | 0.5 | 7/9/2003 | 1110 | 78.3 | 4470 | NA | NA | 51.7 | 0.033 J | 0.22 J | 308 J | 2.3 | 0.6 J | 26.6 | 16500 | 856 |
| 1 | EA | WP-SSS-15 | 0.5 | 7/9/2003 | 3740 | 5 J | <u>573</u> | NA | NA | 149 | 0.25 J | 1.4 | 5570 | 3.5 | 6.4 | 14.6 | 18900 | 12.4 |
| | | WP-SUS-15 | 4 | 7/9/2003 | 4800 | 5.3 J | <u>544</u> | NA | NA | 176 | 0.25 J | 1.1 | 7180 | 4.4 | 6.6 | 18.2 | 20900 | 25 |
| | | MMDGA-T-46 | 3.5 | 9/30/2009 | NA | NA | <u>3340</u> | NA | NA | NA | NA | NA | NA | NA | NA | 152 | NA | 627 |
| | | MMDGA-WR-18 | 3.5 | 9/29/2009 | NA | NA | <u>2700</u> | NA | NA | NA | NA | NA | NA | NA | NA | 45 | NA | 589 |
| | | MMDGA-WR-19 | 3 | 9/29/2009 | NA | NA | <u>223</u> | NA | NA | NA | NA | NA | NA | NA | NA | 9.4 | NA | 16.1 |
| | CES | MMDGA-WR-20 | 3 | 9/29/2009 | NA | NA | <u>4610</u> | NA | NA | NA | NA | NA | NA | NA | NA | 220 | NA | 3210 |
| | CLS | MMDGA-WR-21 | 1 | 9/29/2009 | NA | NA | <u>258</u> | NA | NA | NA | NA | NA | NA | NA | NA | 13.9 | NA | 12 |
| Lwr Mon'tl | | MMDGA-WR-24 | 0.5 | 9/29/2009 | NA | NA | <u>8150</u> | NA | NA | NA | NA | NA | NA | NA | NA | 48 | NA | 712 |
| | | MMDGA-WR-25 | | 9/29/2009 | NA | NA | <u>9360</u> | NA | NA | NA | NA | NA | NA | NA | NA | 60.5 | NA | 453 |
| | | MMDGA-WR-26 | | 9/29/2009 | NA | NA | <u>5690</u> | NA | NA | NA | NA | NA | NA | NA | NA | 135 | NA | 578 |
| | | LMM-WRA-3 | | 10/3/2024 | NA | NA | <u>125 (0.44)</u> | 16.6 (2) | 328 (4.9) | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | LMM-WRA-3-DS | 0.5 - 1 | 10/3/2024 | NA | NA | 21.6 (0.44) | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | LMM-WRA-4 | 0.5 - 1 | 10/3/2024 | NA | NA | <u>2290 (8.8)</u> | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | TEI | | 0.5 - 1 | 10/3/2024 | NA NA | NA NA | <u>2570 (8.5)</u> | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA |
| | | LMM-WRB-1 | 0.5 - 1 0.5 - 1 | 10/3/2024 10/3/2024 | NA NA | NA NA | <u>1090 (0.42)</u> 802 (0.42) | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA |
| | | LMM-WRB-3-DS | 0.5 - 1 | 10/3/2024 | NA NA | NA NA | 29.1 (0.41) | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA |
| | | TA-SUS-25 | 1.5 | 7/14/2003 | 17500 | 0.94 J | 26 | NA NA | NA NA | 269 | 0.55 | ND (0.027) | 1930 | 8.6 | 10.5 | 10.2 | 20600 | 10.4 |
| | EA | WP-SUS-23 | 3.5 | 7/14/2003 | 11900 | 6 | 81.8 | NA NA | NA NA | 188 | 0.33 | 0.63 | 2920 | 6.7 | 8.6 | 30.5 | 20100 | 15.6 |
| Sheridan | CES | SM-WR2-1 | | 6/21/2007 | NA | ND (0.2) | 16.8 | NA | NA | NA | ND (0.2) | 0.23 J | NA | 9 | NA | 7 | 20700 | 11.1 |
| | | SH-WRB-2 | 0.5 - 1 | 10/4/2024 | NA | NA | 80.8 (0.39) | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | TEI | SH-WRC-1 | 0.5 - 1 | 10/4/2024 | NA | NA | 14.4 (0.44) | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | TA-SSS-30 | 0.4 | 7/12/2003 | 11600 | 1.6 J | 58.6 | NA | NA | 201 | 0.2 J | 6.2 | 3480 | 8.8 | 8.8 | 10.4 | 22900 | 40.9 |
| | | WP-SSS-27 | 0.8 | 7/12/2003 | 9660 | 2.4 J | <u>88</u> | NA | NA | 177 | 0.2 J | 3.4 | 2600 | 5.9 | 8.2 | 27.5 | 20000 | 375 |
| | EA | WP-SSS-28 | 0.8 | 7/12/2003 | 3550 | 1.3 J | <u>183</u> | NA | NA | 32.8 | 0.43 J | 2.8 | 26500 | 1.4 | 4.7 | 14.4 | 19300 | 52.2 |
| 1 | | WP-SUS-26 | 3 | 7/12/2003 | 8350 | 1.7 J | <u>156</u> | NA | NA | 138 | 0.29 J | 7.5 | 3120 | 4.3 | 6.7 | 32.3 | 23800 | 120 |
| Tillicum | | WP-SUS-27 | 4.5 | 7/12/2003 | 11700 | 1.8 J | 35.7 | NA | NA | 206 | 0.21 J | 1.9 | 1830 | 6.8 | 8.2 | 15.2 | 21300 | 27.8 |
| | CES | TILL-WR-01 | | 6/26/2007 | NA | 5.5 | <u>371</u> | NA | NA | NA | 0.7 J | 15.6 | NA | 2 J | NA | 27 | 24600 | 184 |
| | | TL-WRA-1-DS-2 | | 10/4/2024 | NA | NA | <u>267 (0.44)</u> | 14.4 (1.9) | 550 (4.9) | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1 | TEI | TL-WRA-3 | | 10/4/2024 | NA | NA | <u>454 (0.42)</u> | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | TL-WRB-4 | 0.5 - 1 | 10/4/2024 | NA | NA | <u>194 (0.42)</u> | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |

Table 3
Summary of Soil Analytical Results
Supplemental Site Investigation Report
Upper Granite Creek Watershed Mines
Wallowa-Whitman National Forest, Oregon

| | | | Collection | | | | | | | | Me | tals | | | | | | |
|--------------------|------------|--------------------------|------------|------------------------|----------|----------|---------------------|-----------|------------|----------|-----------|------------|----------|----------|----------|-------------|----------|--------------------|
| | | | Depth | Sample | | | | Arsenic, | Arsenic, | | | | | Chromium | | | | |
| AOI | Company | Location | (ft bgs) | Date | Aluminum | Antimony | Arsenic | IVBA | Total IVBA | Barium | Beryllium | Cadmium | Calcium | (total) | Cobalt | Copper | Iron | Lead |
| | | G for SAP | (| | | 4895 | 82 | | | | 24468 | 9113 | | | 3681 | 489424 | | |
| | Та | ilings PRG | | | | | 110 | | | | | | | | | | | |
| | | Rock/Soil PRG | | | | | 190 | | | | | | | | | | | |
| ODF | Q Blue Mo | untain Region Clear | n Fill | | | 1.3 | 14 | | | 950 | 2.6 | 0.69 | | 190 | | 120 | | 21 |
| | | C Plant Direct Toxic | | | | 11 | 18 | | | 110 | 2.5 | 32 | | | 13 | 70 | | 120 |
| OD | EQ Eco RBC | Inverts Direct Toxi | city | | | 78 | 6.8 | | | 330 | 40 | 140 | | | | 80 | | 1700 |
| | ODEQ | Eco RBC Bird | · | | | | 15 | | | 630 | | 0.29 | | 23 | 76 | 14 | | 11 |
| | ODEQ E | o RBC Mammal | | | | 0.27 | 19 | | | 1800 | 21 | 0.27 | | 34 | 230 | 42 | - | 56 |
| | ODEQ Exca | vation Worker RCB | } | | | | 420 | | | | 19000 | 9700 | | | | 390000 | | 800 |
| | | ML-SSS-12 | 0.7 | 7/9/2003 | 13300 | 4 J | 73 | NA | NA | 322 | 0.32 J | 0.65 | 3050 | 8.4 | 10.4 | 14.2 | 32000 | 27.5 |
| | | ML-SSS-16 | 0.5 | 7/10/2003 | 6180 | 368 | <u>7500</u> | NA | NA | 129 | 0.25 J | 8.1 | 1610 | 7.7 | 1.6 J | 80 | 16300 | 1350 |
| | EA | WP-SSS-13 | 1 | 7/9/2003 | 4220 | 11.6 | <u>860</u> | NA | NA | 189 | 0.087 J | ND (0.064) | 523 J | 3.6 | 3.6 J | 12.5 | 21500 | 31.3 |
| | LA | WP-SSS-14 | 0.7 | 7/10/2003 | 3190 | 2.5 J | <u>616</u> | NA | NA | 69.8 | 0.26 J | 8.5 | 5980 | 2.3 | 5 J | 7.4 | 13600 | 15 |
| | | WP-SSS-17 | 1 | 7/9/2003 | 10600 | 241 | <u>11400</u> | NA | NA | 73.2 | 0.3 J | 23.4 | 3610 | 2.1 | 2.7 J | 698 | 16300 | 2120 |
| | | WP-SUS-14 | 3.5 | 7/10/2003 | 4680 | 5.8 J | <u>355</u> | NA | NA | 166 | 0.23 J | 0.52 | 10100 | 3.3 | 6.4 | 8 | 18800 | 36.9 |
| | | MMDGA-T-13 | 1 | 9/29/2009 | NA | NA | <u>10200</u> | NA | NA | NA | NA | NA | NA | NA | NA | 58.4 | NA | 1200 |
| | | MMDGA-T-34 | 0.25 | 9/30/2009 | NA | NA | <u>1900</u> | NA | NA | NA | NA | NA | NA | NA | NA | 119 | NA | 478 |
| | | MMDGA-T-34 | 2 | 9/30/2009 | NA | NA | <u>9610</u> | NA | NA | NA | NA | NA | NA | NA | NA | 440 | NA | 2340 |
| | | MMDGA-T-35 | 1 | 9/30/2009 | NA | NA | <u>4770</u> | NA | NA | NA | NA | NA | NA | NA | NA | 247 | NA | 1240 |
| | | MMDGA-T-37 | 0.25 | 9/30/2009 | NA | NA | <u>1360</u> | NA | NA | NA | NA | NA | NA | NA | NA | 128 | NA | 334 |
| | CES | MMDGA-T-40 | 2 | 9/30/2009 | NA | NA | <u>6310</u> | NA | NA | NA | NA | NA | NA | NA | NA | 460 | NA | 1140 |
| | | MMDGA-T-41 | 2 | 9/30/2009 | NA | NA | <u>8750</u> | NA | NA | NA | NA | NA | NA | NA | NA | 700 | NA | 1680 |
| I I a a NA a a lat | | MMDGA-T-9 | 1 | 9/29/2009 | NA | NA | <u>2440</u> | NA | NA | NA | NA | NA | NA | NA | NA NA | 75.3 | NA | 549 |
| Upr Mon'tl | | MMDGA-WR-2 | 4 | 9/28/2009 | NA NA | NA NA | <u>164</u> | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | 15.2 | NA NA | 11.3 |
| | | MMDGA-WR-28 | 0.5 | 9/29/2009 9/28/2009 | NA NA | NA NA | <u>740</u> | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | 8.1 70.6 | NA NA | 10.4 <i>479</i> |
| | | MMDGA-WR-3 MMDGA-WR-5 | 1 | 9/28/2009 | NA NA | NA NA | <u>2240</u> 2920 | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | 51.1 | NA NA | 231 |
| | | UMM-TLA-6 | 0.5 - 1 | 10/2/2024 | NA NA | NA NA | 3270 (8.1) | 1350 (2) | 5560 (4.9) | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA | NA NA | 589 (0.81) |
| | | UMM-TLB-1 | 0.5 - 1 | 10/2/2024 | NA NA | NA NA | 6130 (11) | 1840 (2) | 4420 (4.9) | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | 1710 (1.1) |
| | | UMM-TLB-4 | 0.5 - 1 | 10/2/2024 | NA | NA NA | 1540 (8) | NA | NA | NA NA | NA NA | NA | NA NA | NA NA | NA | NA | NA | NA |
| | | UMM-TLC-1 | 0.5 - 1 | 10/2/2024 | NA | NA NA | 5290 (9.9) | NA | NA NA | NA NA | NA NA | NA | NA NA | NA NA | NA | NA | NA | NA |
| | | UMM-TLC-2 | 0.5 - 1 | 10/2/2024 | NA | NA | 4980 (10) | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | TEI | UMM-WRA-1 | 0.5 - 1 | 10/2/2024 | NA | NA | 1300 (8.4) | 12.7 (2) | 1590 (4.9) | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | UMM-WRA-1-DS | 0.5 - 1 | 10/2/2024 | NA | NA | 37.5 (0.41) | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | UMM-WRA-3 | 0.5 - 1 | 10/2/2024 | NA | NA | 1210 (0.45) | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | UMM-WRB-1 | 0.5 - 1 | 10/2/2024 | NA | NA | 14000 (41) | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | 5210 (4.1) |
| | | UMM-WRB-2 | 0.5 - 1 | 10/2/2024 | NA | NA | 1800 (8.2) | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | UMM-WRB-2-DS | 0.5 - 1 | 10/2/2024 | NA | NA | 79.2 (0.45) | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | UUMM-WRA-2 | 0.5 - 1 | 10/2/2024 | NA | NA | <u>1940 (8.8)</u> | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | UUMM-WRA-3 | 0.5 - 1 | 10/2/2024 | NA | NA | <u>1710 (9.1)</u> | 176 (1.9) | 3440 (4.9) | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Upr Upr Mon'tl | TEI | GOIVIIVI-VVINA-3 | 0.5 - 1 | 10/2/2024 | NA | NA | <u>1470 (8)</u> | 162 (2) | 3280 (5) | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Opi Opi Ivioli ti | | UUMM-WRA-3-DS | + | 10/2/2024 | NA | NA | 16 (0.44) | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | UUMM-WRD-1 | 0.5 - 1 | 10/2/2024 | NA | NA | <u>269 (0.45)</u> | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | UUMM-WRF-1 | 0.5 - 1 | 10/2/2024 | NA | NA | <u>715 (0.44)</u> | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |

Table 3
Summary of Soil Analytical Results
Supplemental Site Investigation Report
Upper Granite Creek Watershed Mines
Wallowa-Whitman National Forest, Oregon

| AOI | | | | Collection | | | | | | | | Metals | | | | | | |
|--|------------|---------|-----------|------------|-----------|-----------|-------------|-----------|-----------|-----------|--------|-----------|----------|--------|--------|----------|----------|-----------|
| AOI | | | | | Sample | | Lead. Total | | | | | | | | | | | |
| PRG for SAP | AOI | Company | Location | | | Lead IVRA | , | Magnesium | Manganese | Mercury | Nickel | Potassium | Selenium | Silver | Sodium | Thallium | Vanadium | Zinc |
| Tailings PRG | | / | | (10 285) | | - | | | | • | | | | | | | | |
| Maste Rock/Soil PRG | | | | | | | | | | | | | | | | | | |
| ODEQ Eco RBC Plant Direct Toxicity | | | | | | | | | | | | | | | | | | |
| ODEQ Eco RBC Plant Direct Toxicity 220 34 38 0.52 560 0.05 60 16 ODEQ Eco RBC Inverts Direct Toxicity 450 0.05 280 4.1 12 ODEQ Eco RBC Bird 1300 0.013 20 0.71 2.6 4.5 4.7 44 ODEQ Eco RBC Mammal 1400 1.7 10 0.63 1.4 0.42 280 7.7 ODEQ Eco RBC Mammal 1400 1.7 10 0.63 1.4 0.42 280 7.7 ODEQ Eco RBC Mammal 230000 2900 190000 49000 230000 2900 190000 | ODE | | | n Fill | | | | | 1800 | 1.4 | 92 | | 0.93 | 0.51 | | | 400 | 160 |
| ODEQ Eco RBC Inverts Direct Toxicity | | - | | | | | | | | | | | | | | 0.05 | | 160 |
| ODEQ Eco RBC Bird | | | | | | | | | | | | | | | | | | 120 |
| ODEQ Excavation Worker RCB | | | | , | | | | | | | | | | | | 4.5 | | 46 |
| BGS-503 O.5-1 6/26/2007 NA NA NA SAB S | | | | | | | | | | | | | | | | | | 79 |
| Beach Series 0.5 7/19/2003 NA NA 2630 837 0.14 23.4 1570 0.76 0.26 J 806 0.97 47.8 10 Be Sess-35 0.5 7/15/2003 NA NA 880 429 0.032 J 5.2 848 0.61 0.28 J 1220 ND (0.28) 24.9 5.0 Be Sess-35 0.5 7/15/2003 NA NA 140 1560 156 0.035 J 5.6 1140 0.42 J 0.42 J 0.42 J 0.42 J 0.62 J 1450 ND (0.29) 26.5 5.4 38 0.5 7/15/2003 NA NA 4930 610 0.027 J 23.4 3920 0.24 J 0.48 J 1180 ND (0.24) 47.2 61 Background BGS-01 0.5-1 6/26/2007 NA NA NA NA NA 0.027 J 23.4 3920 0.24 J 0.48 J 1180 ND (0.24) 47.2 61 < | | | | 3 | | | | | | | _ | | | | | | | |
| Background Bac | | 1 | | | 7/19/2003 | NA | NA | 2630 | 837 | 0.14 | 23.4 | 1570 | 0.76 | 0.26 J | 806 | 0.97 | 47.8 | 105 |
| Background Backgr | | | | | | | | | | | | | | | | | | 50.2 |
| BG-SSS-36 | | EA | | | | | | | | | | | | | | | | 43.2 |
| Background Ref Ref Background Ref Ref Background Ref | | | BG-SSS-36 | 0.5 | · · | NA | NA | 4930 | 610 | 0.027 J | | 3920 | 0.24 J | 0.48 J | 1180 | , , | | 61.3 |
| Background Rescriptions Resc | | | BGS-01 | 0.5 - 1 | 6/26/2007 | NA | NA | NA | 716 | 0.06 J | 7 | NA | 0.37 | 0.29 | NA | NA | NA | 71 |
| CES BGS-03 O.5-1 G/2G/2007 NA NA NA 644 O.05 | Dookaround | | BGS-02 | 0.5 - 1 | 6/26/2007 | NA | NA | NA | 668 | ND (0.04) | 6 | NA | 0.28 J | 0.51 | NA | NA | NA | 61 |
| CES BGS-05 O.5-1 6/26/2007 NA NA NA NA 319 O.06 J 10 NA O.77 O.58 NA NA NA NA NA NA NA N | Background | | BGS-03 | 0.5 - 1 | 6/26/2007 | NA | NA | NA | 644 | 0.05 J | 8 | NA | 0.15 J | 0.2 | NA | NA | NA | 71 |
| BGS-05 | | CES | BGS-04 | 0.5 - 1 | 6/26/2007 | NA | NA | NA | 848 | 0.06 J | 23 | NA | 0.36 | 0.63 | NA | NA | NA | 126 |
| BGS-07 0.5-1 6/27/2007 NA NA NA NA 1060 0.07J 13 NA 0.39 0.23 NA NA NA NA NA 14 NA NA 14 NA | | CLS | BGS-05 | 0.5 - 1 | 6/26/2007 | NA | NA | NA | 319 | 0.06 J | 10 | NA | 0.77 | 0.58 | NA | NA | NA | 44 |
| BGS-08 | | | BGS-06 | 0.5 - 1 | 6/27/2007 | NA | NA | NA | - | ND (0.04) | 7 | NA | 0.24 J | | NA | NA | NA | 88 |
| EA TA-SUS-22 1.5 7/15/2003 NA NA S180 408 0.058 3.8 J 3720 0.24 J 0.28 J 982 ND (0.28) 40.6 41 WP-SUS-20 4 7/15/2003 NA NA S200 270 0.026 J 4.3 4080 ND (0.31) 0.63 J 1100 ND (0.25) 52.2 48 WP-SUS-21 2.5 7/15/2003 NA NA NA 2980 504 0.3 4.1 3240 0.4 J 4.2 122 J 0.45 J 33.9 49 WP-SUS-39 2 7/15/2003 NA NA NA 4560 321 0.064 4.8 3560 0.4 J 0.79 J 1060 ND (0.23) 52.2 50 CM-WR1-1 0.5 6/21/2007 NA NA NA NA 312 0.06 J 3 J NA 0.3 0.14 NA NA NA NA NA NA NA S24 ND (0.04) 3 J NA 0.23 J 0.08 J NA NA NA NA NA NA S25 CM-WR2-2 0.5 6/21/2007 NA NA NA NA NA 198 0.07 J 4 J NA 0.23 J 0.19 NA NA NA NA NA NA D2 S25 CM-WR2-2 0.5 6/21/2007 NA NA NA NA NA 198 0.07 J 4 J NA 0.23 J 0.19 NA NA NA NA NA D2 S25 CM-WR2-2 0.5 6/21/2007 NA NA NA NA NA 198 0.07 J 4 J NA 0.23 J 0.19 NA NA NA NA NA NA D2 S25 CM-WR2-2 0.5 6/21/2007 NA NA NA NA NA 198 0.07 J 4 J NA 0.23 J 0.19 NA NA NA NA NA NA D2 S25 CM-WR2-2 0.5 6/21/2007 NA NA NA NA NA 198 0.07 J 4 J NA 0.23 J 0.19 NA NA NA NA NA NA D2 S25 CM-WR2-2 0.5 6/21/2007 NA NA NA NA NA NA NA NA NA D2 S25 CM-WR2-2 0.5 6/21/2007 NA D2 S25 CM-WR2-2 0.5 6/21/2007 NA D2 S25 CM-WR2-2 0.5 6/21/2007 NA D2 S25 CM-WR2-2 0.5 6/21/2007 NA | | | | | , , | | | | | | | | | | | | | 60 |
| Cap Martin WP-SUS-20 4 7/15/2003 NA NA 5320 270 0.026 J 4.3 4080 ND (0.31) 0.63 J 1100 ND (0.25) 52.2 48 WP-SUS-21 2.5 7/15/2003 NA NA 2980 504 0.3 4.1 3240 0.4 J 4.2 122 J 0.45 J 33.9 49 WP-SUS-39 2 7/15/2003 NA NA 4560 321 0.064 4.8 3560 0.4 J 0.79 J 1060 ND (0.23) 52.2 50 CAP WR1-1 0.5 6/21/2007 NA NA NA 312 0.06J 3 J NA 0.3 0.14 NA NA NA NA CCES CM-WR2-1 0.5 6/21/2007 NA NA NA NA 198 0.07 J 4 J NA 0.23 J 0.19 NA NA NA 24 CCES CM-WR2-2 0.5 6/21/2007 NA NA NA 198 0.07 J | | | BGS-08 | 0.5 - 1 | | NA | NA | | | | 70 | | 0.38 | | | | | 145 |
| Cap Martin EA WP-SUS-21 2.5 7/15/2003 NA NA NA 2980 504 0.3 4.1 3240 0.4 J 4.2 122 J 0.45 J 33.9 49 WP-SUS-39 2 7/15/2003 NA NA NA NA 4560 321 0.064 4.8 3560 0.4 J 0.79 J 1060 ND (0.23) 52.2 50 CM-WR1-1 0.5 6/21/2007 NA NA NA NA NA NA NA NA NA N | | | | | | | | | | | | | | | | 1 | | 41.8 |
| Cap Martin WP-SUS-39 2 7/15/2003 NA NA NA 4560 321 0.064 4.8 3560 0.4 J 0.79 J 1060 ND (0.23) 52.2 50 CM-WR1-1 0.5 6/21/2007 NA NA NA NA NA NA NA NA NA N | | EA | | | | | | | | | | | ` , | | | ` ' | | 48.6 |
| Cap Martin CM-WR1-1 0.5 6/21/2007 NA NA NA NA NA NA S12 0.06 J 3 J NA 0.3 0.14 NA NA NA NA NA NA NA NA NA N | | | | | | | | | | | | | | | | | | 495 |
| Cap Martin CM-WR2-1 0.5 6/21/2007 NA NA NA NA NA NA 198 0.07 J 4 J NA 0.23 J 0.08 J NA NA NA NA NA NA NA NA NA N | | | | | | | | | | | | | | | | | | 50.5 |
| CES CM-WR2-2 0.5 6/21/2007 NA NA NA 198 0.07 J 4 J NA 0.23 J 0.19 NA NA NA NA 25 | Cap Martin | | _ | | | | | | | | | ł | | | | | | 39 |
| | • | CEC | _ | | | | | | | , , | | | | | | | | 34 |
| | | CES | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | 50 330 |
| | | TEI | | | | | | | | | | | | | | | | 330 NA |
| | | IEI | | | | ` , | ` , | | | | | | | | | | | 63.2 |
| | | | | | | | | | | | | | | | | | | 203 |
| | | EA | | | | | | | | | | | | | _ | | | 137 |
| WP-SUS-32 4 7/10/2003 NA NA 6300 697 0.12 9.7 4030 1 0.28 1 1040 1.3 73.7 96 | | | | | | | | | | | | _ | | _ | | | | 96.2 |
| L'entra | Central | | | | | | | | | _ | _ | | _ | | | _ | - | NA |
| CFM-WRA-4-DS 0.5 - 1 10/2/2024 NA | | | | | | ` , | , , | | | | | | | | | | | NA |
| | | TEI | | | | | | | | | | | | | | | | NA |
| | | | | | | | | | | | | | | | | | | NA |

Terraphase Engineering Inc.
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Table 3
Summary of Soil Analytical Results
Supplemental Site Investigation Report
Upper Granite Creek Watershed Mines
Wallowa-Whitman National Forest, Oregon

| | | | Collection | | | | | | | | Metals | | | | | | |
|-------------------------|-----------|----------------------|------------|-----------|-------------|-------------|-----------|-----------|------------|--------|-----------|----------|--------|--------|----------|----------|------|
| | | | Depth | Sample | | Lead. Total | | | | | | | | | | | |
| AOI | Company | Location | (ft bgs) | Date | Lead. IVBA | , | Magnesium | Manganese | Mercury | Nickel | Potassium | Selenium | Silver | Sodium | Thallium | Vanadium | Zinc |
| | / | G for SAP | (10.00) | | | | | | 2153 | 244668 | | 61175 | 61145 | | | 61218 | |
| | Tai | ilings PRG | | | | | | | | | | | | | | | |
| | Waste I | Rock/Soil PRG | | | | | | | | | | | | | | | |
| ODEQ | Blue Mou | ıntain Region Clear | ı Fill | | | | | 1800 | 1.4 | 92 | | 0.93 | 0.51 | | | 400 | 160 |
| ODE | Q Eco RBC | Plant Direct Toxic | ity | | | | | 220 | 34 | 38 | | 0.52 | 560 | | 0.05 | 60 | 160 |
| ODEC | Q Eco RBC | Inverts Direct Toxio | city | | | | | 450 | 0.05 | 280 | | 4.1 | | | | | 120 |
| | ODEQ | Eco RBC Bird | | | | | | 1300 | 0.013 | 20 | | 0.71 | 2.6 | | 4.5 | 4.7 | 46 |
| | ODEQ Ec | o RBC Mammal | | | | | | 1400 | 1.7 | 10 | | 0.63 | 14 | | 0.42 | 280 | 79 |
| 0 | DEQ Excav | ation Worker RCB | | | | | | 230000 | 2900 | 190000 | | | 49000 | | | | |
| | | GF-WR-01 | | 6/25/2007 | NA | NA | NA | 692 | NDH (0.04) | 6 | NA | 0.23 J | 0.58 | NA | NA | NA | 191 |
| | CES | GF-WR-2 | 0.5 | 6/25/2007 | NA | NA | NA | 97.5 | 2.61 | 1 | NA | 3.26 | 52 | NA | NA | NA | 305 |
| | CLS | GF-WR2-1 | 0.5 | 6/21/2007 | NA | NA | NA | 718 | 0.19 J | 7 | NA | 0.39 | 7.95 | NA | NA | NA | 201 |
| Golden Fraction | | GF-WR-3 | 0.5 | 6/25/2007 | NA | NA | NA | 544 | NDH (0.04) | 8 | NA | 0.34 | 0.64 | NA | NA | NA | 94 |
| Golden Haction | | GF-DR-1 | 0.5 - 1 | 10/5/2024 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | TEI | GF-WRA-1 | 0.5 - 1 | 10/5/2024 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | 121 | GF-WRD-4-DS | 0.5 - 1 | 10/5/2024 | 8.94 (0.2) | 25.6 (0.49) | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | GF-WRD-6 | 0.5 - 1 | 10/5/2024 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | CES | GC5-WR-01 | 0.5 | 6/26/2007 | NA | NA | NA | 821 | 0.08 JH | 8 | NA | 0.4 | 1.2 | NA | NA | NA | 221 |
| | 020 | GC5-WR-02 | 0.5 | 6/26/2007 | NA | NA | NA | 929 | 0.07 JH | 8 | NA | 0.55 | 5.05 | NA | NA | NA | 250 |
| Granite Creek #5 | | GC5-WRA-3 | 0.5 - 1 | 10/4/2024 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | TEI | GC5-WRA-4 | 0.5 - 1 | 10/4/2024 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | GC5-WRA-4-DS | 0.5 - 1 | 10/4/2024 | 26.4 (0.19) | 70.4 (0.5) | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | GC6-WR-01 | | 6/24/2007 | NA | NA | NA | 497 | 1.21 H | 4 J | NA | 0.25 J | 0.08 J | NA | NA | NA | 59 |
| | CES | GC6-WR-02 | 0.5 | 6/24/2007 | NA | NA | NA | 367 | 0.09 JH | 4 J | NA | 0.26 J | 0.09 J | NA | NA | NA | 62 |
| Granite Creek #6 | | GC6-WR-03 | 0.5 | 6/24/2007 | NA | NA | NA | 25.3 | NDH (0.05) | ND (1) | NA | 0.17 J | 0.08 J | NA | NA | NA | 4 J |
| | TEI | GC6-WRA-1 | 0.5 - 1 | 10/4/2024 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | GC6-WRA-2 | 0.5 - 1 | 10/4/2024 | 150 (0.2) | 360 (0.49) | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | GC7-WR-01 | 0.5 | 6/24/2007 | NA | NA | NA | 661 | 0.24 H | 5 J | NA | 0.35 | 20.4 | NA | NA | NA | 134 |
| | CES | GC7-WR-02 | 0.5 | 6/24/2007 | NA | NA | NA | 593 | 0.24 | 5 | NA | 0.4 | 1.79 | NA | NA | NA | 84 |
| Granite Creek 7 | | GC7-WR-03 | 0.5 | 6/24/2007 | NA | NA | NA | 608 | 0.42 | 0.4 | NA | 0.45 | 4.08 | NA | NA | NA | 83 |
| | | GC7-WR-04 | 0.5 | 6/24/2007 | NA | NA | NA | 443 | NDH (0.04) | 4 J | NA | 0.26 | 0.34 | NA | NA | NA | 61 |
| | TEI | GC7-WRA-3 | 0.5 - 1 | 10/4/2024 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | GC7-WRB-1 | 0.5 - 1 | 10/4/2024 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Granite Creek Aq. St. 3 | CES | GC3-WR-01 | 0.5 | 6/24/2007 | NA | NA | NA | 1070 | 0.29 H | 4 J | NA | 0.27 J | 19.1 | NA | NA | NA | 377 |

Table 3
Summary of Soil Analytical Results
Supplemental Site Investigation Report
Upper Granite Creek Watershed Mines
Wallowa-Whitman National Forest, Oregon

| | | | Collection | | | | | | | | Metals | | | | | | |
|------------|------------|----------------------------|------------|------------------------|------------------|-----------------|-------------|---------------|--------------|----------|-----------|----------|--------------|----------|-----------|----------|------------|
| | | | Depth | Sample | | Lead, Total | | | | | | | | | | | |
| AOI | Company | Location | (ft bgs) | Date | Lead, IVBA | IVBA | Magnosium | Manganese | Mercury | Nickel | Potassium | Selenium | Silver | Sodium | Thallium | Vanadium | Zinc |
| AOI | | G for SAP | (it bgs) | Date | | IVDA | iviagnesium | ivialigaliese | 2153 | 244668 | | 61175 | 61145 | Joululli | | 61218 | |
| | | llings PRG | | | | | | | | | | | 01143 | | | | |
| | | Rock/Soil PRG | | | | | | | | | | | | | | | |
| ODE | | Intain Region Clear | . r:II | | | | | 1800 | 1.4 | 92 | | 0.93 | 0.51 | | | 400 | 160 |
| | | | | | | | | | | | | | | | | | |
| | | Plant Direct Toxic | • | | | | | 220 | 34 | 38 | | 0.52 | 560 | | 0.05 | 60 | 160 |
| UDE | | Inverts Direct Toxio | city | | | | | 450 | 0.05 | 280 | | 4.1 | | | | | 120 |
| | | Eco RBC Bird | | | | | | 1300 | 0.013 | 20 | | 0.71 | 2.6 | | 4.5 | 4.7 | 46 |
| | | o RBC Mammal | | | | | | 1400 | 1.7 | 10 | | 0.63 | 14 | | 0.42 | 280 | 79 |
| | ODEQ Excav | ation Worker RCB | | | | | | 230000 | 2900 | 190000 | | | 49000 | | | | |
| | | ML-SSS-38 | 0.5 | 7/9/2003 | NA | NA | 212 J | 30.9 | 0.37 | 2.2 J | 836 | 0.86 | 48 | 193 J | ND (0.46) | 5.1 J | 65 |
| | EA | WP-SSS-15 | 0.5 | 7/9/2003 | NA | NA | 3690 | 757 | 0.14 | 4.8 | 2010 | 0.9 | 7.1 | 385 J | 1.5 | 24.7 | 107 |
| | | WP-SUS-15 | 4 | 7/9/2003 | NA | NA | 4940 | 776 | 0.33 | 6 | 2730 | 0.99 | 6.4 | 478 | 1.8 | 30.3 | 130 |
| | | MMDGA-T-46 | 3.5 | 9/30/2009 | NA | NA | NA | 208 | 95 | NA | NA | NA | 54.9 | NA | NA | NA | 1500 |
| | | MMDGA-WR-18 | 3.5 | 9/29/2009 | NA | NA | NA | 51.1 | 0.42 | NA | NA | NA | 48.8 | NA | NA | NA | 152 |
| | | MMDGA-WR-19 | 3 | 9/29/2009 | NA | NA | NA | 277 | 0.17 J | NA | NA | NA | 1.14 | NA | NA | NA | 63 |
| | CES | MMDGA-WR-20 | 3 | 9/29/2009 | NA | NA | NA | 185 | 1.28 | NA | NA | NA | 343 | NA | NA | NA | 1140 |
| | | MMDGA-WR-21 | 1 | 9/29/2009 | NA | NA | NA | 784 | 0.36 | NA | NA | NA | 2.6 | NA | NA | NA | 132 |
| Lwr Mon'tl | | MMDGA-WR-24 | 0.5 | 9/29/2009 | NA | NA | NA | 342 207 | 2.99 | NA | NA | NA | 21.9 9.47 | NA | NA | NA NA | 78 |
| | | MMDGA-WR-25 MMDGA-WR-26 | 0.5 0.5 | 9/29/2009 | NA NA | NA NA | NA NA | 713 | 0.53 0.84 | NA NA | NA NA | NA NA | 40 | NA NA | NA NA | NA NA | 69 2030 |
| | | LMM-WRA-3 | 0.5 - 1 | | | | NA NA | NA | 0.84 NA | NA NA | | NA NA | NA | NA NA | NA NA | NA NA | NA |
| | | LMM-WRA-3-DS | 0.5 - 1 | 10/3/2024 10/3/2024 | 10.8 (0.2) NA | 32 (0.49) NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA |
| | | LIVIIVI-VV NA-3-D3 | 0.5 - 1 | 10/3/2024 | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA |
| | TEI | LMM-WRA-4 | 0.5 - 1 | 10/3/2024 | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA |
| | 1 '' | | 0.5 - 1 | 10/3/2024 | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA |
| | | LMM-WRB-1 | 0.5 - 1 | 10/3/2024 | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA | NA NA | NA NA | NA NA | NA |
| | | LMM-WRB-3-DS | 0.5 - 1 | 10/3/2024 | NA NA | NA | NA NA | NA NA | NA | NA | NA NA | NA NA | NA | NA | NA NA | NA NA | NA |
| | + | TA-SUS-25 | 1.5 | 7/14/2003 | NA NA | NA | 6310 | 444 | 0.048 | 5.3 | 4900 | 0.24 J | 1.4 | 1330 | ND (0.26) | 58.5 | 66.9 |
| | EA | WP-SUS-23 | 3.5 | 7/14/2003 | NA NA | NA | 5200 | 782 | 0.36 | 5.2 | 3320 | 0.48 | 32.5 | 676 | 0.76 J | 50.8 | 87.8 |
| Sheridan | CES | SM-WR2-1 | 0.5 | 6/21/2007 | NA | NA | NA | 278 | 0.15 J | 5 J | NA | 0.25 J | 0.16 | NA | NA | NA | 67 |
| | | SH-WRB-2 | 0.5 - 1 | 10/4/2024 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | TEI | SH-WRC-1 | 0.5 - 1 | 10/4/2024 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | TA-SSS-30 | 0.4 | 7/12/2003 | NA | NA | 6290 | 579 | 0.12 | 5.7 | 3490 | 0.45 J | 0.29 J | 927 | 0.98 J | 51.6 | 297 |
| | | WP-SSS-27 | 0.8 | 7/12/2003 | NA | NA | 4330 | 556 | 0.38 | 4.3 | 2610 | 0.84 | 1.8 | 590 | 1.8 | 36.5 | 322 |
| | EA | WP-SSS-28 | 0.8 | 7/12/2003 | NA | NA | 1740 | 890 | 0.21 | 4 | 1410 | 0.78 | 1.2 | 38.5 J | 2 | 11.7 | 183 |
| | | WP-SUS-26 | 3 | 7/12/2003 | NA | NA | 3220 | 660 | 0.1 | 3.9 J | 1980 | 1.1 | 2.2 | 271 J | 2.3 | 34.5 | 356 |
| Tillicum | | WP-SUS-27 | 4.5 | 7/12/2003 | NA | NA | 5880 | 603 | 0.029 J | 5.2 | 3820 | 0.95 | ND (0.24) | 947 | 1.6 | 51.8 | 157 |
| | CES | TILL-WR-01 | 0 | 6/26/2007 | NA | NA | NA | 1020 | 0.46 H | 4 J | NA | 0.84 | 3.34 | NA | NA | NA | 525 |
| | | TL-WRA-1-DS-2 | 0.5 - 1 | 10/4/2024 | 83.3 (0.19) | 218 (0.49) | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | TEI | TL-WRA-3 | 0.5 - 1 | 10/4/2024 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | TL-WRB-4 | 0.5 - 1 | 10/4/2024 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |

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Table 3
Summary of Soil Analytical Results
Supplemental Site Investigation Report
Upper Granite Creek Watershed Mines
Wallowa-Whitman National Forest, Oregon

| | | | Collection | | | | | | | | Metals | | | | | | |
|----------------|----------|-------------------------|------------|---------------------|-------------|-------------|----------|------------|---------------|----------|-----------|----------|--------------|-----------|----------|----------|----------|
| | | | Depth | Sample | | Lead, Total | | | | | | | | | | | |
| AOI | Company | Location | (ft bgs) | Date | Lead, IVBA | IVBA | | Manganese | Mercury | Nickel | Potassium | Selenium | Silver | Sodium | Thallium | Vanadium | Zinc |
| 7.0. | <u> </u> | G for SAP | (10.080) | Dute | | | | | 2153 | 244668 | | 61175 | 61145 | | | 61218 | |
| | | ilings PRG | | | | | | | | | | | | | | | |
| | | Rock/Soil PRG | | | | | | | | | | | | | | | |
| ODEC | | ıntain Region Clea | n Fill | | | | | 1800 | 1.4 | 92 | | 0.93 | 0.51 | | | 400 | 160 |
| | | Plant Direct Toxic | | | | | | 220 | 34 | 38 | | 0.52 | 560 | | 0.05 | 60 | 160 |
| | - | Inverts Direct Toxi | • | | | | | 450 | 0.05 | 280 | | 4.1 | | | | | 120 |
| ODL | - | Eco RBC Bird | city | | | | | 1300 | 0.03 | 200 | | 0.71 | 2.6 | | 4.5 | 4.7 | 46 |
| | | o RBC Mammal | | | | | | 1400 | 1.7 | 10 | | 0.63 | 14 | | 0.42 | 280 | 79 |
| | - | vation Worker RCB | | | | | | 230000 | 2900 | 190000 | | | 49000 | | | | |
| | | ML-SSS-12 | 0.7 | 7/9/2003 | NA | NA | 5730 | 730 | 56 | 7.3 | 4270 | 1.1 | 1.8 | 1080 | 2.5 | 66.2 | 211 |
| | | ML-SSS-16 | 0.5 | 7/10/2003 | NA | NA | 678 | 100 | 3.1 | 2.5 J | 2550 | 1.6 | 156 | 370 J | 1.1 J | 15.6 | 432 |
| | | WP-SSS-13 | 1 | 7/9/2003 | NA | NA | 2270 | 115 | 0.5 | 2.6 J | 2950 | 0.83 | 21.2 | 557 | 0.57 J | 26.1 | 55 |
| | EA | WP-SSS-14 | 0.7 | 7/10/2003 | NA | NA | 2450 | 691 | 0.51 | 4.7 | 1650 | 0.7 | 1.5 | ND (23.6) | 1.2 | 15 | 857 |
| | | WP-SSS-17 | 1 | 7/9/2003 | NA | NA | 3200 | 321 | 784 | 3.2 J | 3480 | 0.75 | 319 | 3240 | 1.6 | 14.9 | 2410 |
| | | WP-SUS-14 | 3.5 | 7/10/2003 | NA | NA | 4100 | 511 | 0.61 | 4.6 | 2920 | 0.61 | 11.6 | 516 | 1.7 | 25.4 | 107 |
| | | MMDGA-T-13 | 1 | 9/29/2009 | NA | NA | NA | 381 | 8 | NA | NA | NA | 35 | NA | NA | NA | 674 |
| | | MMDGA-T-34 | 0.25 | 9/30/2009 | NA | NA | NA | 398 | 190 | NA | NA | NA | 85 | NA | NA | NA | 816 |
| | | MMDGA-T-34 | 2 | 9/30/2009 | NA | NA | NA | 400 | 770 | NA | NA | NA | 229 | NA | NA | NA | 3490 |
| | | MMDGA-T-35 | 1 | 9/30/2009 | NA | NA | NA | 281 | 270 | NA | NA | NA | 144 | NA | NA | NA | 1760 |
| | | MMDGA-T-37 | 0.25 | 9/30/2009 | NA | NA | NA | 781 | 101 | NA | NA | NA | 51.1 | NA | NA | NA | 764 |
| | CES | MMDGA-T-40 | 2 | 9/30/2009 | NA | NA | NA | 565 | 254 | NA | NA | NA | 214 | NA | NA | NA | 3030 |
| | | MMDGA-T-41 | 2 | 9/30/2009 | NA | NA | NA | 575 | 222 | NA | NA | NA | 303 | NA | NA | NA | 4900 |
| | | MMDGA-T-9 | 1 | 9/29/2009 | NA | NA | NA | 246 | 12 | NA | NA | NA | 80.1 | NA | NA | NA | 294 |
| Upr Mon'tl | | MMDGA-WR-2 | 4 | 9/28/2009 | NA | NA | NA | 1200 | 0.88 | NA | NA | NA | 0.82 | NA | NA | NA | 116 |
| | | MMDGA-WR-28 | 0.5 | 9/29/2009 | NA | NA | NA | 197 | 0.15 J | NA | NA | NA | 2.58 | NA | NA | NA | 52 |
| | | MMDGA-WR-3 | 4 | 9/28/2009 | NA NA | NA NA | NA NA | 865 313 | 1.09 0.4 | NA NA | NA NA | NA NA | 48.1 39.8 | NA NA | NA NA | NA NA | 248 |
| | | MMDGA-WR-5 UMM-TLA-6 | 0.5 - 1 | 9/28/2009 10/2/2024 | | 1110 (0.49) | NA NA | NA | 9.23 (0.19) | NA NA | NA NA | NA NA | 39.8 NA | NA NA | NA NA | NA NA | NA |
| | | UMM-TLB-1 | 0.5 - 1 | 10/2/2024 | | 840 (0.49) | NA NA | NA NA | 387 (11) | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA | NA NA |
| | | UMM-TLB-4 | 0.5 - 1 | 10/2/2024 | NA | NA | NA | NA | NA | NA NA | NA NA | NA | NA | NA NA | NA NA | NA NA | NA NA |
| | | UMM-TLC-1 | 0.5 - 1 | 10/2/2024 | NA NA | NA NA | NA | NA NA | NA NA | NA | NA NA | NA | NA | NA | NA | NA NA | NA NA |
| | | UMM-TLC-2 | 0.5 - 1 | 10/2/2024 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | TEI | UMM-WRA-1 | 0.5 - 1 | 10/2/2024 | 66 (0.2) | 249 (0.49) | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | UMM-WRA-1-DS | 0.5 - 1 | 10/2/2024 | NA , | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | UMM-WRA-3 | 0.5 - 1 | 10/2/2024 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | UMM-WRB-1 | 0.5 - 1 | 10/2/2024 | NA | NA | NA | NA | 0.663 (0.098) | NA | NA | NA | NA | NA | NA | NA | NA |
| | | UMM-WRB-2 | 0.5 - 1 | 10/2/2024 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | UMM-WRB-2-DS | 0.5 - 1 | 10/2/2024 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | UUMM-WRA-2 | 0.5 - 1 | 10/2/2024 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | UUMM-WRA-3 | 0.5 - 1 | | 12.6 (0.19) | 340 (0.49) | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Upr Upr Mon'tl | TEI | | 0.5 - 1 | | 7.14 (0.2) | 340 (0.5) | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| - p p | | UUMM-WRA-3-DS | | 10/2/2024 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | UUMM-WRD-1 | 0.5 - 1 | 10/2/2024 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | UUMM-WRF-1 | 0.5 - 1 | 10/2/2024 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |

Table 3 Summary of Soil Notes Analytical Results Supplemental Site Investigation Report

Upper Granite Creek Watershed Mines
Wallowa-Whitman National Forest, Oregon

| | | | | Collection | | | | | | | | Me | etals | | | | | | |
|-----|--------------------------------------|----------------------|------------------|------------|--------|----------|----------|---------|----------|------------|--------|-----------|---------|---------|----------|--------|--------|------|------|
| | | | | Depth | Sample | | | | Arsenic, | Arsenic, | | | | | Chromium | | | | |
| AOI | Com | npany | Location | (ft bgs) | Date | Aluminum | Antimony | Arsenic | IVBA | Total IVBA | Barium | Beryllium | Cadmium | Calcium | (total) | Cobalt | Copper | Iron | Lead |
| | | PR | G for SAP | | | - | 4895 | 82 | | | - | 24468 | 9113 | | | 3681 | 489424 | | |
| | | Tai | lings PRG | | | | | 110 | | | 1 | | | | | - | | | |
| | V | Waste F | Rock/Soil PRG | | | | | 190 | | | - | | | | | | | | |
| | ODEQ Blue Mountain Region Clean Fill | | | | | | 1.3 | 14 | | | 950 | 2.6 | 0.69 | | 190 | - | 120 | | 21 |
| | ODEQ Eco RBC Plant Direct Toxicity | | | | | | 11 | 18 | | | 110 | 2.5 | 32 | | | 13 | 70 | | 120 |
| | ODEQ Ec | Inverts Direct Toxic | city | | | 78 | 6.8 | | | 330 | 40 | 140 | | | | 80 | | 1700 | |
| | | ODEQ | Eco RBC Bird | | | | | 15 | | | 630 | | 0.29 | | 23 | 76 | 14 | | 11 |
| | OI | DDEQ Eco | o RBC Mammal | | | | 0.27 | 19 | | | 1800 | 21 | 0.27 | | 34 | 230 | 42 | | 56 |
| | ODEC | EQ Excav | ation Worker RCB | | | | | 420 | | | - | 19000 | 9700 | | | | 390000 | | 800 |

Table 3

Summary of Soil Notes Analytical Results

Supplemental Site Investigation Report Upper Granite Creek Watershed Mines Wallowa-Whitman National Forest, Oregon

| | | | Collection | | | | | | | | Me | tals | | | | | | |
|-----|--------------|-----------------------|-------------------|----------------|--------------|----------|---------|----------|------------------------|--------|-----------|---------|---------|---------------------|--------|--------|-------|------|
| AOI | Company | Location | Depth (ft bgs) | Sample Date | Aluminum | Antimony | Arsenic | Arsenic, | Arsenic, Total IVBA | Barium | Beryllium | Cadmium | Calcium | Chromium (total) | Cobalt | Copper | Iron | Lead |
| AOI | | | (It bgs) | Date | Alullillulli | | | IVDA | TOTALIVEA | Darium | · · | | Calcium | (total) | | | 11011 | Leau |
| | Р | RG for SAP | | | | 4895 | 82 | | | | 24468 | 9113 | | | 3681 | 489424 | | |
| | T | ailings PRG | | | | | 110 | | | | | | | | | | | |
| | Waste | Rock/Soil PRG | | | | | 190 | | | | | | - | | 1 | - | - | |
| | ODEQ Blue Mo | ountain Region Clear | | | 1.3 | 14 | | | 950 | 2.6 | 0.69 | | 190 | - | 120 | | 21 | |
| | ODEQ Eco RE | C Plant Direct Toxic | | | 11 | 18 | | | 110 | 2.5 | 32 | | | 13 | 70 | | 120 | |
| | ODEQ Eco RB | C Inverts Direct Toxi | city | | | 78 | 6.8 | | | 330 | 40 | 140 | - | | - | 80 | - | 1700 |
| | ODE | Q Eco RBC Bird | | | | | 15 | | | 630 | | 0.29 | | 23 | 76 | 14 | | 11 |
| | ODEQ E | co RBC Mammal | | | | 0.27 | 19 | | | 1800 | 21 | 0.27 | | 34 | 230 | 42 | | 56 |
| | ODEQ Exca | avation Worker RCB | i | | | | 420 | | | | 19000 | 9700 | | | | 390000 | | 800 |

Note:

- 1. All concentrations reported in mg/kg (ppm); detection limits in parentheses.
- 2. ODEQ does not provide a Eco Soil RBC for aluminum, but states that it is toxic if soil has a pH < 5.5.
- 3. Iron is a narrative criterion.
- 4. Underlined concentrations exceed the PRG for SAP.
- 5. Double underlined concentrations for results from Tailings exceed the Tailings PRG.
- 6. Double underlined concentrations for results from Waste Rock/Soil exceed the Waste Rock/Soil PRG.
- 7. Italicized concentrations exceed the ODEQ Blue Mountain Region Clean Fill.
- 8. Grey shaded concentrations exceed one or more of the ODEQ Eco RBC (i.e., plant, inverts, bird, or mammal).
- 9. Boldfaced concentrations exceed the ODEQ Excavation Worker RCB.
- CES Cascade Earth Scienes
- EA EA Engineering, Science, and Technology, Inc.
- Eco Ecological
- J Estimated Concentration
- H Storage and Preservation Times were Not Met
- Mon'tl Monumental
- ND Not Detected
- NA Not Analyzed
- ODEQ Oregon Department of Environmental Quality
- PRG Preliminary Remediation Goal
- RBC Risk-Based Concentration
- SAP Sampling and Analysis Plan
- St Station
- TEI Terraphase Engineering Inc.

Table 4
Waste Rock/Tailings Pile UCL Calculations

Supplemental Site Investigation Report Upper Granite Creek Watershed Mines Wallowa-Whitman National Forest, Oregon

| Area of Interest | Feature | UCL (mg/kg) | Maximum Arsenic Concentration (mg/kg) | Distribution | Sample Size | Number of Locations |
|------------------------|------------|----------------|---|---------------|-------------|------------------------|
| | CEM-WRA | 239.5 | 299 | Normal | 7 | 7 |
| Central Mine | CEM-WRB | 185.8 | 242 | Normal | 13 | 3 |
| Central Wille | CEM-WRC | 124.5 | 187 | Normal | 16 | 3 |
| | CEM-WRD | 82.88 | 87 | Normal | 4 | 1 |
| | CM-PS | 36.61 | 38.61 | Normal | 7 | 3 |
| Con Montin Mine | CM-WRA | 12.61 | 19.6 | Normal | 12 | 4 |
| Cap Martin Mine | CM-WRB | 13.26 | 17.5 | Normal | 11 | 3 |
| | CM-WRC | 243.5 | 365.8 | Normal | 9 | 9 |
| Granite Creek Aquatic | GC03-WRA | 43.57 | 45 | Normal | 4 | 4 |
| Station 03 | GC03-WRB | 309.3 | 485 | Normal | 9 | 9 |
| Cranita Craak #F Mina | GC5-WRA | 293.2 | 421 | Normal | 8 | 8 |
| Granite Creek #5 Mine | GC5-WRB | 137.1 | 162 | Normal | 10 | 2 |
| Cranita Craal, #C Mina | GC6-WRA | 286.6 | 504 | Normal | 17 | 4 |
| Granite Creek #6 Mine | GC6-WTP | 10.02 | 16 | Normal | 14 | 5 |
| Cuanita Cuank #7 Mina | GC7-WRA | 22.44 | 31 | Normal | 14 | 5 |
| Granite Creek #7 Mine | GC7-WRB | 176.6 | 220 | Normal | 6 | 6 |
| | GF-WRA | 332 | 491 | Normal | 26 | 4 |
| | GF-WRB | 115.9 | 141 | Normal | 7 | 7 |
| Golden Fraction Mine | GF-WRC | 274 | 1340 | Nonparametric | 17 | 5 |
| | GF-WRC-Rev | 77.26 | 102 | Normal | 16 | 4 |
| | GF-WRD | 72.49 | 80 | Normal | 7 | 7 |

Terraphase Engineering Inc. Page 1 of 2

Table 4 Waste Rock/Tailings Pile UCL Calculations

Supplemental Site Investigation Report Upper Granite Creek Watershed Mines Wallowa-Whitman National Forest, Oregon

| Area of Interest | Feature | UCL (mg/kg) | Maximum Arsenic Concentration (mg/kg) | Distribution | Sample Size | Number of Locations |
|--------------------------|--|----------------|---|---------------|-------------|------------------------|
| | LMM-TLA | 8099 | 10884 | Normal | 7 | 7 |
| Lower Monumental Mine | LMM-WRA | 2683 | 4610 | Gamma | 13 | 13 |
| | LMM-WRB | 7612 | 8150 | Gamma | 6 | 6 |
| | SH-WRA | 33.18 | 81.8 | Nonparametric | 10 | 4 |
| Sheridan Mine | SH-WRB | 62.2 | 80.8 | Normal | 9 | 3 |
| | SH-WRC | 19.5 | 21 | Normal | 9 | 3 |
| | TL-WRA | 357.7 | 454 | Normal | 7 | 7 |
| Tillicum Mine | TL-WRB | 165.1 | 194 | Normal | 7 | 7 |
| | TL-WRC | 188.1 | 205 | Normal | 9 | 3 |
| | UMM-TLA | 7487 | 10200 | Normal | 6 | 6 |
| | UMM-TLB | 6067 | 11400 | Normal | 12 | 12 |
| Upper Monumental Mine | UMM-TLC | 3238 | 8750 | Gamma | 23 | 5 |
| | UMM-WRA | 1261 | 2920 | Normal | 16 | 16 |
| | UMM-WRB | 13851 | 14142 | Lognormal | 7 | 7 |
| | UUMM-WRA | 2091 | 2435 | Normal | 6 | 6 |
| | UUMM-WRB | 159.5 | 202 | Normal | 10 | 1 |
| Upper Upper | UUMM-WRC | 19.76 | 20 | Normal | 4 | 1 |
| Monumental Mine | UUMM-WRD | 312.5 | 334 | Normal | 5 | 2 |
| | Mine LMM-WRB SH-WRA SH-WRB SH-WRC TL-WRA TI-WRB TL-WRC UMM-TLA UMM-TLB UMM-TLC UMM-WRA UMM-WRB UUMM-WRB UUMM-WRB UUMM-WRB UUMM-WRB UUMM-WRC UUMM-WRC | 25.88 | 26 | Normal | 4 | 1 |
| | UUMM-WRF | 608.4 | 786 | Normal | 11 | 2 |

Note:

UCL =Calculated 95 percent upper concentration level, estimate of the mean mg/kg = milligrams per kilogram

Shaded cells represent features with UCLs above preliminary remediation goals

Terraphase Engineering Inc. Page 2 of 2

Table 5
Summary of Sediment Analytical Results
Supplemental Site Investigation Report
Upper Granite Creek Watershed Mines
Wallowa-Whitman National Forest, Oregon

| | | | | | Metals | | | | | | | | | | |
|-----------------|--------------|------------------------|------------------------|--------------|--------------------------------|-----------------------------------|--------------|------------------|-------------------------------|--------------|---------------------------|----------------|----------------|----------------|-------------------------------------|
| | | | Sample | | | | | | | | Chromium | | | | |
| AOI | Company | Location | Date | Aluminum | Antimony | Arsenic | Barium | Beryllium | Cadmium | Calcium | (total) | Cobalt | Copper | Iron | Lead |
| | PRG fo | r SAP | | | 4895 | 82 | | 24468 | 9113 | | | 3681 | 489424 | | |
| | Tailing | s PRG | | | | 110 | | | | | | | | | |
| ODEQ B | lue Mounta | in Region Clean | Fill | | 1.3 | 14 | 950 | 2.6 | 0.69 | | 190 | | 120 | 21 | |
| | ODEQ Eco | RBC FW | | | 3 | 6 | | | 0.6 | | 37 | | 36 | | 35 |
| USEPA R4 Eco | SV FW Non- | Narcotic Mode | of Action | 25000 | 2 | 9.8 | 20 | | 1 | | 43.4 | 50 | 31.6 | 20000 | 35.8 |
| USEPA R4 Eco SV | FW Aquatic I | Non-Narcotic Mo | de of Action | | | | | | | | | | | | |
| USEPA R4 Eco SV | FW Wildlife | | | | | | | | | | | | | | |
| | | ST-PSD-03 | 7/15/2003 | 4360 | 1.2 J | 13.8 | 76.3 | 0.32 J | ND (0.053) | 2050 | <i>45.6</i> | 6.4 | 2.5 | 40000 | 4.4 |
| | | ST-PSD-04 ST-PSD-05 | 7/15/2003 7/14/2003 | 6260 6670 | 1.5 J ND (0.39) | 19.5 18.7 | 127 126 | 0.38 J 0.27 J | ND (0.053) ND (0.062) | 1650 1820 | 5.2 7 | 6.3 5.7 | 3.1 2.4 J | 11600 14500 | 4.9 6.4 |
| | | ST-PSD-05 | 7/14/2003 | 9210 | ND (0.33) | 18.6 | 170 | 0.27 J | ND (0.065) | 2130 | 8.1 | 8.2 | 3 | 18800 | 4.9 |
| | | ST-PSD-07 | 7/12/2003 | 6980 | ND (0.36) | 21.9 | 127 | 0.3 J | ND (0.057) | 2040 | 11.5 | 5.7 | 10.6 | 19100 | 5.3 |
| | | ST-PSD-08 | 7/12/2003 | 11700 | ND (0.55) | 25.9 | 217 | 0.47 J | ND (0.086) | 2990 | 10.7 | 9.6 | 7.8 | 24600 | 6.7 |
| | | ST-PSD-09 | 7/11/2003 | 3990 | ND (0.42) | 9.6 | 52.3 | 0.11 J | 0.069 J | 1240 | 2.3 | 1.9 J | 1.5 J | 5650 | 2.2 |
| | | ST-PSD-10 | 7/10/2003 | 6680 | 0.74 J | 22.5 | 109 | 0.29 J | 0.12 J | 1710 | 9 | 5.1 J | 12.2 | 16100 | 8 |
| | | ST-PSD-53 | 7/19/2003 | 10200 | 2 J | <u>130</u> | 139 | 0.24 J | 0.96 | 2180 | 10.4 | 6.9 | 18.1 | 21600 | 38.2 |
| | EA | ST-PSD-54 | 7/17/2003 | 8910 | 5.1 J | <u>303</u> | 144 | 0.26 J | 2.8 | 2740 | 10.9 | 6.5 | 28 | 18900 | 148 |
| | | ST-RSD-03 ST-RSD-04 | 7/15/2003 7/15/2003 | 3820 5940 | ND (0.4) ND (0.41) | 17.4 44.2 | 68.2 92.5 | 0.2 J 0.23 J | ND (0.062) 0.074 J | 1430 2070 | 12.9 6.1 | 3.7 J 4.7 J | 1.3 J 2.1 J | 15400 12400 | 4.1 6.3 |
| | | ST-RSD-04 | 7/13/2003 | 6030 | ND (0.41) | 23 | 105 | 0.23 J | ND (0.063) | 1950 | 9.7 | 4.7 J | 2.13 | 15200 | 3.8 |
| | | ST-RSD-06 | 7/14/2003 | 4640 | 0.92 J | 9.3 | 92.1 | 0.32 J | ND (0.059) | 1900 | 24.9 | 6 | 2.4 J | 29900 | 4.4 |
| | | ST-RSD-07 | 7/12/2003 | 9650 | ND (0.42) | 19.3 | 174 | 0.39 J | ND (0.066) | 2330 | 10.1 | 8 | 3.5 | 22000 | 4.3 |
| | | ST-RSD-08 | 7/12/2003 | 8350 | ND (0.4) | 14.8 | 158 | 0.39 J | ND (0.063) | 2310 | 15.3 | 8.2 | 7.7 | 25300 | 5.7 |
| | | ST-RSD-09 | 7/11/2003 | 6190 | 0.56 J | 57.9 | 101 | 0.27 J | 0.62 | 1820 | 10 | 5.2 | 7.7 | 16900 | 52.4 |
| Granite Creek | | ST-RSD-10 | 7/10/2003 | 6850 | 1 J | 29 | 116 | 0.36 J | ND (0.068) | 2300 | 24.3 | 7.9 | 8.9 | 33700 | 9.5 |
| | | ST-RSD-53 | 7/19/2003 | 9670 | 2.3 J | <u>126</u> | 127 | 0.25 J | 1.2 | 2230 | 9.9 | 6.2 | 18.6 | 19000 | 44.3 |
| | | ST-RSD-54 GC-ABS-01 | 7/17/2003 6/26/2007 | 7770 NA | 5.1 <i>J</i> 1.2 | <u>246</u> 27.9 | 126 NA | 0.21 J 0.2 J | 1.8 0.44 | 1750 NA | 8.3 25 | 6.4 NA | 30 4 J | 18300 36000 | 121 12.5 |
| | | GC-ABS-01 | 6/26/2007 | NA NA | 1.2 | <u>127</u> | NA NA | ND (0.2) | 0.44 | NA NA | 12 | NA NA | 7 | 26600 | 45.3 |
| | | GC-ABS-03 | 6/26/2007 | NA NA | 0.7 J | 25 | NA | ND (0.2) | 0.85 | NA NA | 42 | NA NA | 3 J | 54600 | 15.1 |
| | CES | GC-ABS-04 | 6/27/2007 | NA | 1.7 | 67.4 | NA | 0.3 J | 1.49 | NA | 18 | NA | 10 | 29400 | 45.8 |
| | | GC-SS-01 | 6/25/2007 | NA | ND (0.2) | 7.5 | NA | 0.3 J | 0.22 J | NA | 9 | NA | 3 J | 9320 | 1.89 |
| | | GC-SS-02 | 6/25/2007 | NA | 0.3 J | 6.3 | NA | 0.6 J | 0.12 J | NA | 9 | NA | 2 J | 13700 | 2.04 |
| | | GC-SS-03 | 6/25/2007 | NA | 0.3 J | 36.5 | NA | 0.8 J | 0.17 J | NA | 10 | NA | 3 J | 16600 | 2.63 |
| | | CS-SD-1 | 10/5/2024 | NA | 0.26 (0.13) | 5.8 (1.3) | NA | NA | 0.234 (0.053) | NA | 7.81 (0.53) | NA | NA | NA | 4.12 (0.13) |
| | | CS-SD-2 | 10/3/2024 | NA NA | 0.038 J (0.054) | | NA | NA NA | 0.038 (0.022) | NA NA | 2.49 (0.22) | NA | NA NA | NA NA | 0.927 (0.054) |
| | | CS-SD-3 CS-SD-4 | 10/3/2024 10/3/2024 | NA NA | 0.069 (0.063) 0.892 (0.058) | 11.7 (0.63) 32.7 (0.58) | NA NA | NA NA | 0.062 (0.025) 1.09 (0.023) | NA NA | 4.9 (0.25) 9.05 (0.23) | NA NA | NA NA | NA NA | 1.53 (0.063) 25.6 (0.058) |
| | TEI | CS-SD-4 CS-SD-5 | 10/3/2024 | NA NA | 0.892 (0.038) | 14.1 (0.51) | NA | NA NA | 0.169 (0.02) | NA NA | 5.03 (0.23) | NA NA | NA NA | NA NA | 2.79 (0.051) |
| | - | CS-SD-6 | 10/4/2024 | NA | 0.147 (0.045) | 16.6 (0.45) | NA | NA | 0.146 (0.018) | NA | 4.76 (0.18) | NA | NA | NA | 2.74 (0.045) |
| | | CS-SD-7 | 10/4/2024 | NA | 0.355 (0.048) | 24.2 (0.48) | NA | NA | 0.538 (0.019) | NA | 10.6 (0.19) | NA | NA | NA | 12.1 (0.048) |
| | | CS-SD-7 (DUP) | 10/4/2024 | NA | 0.334 (0.054) | 24.3 (0.54) | NA | NA | 0.446 (0.022) | NA | 9.1 (0.22) | NA | NA | NA | 12.8 (0.054) |
| | | CS-SD-8 | 10/5/2024 | NA | 0.406 (0.058) | 35.2 (0.58) | NA | NA | 0.316 (0.023) | NA | 9.13 (0.23) | NA | NA | NA | 10.7 (0.058) |

Table 5
Summary of Sediment Analytical Results
Supplemental Site Investigation Report
Upper Granite Creek Watershed Mines
Wallowa-Whitman National Forest, Oregon

| | | | | | Metls | | | | | | | | | |
|-----------------|---|--------------------------|------------------------|--------------|------------|--------------------------------|--------------|--------------|----------------|----------------------------|---------------------|---------------------|------------|---------------------------------|
| | | | Sample | | | | | | | | | | | |
| AOI | Company | Location | Date | Magnesium | Manganese | Mercury | Nickel | Potassium | Selenium | Silver | Sodium | Thallium | Vanadium | Zinc |
| 7.0. | PRG fo | | | | | 2153 | 244668 | | 61175 | 61145 | | | 61218 | |
| | Tailing | | | | | | | | | | | | | |
| ODEQ B | _ | in Region Clean | Fill | | 1800 | 1.4 | 92 | | 0.93 | 0.51 | | | 400 | 160 |
| , | ODEQ Eco | | | | 1100 | 0.2 | 18 | | | 4.5 | | | | 123 |
| USEPA R4 Eco | SV FW Non- | Narcotic Mode | of Action | | 460 | | 22.7 | | 0.72 | 1 | | | | 121 |
| USEPA R4 Eco SV | USEPA R4 Eco SV FW Aquatic Non-Narcotic Mode of Action | | | | | 0.18 | | | | | | | | |
| USEPA R4 Eco SV | USEPA R4 Eco SV FW Wildlife Non-Narcotic Mode of Action | | | | | 0.17 | | | 0.8 | | | | | |
| | ST-PSD-03 7/15/2003 | | | 1520 | 162 | ND (0.019) | 5.5 | 950 | 0.88 | 0.22 J | ND (41.6) | 1.8 | 154 | 23 |
| | | ST-PSD-04 | 7/15/2003 | 3330 | 159 | ND (0.02) | 4.3 | 2020 | 0.34 J | 0.58 J | ND (41.9) | ND (0.25) | 28.5 | 43.7 |
| | | ST-PSD-05 | 7/14/2003 | 3530 | 187 | ND (0.021) | 3.2 J | 2190 | 0.5 J | 0.64 J | ND (48.9) | ND (0.29) | 36.6 | 41.9 |
| | | ST-PSD-06 | 7/14/2003 | 5550 | 343 | 0.027 J | 4.4 | 3000 | 0.57 | 0.54 J | ND (50.9) | 0.5 J | 45.3 | 63.3 |
| | | ST-PSD-07 | 7/12/2003 | 3080 | 202 | 0.087 | 3.6 J | 2100 | 0.4 J | 0.83 J | ND (44.8) | 0.3 J | 57.5 | 62.6 |
| | | ST-PSD-08 | 7/12/2003 | 6100 | 342 | 0.12 | 5.7 J | 3870 | 0.73 | 0.63 J | ND (68) | 0.44 J | 61.9 | 94.2 |
| | | ST-PSD-09 | 7/11/2003 | 1370 | 100 | ND (0.019) | 1.1 J | 762 | 0.29 J | ND (0.1) | 230 J | ND (0.31) | 13 46 | 20.7 |
| | | ST-PSD-10 ST-PSD-53 | 7/10/2003 7/19/2003 | 2840 4790 | 177 364 | 0.07 0.11 | 3.2 J 6.2 | 2000 2840 | 0.63 0.44 J | 0.49 J 1.8 | 79.7 J ND (45.2) | ND (0.33) 0.69 J | 52.1 | 50.2 <i>150</i> |
| | | ST-PSD-54 | 7/17/2003 | 3460 | 611 | 0.32 | 7.6 | 2400 | 0.44) | 7.9 | 70.2 J | ND (0.67) | 43 | 186 |
| | EA | ST-RSD-03 | 7/15/2003 | 1600 | 171 | ND (0.019) | 2.2 J | 1070 | 0.43 J | ND (0.094) | 96.8 J | ND (0.29) | 50.2 | 21.8 |
| | | ST-RSD-04 | 7/15/2003 | 3390 | 203 | ND (0.021) | 2.7 J | 1320 | 0.35 J | 0.86 J | 120 J | ND (0.31) | 29.5 | 34 |
| | | ST-RSD-05 | 7/14/2003 | 2600 | 169 | ND (0.023) | 3.1 J | 1630 | 0.41 J | ND (0.094) | 76 J | ND (0.29) | 45.9 | 38.7 |
| | | ST-RSD-06 | 7/14/2003 | 2220 | 156 | 0.037 J | 4.3 | 1420 | 0.63 | 0.24 J | ND (46.8) | 1.1 | 113 | 35.6 |
| | | ST-RSD-07 | 7/12/2003 | 5160 | 277 | 0.05 | 4.4 | 3500 | 0.37 J | 1.9 | ND (52.2) | 0.59 J | 58.5 | 57.7 |
| | | ST-RSD-08 | 7/12/2003 | 5210 | 283 | 0.058 | 4.8 | 3330 | 0.34 J | 0.73 J | ND (49.8) | 0.69 J | 76.2 | 58.1 |
| | | ST-RSD-09 | 7/11/2003 | 3130 | 177 | 0.031 J | 3.2 J | 1920 | 0.4 J | 1 | ND (44.1) | 0.51 J | 51.2 | 75.1 |
| Granite Creek | | ST-RSD-10 | 7/10/2003 | 3490 | 193 | 0.034 J | 5.2 | 2410 | 0.58 | 0.92 J | ND (53.2) | 1.4 | 117 | 64.9 |
| | | ST-RSD-53 | 7/19/2003 | 4030 | 360 | 0.12 | 6.5 | 2550 | 0.42 J | 4.9 | 45.9 | 0.73 J | 45.9 | 148 |
| | | ST-RSD-54 GC-ABS-01 | 7/17/2003 6/26/2007 | 3380 NA | 560 243 | 0.12 0.23 | 7.3 3 J | 2340 NA | 0.63 0.28 J | 6.3 1.15 | 79.5 J NA | 0.76 J NA | 38.3 NA | 151 77 |
| | | GC-ABS-01 | 6/26/2007 | NA NA | 376 | 0.12 J | 4 J | NA NA | 0.28 J | 3.27 | NA NA | NA NA | NA NA | 99 |
| | | GC-ABS-03 | 6/26/2007 | NA | 320 | 0.09 J | 3 J | NA NA | 0.38 | 0.68 | NA NA | NA NA | NA NA | 84 |
| | CES | GC-ABS-04 | 6/27/2007 | NA | 414 | ND (0.05) | 5 | NA | 0.64 | 2.4 | NA | NA | NA | 120 |
| | | GC-SS-01 | 6/25/2007 | NA | 165 | 0.07 J | 1 J | NA | 0.31 | 0.12 | NA | NA | NA | 25 |
| | | GC-SS-02 | 6/25/2007 | NA | 213 | ND (0.04) | ND (1) | NA | 0.09 J | 0.05 J | NA | NA | NA | 36 |
| | | GC-SS-03 | 6/25/2007 | NA | 298 | 0.1 JH | ND (1) | NA | 0.15 J | 0.13 | NA | NA | NA | 36 |
| | | CS-SD-1 | 10/5/2024 | NA | NA | 0.031 J (0.053) | NA | NA | NA | 0.282 (0.053) | NA | NA | NA | 45 (1.3) |
| | | CS-SD-2 | 10/3/2024 | NA | NA | ND (0.024) | NA | NA | NA | 0.043 (0.022) | NA | NA | NA | 16.9 (0.54) |
| | | CS-SD-3 | 10/3/2024 | NA | NA | 0.923 (0.027) | NA | NA | NA | 0.112 (0.025) | NA | NA | NA | 29.7 (0.63) |
| | TE: | CS-SD-4 | 10/3/2024 | NA | NA | 0.011 J (0.029) | NA | NA NA | NA NA | 0.961 (0.023) | NA | NA | NA | 47.2 (0.58) |
| | TEI | CS-SD-5 | 10/4/2024 | NA NA | NA NA | 0.056 (0.025) | NA NA | NA NA | NA NA | 0.582 (0.02) | NA NA | NA NA | NA NA | 32.7 (0.51) |
| | | CS-SD-6 | 10/4/2024 | NA NA | NA NA | 0.033 (0.021) | NA NA | NA NA | NA NA | 0.2 (0.018) 1.1 (0.019) | NA NA | NA NA | NA NA | 37.1 (0.45) |
| | | CS-SD-7 CS-SD-7 (DUP) | 10/4/2024 10/4/2024 | NA NA | NA NA | 0.097 (0.023) 0.099 (0.024) | NA NA | NA NA | NA NA | 1.62 (0.022) | NA NA | NA NA | NA NA | 168 (0.48) 102 (0.54) |
| | | CS-SD-7 (DOF) | 10/4/2024 | NA NA | NA NA | 0.096 (0.024) | NA NA | NA NA | NA NA | 1.26 (0.023) | NA NA | NA NA | NA NA | 102 (0.54) |
| | <u>I</u> | C3 3D 0 | 10/ 3/ 2024 | 14/7 | INA | 3.030 (0.020) | IVA | I INA | INA | 1.20 (0.023) | 14/7 | INA | I | 100 (0.50) |

Table 5

Summary of Sediment Notes Analytical Results

Supplemental Site Investigation Report Upper Granite Creek Watershed Mines Wallowa-Whitman National Forest, Oregon

| | | | | | Metals | | | | | | | | | | |
|---|--|----------------|----------------|----------|----------|---------|--------|-----------|---------|---------|---------------------|--------|--------|-------|------|
| AOI | Company | Location | Sample Date | Aluminum | Antimony | Arsenic | Barium | Beryllium | Cadmium | Calcium | Chromium (total) | Cobalt | Copper | Iron | Lead |
| PRG for SAP | | | | | 4895 | 82 | | 24468 | 9113 | | | 3681 | 489424 | | |
| Tailings PRG | | | | | | 110 | | | | | | | | | |
| ODEQ | Blue Mountai | n Region Clean | Fill | | 1.3 | 14 | 950 | 2.6 | 0.69 | | 190 | | 120 | | 21 |
| | ODEQ Eco | RBC FW | | | 3 | 6 | | | 0.6 | | 37 | | 36 | | 35 |
| USEPA R4 Eco | USEPA R4 Eco SV FW Non-Narcotic Mode of Action | | | 25000 | 2 | 9.8 | 20 | | 1 | | 43.4 | 50 | 31.6 | 20000 | 35.8 |
| USEPA R4 Eco S | USEPA R4 Eco SV FW Aquatic Non-Narcotic Mode of Action | | | | | | | | | | | | | | |
| USEPA R4 Eco SV FW Wildlife Non-Narcotic Mode of Action | | | | | | | | | | | | | | | |

Note:

- 1. All concentrations reported in mg/kg (ppm); detection limits in parentheses.
- 2. Underlined concentrations exceed the PRG for SAP.
- 3. Double underlined concentrations exceed the Tailings PRG.
- 4. Boldfaced concentrations exceed the ODEQ Blue Mountain Region Clean Fill.
- 5. Italicized concentrations exceed the ODEQ Eco RBC FW.
- 6. Grey shaded concentrations exceed the USEPA R4 Eco SV FW Non-Narcotic Mode of Action.
- 7. Blue shaded concentrations exceed the USEPA R4 Eco SV FW Aquatic Non-Narcotic Mode of Action.
- 8. Red colored concentrations exceed the USEPA R4 Eco SV FW Wildlife Non-Narcotic Mode of Action.
- CES = Cascade Earth Scienes
- EA = EA Engineering, Science, and Technology, Inc.
- Eco = Ecological
- FW = Freshwater
- ND = Not Detected NA = Not Analyzed
- J = Estimated Concentration
- ODEQ = Oregon Department of Environmental Quality
- PRG = Preliminary Remediation Goal
- RBC = Risk-Based Concentration
- SAP = Sampling and Analysis Plan
- SV = Screening Value
- TEI = Terraphase Engineering Inc.
- USEPA R4 = United States Environmental Protection Agency Region 4

Table 6
Summary of Surface Water Analytical Results
Supplemental Site Investigation Report
Upper Granite Creek Watershed Mines
Wallowa-Whitman National Forest, Oregon

| | | | | Physical Properties | rties Metals | | | | | | | | | |
|------------------|-------------|------------------|-----------|---------------------|--------------|----------------------|--------------------|----------|----------------------|-------------|--------------------|---------------|-------------|--|
| | | | Sample | | | | | | | | | | | |
| AOI | Company | Location | Date | Hardness (total) | Aluminum | Antimony | Arsenic | Barium | Cadmium | Calcium | Chromium (total) | Copper | Iron | |
| Eco RBC | FW Aquatic | Chronic Exposure | | | 0.32 | 0.19 | 0.15 | 0.22 | 0.000094 | 120 | 11 | 0.0014 | 1 | |
| Eco RBC | FW Aquati | c Acute Exposure | | | 0.69 | 0.9 | 0.34 | 2 | 0.00049 | | 16 | 0.0023 | | |
| Eco RBC | FW Wildlife | Chronic Exposure | 1 | | | | | | | | | | | |
| Eco RBC | FW Wildlif | e Acute Exposure | | | | | | | | | | | | |
| Cara Mantin | CEC. | CM-AS-01 | 6/21/2007 | NA | NA | ND (0.0004) | ND (0.0005) | NA | ND (0.0001) | 9.8 | ND (0.01) | ND (0.0005) | 0.65 | |
| Cap Martin | CES | CM-AS-02 | 6/21/2007 | NA | NA | ND (0.0004) | 0.0013 | NA | 0.0001 J | 9.9 | ND (0.01) | ND (0.0005) | 2.03 | |
| | | ST-SFW-03 | 7/15/2003 | NA | ND (0.0236) | ND (0.0047) | ND (0.0048) | 0.0349 J | ND (0.0006) | 5.56 | ND (0.0014) | ND (0.0024) | ND (0.0333) | |
| | | ST-SFW-04 | 7/15/2003 | NA | 0.126 J | ND (0.0047) | ND (0.0048) | 0.0415 J | ND (0.0006) | 7.06 | ND (0.0014) | ND (0.0024) | 0.0941 J | |
| | | ST-SFW-05 | 7/13/2003 | NA | ND (0.0236) | ND (0.0047) | ND (0.0048) | 0.0385 J | ND (0.0006) | 7.13 | ND (0.0014) | ND (0.0024) | ND (0.0333) | |
| | | ST-SFW-06 | 7/13/2003 | NA | ND (0.0236) | ND (0.0047) | ND (0.0048) | 0.0456 J | ND (0.0006) | 8.45 | ND (0.0014) | ND (0.0024) | ND (0.0333) | |
| | EA | ST-SFW-07 | 7/12/2003 | NA | ND (0.0631) | ND (0.005) | ND (0.006) | 0.0455 J | ND (0.0012) | 8.7 | ND (0.0019) | ND (0.0033) | ND (0.0667) | |
| | EA | ST-SFW-08 | 7/12/2003 | NA | ND (0.0236) | ND (0.0047) | ND (0.0048) | 0.0485 J | ND (0.0006) | 9.01 | ND (0.0014) | ND (0.0024) | ND (0.0333) | |
| | | ST-SFW-09 | 7/11/2003 | NA | ND (0.0631) | ND (0.005) | ND (0.006) | 0.0509 J | ND (0.0012) | 9.69 | ND (0.0019) | ND (0.0033) | ND (0.0667) | |
| | | ST-SFW-10 | 7/10/2003 | NA | ND (0.0631) | ND (0.005) | ND (0.006) | 0.0529 J | ND (0.0012) | 9.91 | ND (0.0019) | ND (0.0033) | ND (0.0667) | |
| | | ST-SFW-53 | 7/17/2003 | NA | 0.0793 J | ND (0.0047) | 0.0131 | 0.055 J | ND (0.0006) | 15.3 | ND (0.0014) | ND (0.0024) | ND (0.0168) | |
| | | ST-SFW-54 | 7/17/2003 | NA | 0.0264 J | ND (0.0038) | 0.0096 J | 0.051 J | ND (0.0003) | 15.9 | 0.00074 J | ND (0.0014) | 0.0323 J | |
| Granite Creek | | GC-SW-01 | 6/25/2007 | NA | NA | ND (0.0004) | 0.0006 J | NA | ND (0.0001) | 4.5 | ND (0.01) | ND (0.0005) | 0.03 J | |
| Granite Creek | CES | GC-SW-02 | 6/25/2007 | NA | NA | ND (0.0004) | ND (0.0005) | NA | ND (0.0001) | 4.5 | ND (0.01) | ND (0.0005) | 0.04 J | |
| | | GC-SW-03 | 6/5/2007 | NA | NA | ND (0.0004) | 0.0006 J | NA | ND (0.0001) | 4.7 | ND (0.01) | ND (0.0005) | 0.1 | |
| | | CS-SW-1 | 10/5/2024 | 18.1 (0.09) | NA | 0.000036 J (0.00005) | 0.00036 J (0.0005) | NA | ND (0.00002) | 5.59 (0.02) | 0.00011 J (0.0002) | NA | NA | |
| | | CS-SW-2 | 10/3/2024 | 19.7 (0.09) | NA | 0.000025 J (0.00005) | 0.00067 (0.0005) | NA | ND (0.00002) | 6.07 (0.02) | 0.00011 J (0.0002) | NA | NA | |
| | | CS-SW-2 (DUP) | 10/3/2024 | 19.3 (0.09) | NA | 0.000031 J (0.00005) | 0.00061 (0.0005) | NA | ND (0.00002) | 5.92 (0.02) | 0.00011 J (0.0002) | NA | NA | |
| | | CS-SW-3 | 10/3/2024 | 21 (0.09) | NA | 0.000038 J (0.00005) | 0.00087 (0.0005) | NA | ND (0.00002) | 6.49 (0.02) | 0.00012 J (0.0002) | NA | NA | |
| | TEI | CS-SW-4 | 10/3/2024 | 27.5 (0.09) | NA | 0.000036 J (0.00005) | 0.00092 (0.0005) | NA | ND (0.00002) | 8.41 (0.02) | 0.00014 J (0.0002) | NA | NA | |
| | | CS-SW-5 | 10/4/2024 | 31.8 (0.09) | NA | 0.000098 (0.00005) | 0.00178 (0.0005) | NA | 0.00001 J (0.00002) | 9.55 (0.02) | 0.00011 J (0.0002) | NA | NA | |
| | | CS-SW-6 | 10/4/2024 | 32.3 (0.09) | NA | 0.000076 (0.00005) | 0.00204 (0.0005) | NA | ND (0.00002) | 9.71 (0.02) | 0.00011 J (0.0002) | NA | NA | |
| | | CS-SW-7 | 10/4/2024 | 36.3 (0.09) | NA | 0.000104 (0.00005) | 0.00199 (0.0005) | NA | 0.000019 J (0.00002) | 10.9 (0.02) | 0.00009 J (0.0002) | NA | NA | |
| | | CS-SW-8 | 10/5/2024 | 36.7 (0.09) | NA | 0.000108 (0.00005) | 0.00221 (0.0005) | NA | 0.00002 J (0.00002) | 10.9 (0.02) | 0.00011 J (0.0002) | NA | NA | |
| Granite Creek #5 | CES | GC5-AS-01 | 6/24/2007 | NA | NA | 0.0009 J | 0.0046 | NA | <u>0.0007</u> | 22.7 | ND (0.01) | <u>0.0038</u> | 1.74 | |
| Golden Fraction | CES | GF-AS-01 | 6/25/2007 | NA | NA | 0.0007 J | 0.0119 | NA | ND (0.0001) | 28.2 | ND (0.01) | 0.0007 J | 1.87 | |
| | EA | SP-SFW-19 | 7/19/2003 | NA | ND (0.0631) | ND (0.005) | 0.0214 | 0.0995 J | ND (0.0012) | 22.6 | ND (0.0019) | ND (0.0033) | ND (0.0667) | |
| Lwr Mon'tl | | MMDGA-AS-01 | 9/28/2009 | NA | NA | NA | 0.0218 | NA | NA | NA | NA | NA | 0.13 | |
| LWI WOIL | CES | | 9/28/2009 | NA | NA | NA | 0.0199 | NA | NA | NA | NA | NA | 0.06 | |
| | | MMDGA-SW-02 | | NA | NA | NA | 0.0242 | NA | NA | NA | NA | NA | ND (0.02) | |
| | EA | SP-SFW-18 | 7/9/2003 | NA | ND (0.0631) | ND (0.005) | 0.0818 | 0.0677 J | ND (0.0012) | 17.4 | ND (0.0019) | ND (0.0033) | ND (0.0667) | |
| | EA | | 7/10/2003 | NA | ND (0.0631) | ND (0.005) | ND (0.006) | 0.0756 J | ND (0.0012) | 17.8 | ND (0.0019) | ND (0.0033) | ND (0.0667) | |
| Upr Mon'tl | CES | | 9/28/2009 | NA | NA | NA | 0.0272 | NA | NA | NA | NA | NA | 0.33 | |
| | CES | | 9/28/2009 | NA | NA | NA | 0.105 | NA | NA | NA | NA | NA | 5.61 | |
| | CES | MMDGA-SW-01 | 9/28/2009 | NA | NA | NA | 0.051 | NA | NA | NA | NA | NA | 4.22 | |

Table 6 **Summary of Surface Water Analytical Results** Supplemental Site Investigation Report

Upper Granite Creek Watershed Mines Wallowa-Whitman National Forest, Oregon

| | | | | Metals | | | | | | | | | | |
|------------------|---------------|------------------|----------------|----------------------|--------------|-------------|----------------|-----------|-------------|--------------|--------|------------------|--|--|
| AOI | Company | Location | Sample Date | Lead | Magnesium | Manganese | Mercury | Potassium | Selenium | Silver | Sodium | Zinc | | |
| Eco RBC | FW Aquatic | Chronic Exposure | | 0.00054 | 82 | 0.093 | 0.000012 | 53 | 0.0046 | 0.0001 | 680 | 0.036 | | |
| Eco RB | C FW Aquati | c Acute Exposure | | 0.014 | | 1.7 | 0.0014 | | 0.02 | 0.0003 | | 0.036 | | |
| Eco RBC | FW Wildlife | Chronic Exposure |) | | | | 0.000013 | | | | | | | |
| Eco RB0 | C FW Wildlife | e Acute Exposure | | | | | 0.000012 | | | | | | | |
| Can Martin | CES | CM-AS-01 | 6/21/2007 | 0.0001 J | 2 | 0.021 J | 0.0000095 | NA | ND (0.0001) | ND (0.00005) | NA | <u>1.31</u> | | |
| Cap Martin | CES | CM-AS-02 | 6/21/2007 | 0.0001 J | 2.1 | 0.026 J | 0.00000574 | NA | ND (0.0001) | ND (0.00005) | NA | ND (0.01) | | |
| | | ST-SFW-03 | 7/15/2003 | ND (0.0013) | 0.998 J | ND (0.0007) | ND (0.0001) | 1.21 J | ND (0.0034) | ND (0.0022) | 2.81 J | 0.002 J | | |
| | | ST-SFW-04 | 7/15/2003 | ND (0.0013) | 1.32 J | 0.0057 J | ND (0.0001) | 1.75 J | ND (0.0034) | ND (0.0022) | 3.16 J | 0.0026 J | | |
| | | ST-SFW-05 | 7/13/2003 | ND (0.0013) | 1.33 J | 0.00088 J | ND (0.0001) | 2.34 J | ND (0.0034) | ND (0.0022) | 3.26 J | 0.0025 J | | |
| | | ST-SFW-06 | 7/13/2003 | ND (0.0013) | 1.72 J | 0.00072 J | ND (0.0001) | 1.99 J | ND (0.0034) | ND (0.0022) | 3.22 J | 0.0023 J | | |
| | F.A. | ST-SFW-07 | 7/12/2003 | 0.0017 J | 1.76 J | ND (0.0019) | ND (0.0001) | 1.59 J | ND (0.0017) | ND (0.0029) | 3.16 J | 0.0029 J | | |
| | EA | ST-SFW-08 | 7/12/2003 | ND (0.0013) | 1.82 J | 0.0011 J | ND (0.0001) | 2.67 J | ND (0.0034) | ND (0.0022) | 3.42 J | 0.003 J | | |
| | | ST-SFW-09 | 7/11/2003 | ND (0.0015) | 2.01 J | ND (0.0019) | ND (0.0001) | 1.62 J | ND (0.0017) | ND (0.0029) | 3.24 J | 0.0033 J | | |
| | | ST-SFW-10 | 7/10/2003 | ND (0.0015) | 2.07 J | ND (0.0019) | ND (0.0001) | 1.63 J | ND (0.0017) | ND (0.0029) | 3.14 J | 0.0035 J | | |
| | | ST-SFW-53 | 7/17/2003 | ND (0.0013) | 3.54 J | 0.0103 J | 0.0002 J | 1.87 J | ND (0.0017) | ND (0.0022) | 3.38 J | 0.0031 J | | |
| | | ST-SFW-54 | 7/17/2003 | ND (0.0013) | 4.04 J | 0.0067 J | 0.0001 J | 2.49 J | ND (0.0017) | ND (0.0009) | 3.65 J | ND (0.0057) | | |
| | | GC-SW-01 | 6/25/2007 | 0.0001 J | 0.7 J | ND (0.005) | ND (0.0000001) | NA | ND (0.0001) | ND (0.00005) | NA | ND (0.01) | | |
| Granite Creek | CES | GC-SW-02 | 6/25/2007 | ND (0.0001) | 0.8 J | ND (0.005) | 0.00000048 | NA | ND (0.0001) | ND (0.00005) | NA | 0.01 J | | |
| | | GC-SW-03 | 6/5/2007 | 0.0001 J | 0.9 J | ND (0.005) | 0.0000048 | NA | ND (0.0001) | ND (0.00005) | NA | 0.01 J | | |
| | | CS-SW-1 | 10/5/2024 | 0.000013 J (0.00002) | 0.996 (0.01) | NA | ND (0.0002) | NA | NA | ND (0.00002) | NA | ND (0.002) | | |
| | | CS-SW-2 | 10/3/2024 | 0.000012 J (0.00002) | 1.11 (0.01) | NA | ND (0.0002) | NA | NA | ND (0.00002) | NA | ND (0.002) | | |
| | | CS-SW-2 (DUP) | 10/3/2024 | 0.000007 J (0.00002) | 1.09 (0.01) | NA | ND (0.0002) | NA | NA | ND (0.00002) | NA | ND (0.002) | | |
| | | CS-SW-3 | 10/3/2024 | 0.000012 J (0.00002) | 1.17 (0.01) | NA | ND (0.0002) | NA | NA | ND (0.00002) | NA | ND (0.002) | | |
| | TEI | CS-SW-4 | 10/3/2024 | ND (0.00002) | 1.59 (0.01) | NA | ND (0.0002) | NA | NA | ND (0.00002) | NA | ND (0.002) | | |
| | | CS-SW-5 | 10/4/2024 | 0.000018 J (0.00002) | 1.93 (0.01) | NA | ND (0.0002) | NA | NA | ND (0.00002) | NA | 0.0018 J (0.002) | | |
| | | CS-SW-6 | 10/4/2024 | 0.000013 J (0.00002) | 1.96 (0.01) | NA | ND (0.0002) | NA | NA | ND (0.00002) | NA | 0.0007 J (0.002) | | |
| | | CS-SW-7 | 10/4/2024 | 0.000022 (0.00002) | 2.2 (0.01) | NA | ND (0.0002) | NA | NA | ND (0.00002) | NA | 0.0008 J (0.002) | | |
| | | CS-SW-8 | 10/5/2024 | 0.000084 (0.00002) | 2.31 (0.01) | NA | ND (0.0002) | NA | NA | ND (0.00002) | NA | 0.0008 J (0.002) | | |
| Granite Creek #5 | CES | GC5-AS-01 | 6/24/2007 | 0.009 | 4.9 | 0.01 J | 0.000141 | NA | 0.0005 J | 0.00009 J | NA | 0.02 J | | |
| Golden Fraction | CES | GF-AS-01 | 6/25/2007 | 0.0002 J | 6.7 | 0.374 | 0.00000194 | NA | ND (0.0001) | ND (0.00005) | NA | ND (0.01) | | |
| | EA | SP-SFW-19 | 7/19/2003 | 0.0023 J | 7.15 | 0.0067 J | ND (0.0001) | 2.72 J | 0.0026 J | ND (0.0029) | 3.31 J | 0.0156 J | | |
| Lur Manit | | MMDGA-AS-01 | 9/28/2009 | ND (0.0001) | NA | NA | NA | NA | NA | NA | NA | 0.004 J | | |
| Lwr Mon'tl | CES | MMDGA-SP-02 | 9/28/2009 | ND (0.0001) | NA | NA | NA | NA | NA | NA | NA | 0.004 J | | |
| | | MMDGA-SW-02 | 9/28/2009 | 0.0003 J | NA | NA | NA | NA | NA | NA | NA | 0.009 J | | |
| | EA | SP-SFW-18 | 7/9/2003 | ND (0.0015) | 4.66 J | 0.0029 J | ND (0.000001) | 2.44 J | ND (0.0017) | ND (0.0029) | 2.94 J | 0.0276 | | |
| | EA | SP-SFW-51 | 7/10/2003 | 0.0021 J | 4.53 J | 0.0554 | ND (0.0000001) | 1.61 J | ND (0.0017) | ND (0.0029) | 2.63 J | 0.005 J | | |
| Upr Mon'tl | CES | MMDGA-AS-02 | 9/28/2009 | 0.0004 J | NA | NA | NA | NA | NA | NA | NA | 0.014 | | |
| | CES | MMDGA-SP-01 | 9/28/2009 | <u>0.0294</u> | NA | NA | NA | NA | NA | NA | NA | <u>0.12</u> | | |
| | CES | MMDGA-SW-01 | 9/28/2009 | 0.0118 | NA | NA | NA | NA | NA | NA | NA | 0.028 | | |

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Table 6 Summary of Surface Water Analytical Results Upper Granite Creek Watershed Mines

Wallowa-Whitman National Forest, Oregon

| | | | | Physical Properties | | Metals | | | | | | | | | |
|-----|--------------------------------------|----------------|--------|---------------------|----------|----------|---------|------------------|------------|------------|--------------------|--------|------|--|--|
| 101 | | | Sample | Handana (tata) | Almetama | A., 11. | A | D avidson | On desirem | Collations | Characters (Astal) | • | 1 | | |
| AOI | Compan | y Locatio | n Date | Hardness (total) | Aluminum | Antimony | Arsenic | Barium | Cadmium | Calcium | Chromium (total) | Copper | Iron | | |
| Eco | RBC FW Aqua | ic Chronic Exp | osure | | 0.32 | 0.19 | 0.15 | 0.22 | 0.000094 | 120 | 11 | 0.0014 | 1 | | |
| Ec | RBC FW Aqua | tic Acute Expo | sure | | 0.69 | 0.9 | 0.34 | 2 | 0.00049 | - | 16 | 0.0023 | | | |
| Eco | Eco RBC FW Wildlife Chronic Exposure | | | | | | | | | | | | | | |
| Eco | Eco RBC FW Wildlife Acute Exposure | | | | | | | | | | | | | | |

Note:

- 1. All concentrations reported in mg/L; detection limits in parentheses.
- 2. Only compounds with at least one detection are shown.
- 3. The numbers presented for Chromium (total) are the criteria established by ODEQ for Chromium VI.
- 4. Grey-shaded concentrations exceed the Eco RBC FW Aquatic Chronic Exposure.
- 5. Underlined concentrations exceed the Eco RBC FW Aquatic Acute Exposure.
- 6. Boldfaced concentrations exceed the Eco RBC FW Wildlife Chronic Exposure.
- 7. Italicized concentrations exceed the Eco RBC FW Wildlife Acute Exposure.
- CES = Cascade Earth Scienes
- EA = EA Engineering, Science, and Technology, Inc.
- Eco = Ecological
- FW = Freshwater
- ND = Not Detected
- NA = Not Analyzed
- J = Estimated Concentration
- Mon'tl = Monumental
- ODEQ =Oregon Department of Environmental Quality
- RBC = Risk-Based Concentration
- TEI = Terraphase Engineering Inc.

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Table 7
In Vitro Bioaccessibility (IVBA) and Relative Bioavailability (RBA) Calculations

Supplemental Site Investigation Report Upper Granite Creek Watershed Mines Wallowa-Whitman National Forest, Oregon

| Material | Waste Rock CEM-WRA-2 | Waste Rock CM-WRC-4 | Waste Rock GC6-WRA-2 | Waste Rock LMM-WRA-3 | Waste Rock | Waste Rock UMM-WRA-3 L | Waste Rock | Native Soil GC5-WRA-4-DS | Native Soil GF-WRD-4-DS T | Native Soil | Tailings UMM-TLA-6 | Tailings UMM-TLB-1 |
|---------------------|-------------------------|------------------------|-------------------------|-------------------------|------------|---------------------------|----------------|-----------------------------|------------------------------|-------------|-----------------------|-----------------------|
| | | | | | | | | | | | | |
| Mine Site | Central | | iranite Creek #6 | Lwr Mon'tl | • | | | | Golden Fraction | Tillicum | Upr Mon'tl | Upr Mon'tl |
| Depth (ft bgs) | 0.5 - 1.0 | 0.5 - 1.0 | 0.5 - 1.0 | 0.5 - 1.0 | 0.5 - 1.0 | 0.5 - 1.0 | 0.5 - 1.0 | 0.5 - 1.0 | 0.5 - 1.0 | 0.5 - 1.0 | 0.5 - 1.0 | 0.5 - 1.0 |
| Sample Date | 10/5/2024 | 10/3/2024 | 10/4/2024 | 10/3/2024 | 10/2/2024 | 10/2/2024 | 10/2/2024 | 10/4/2024 | 10/5/2024 | 10/4/2024 | 10/2/2024 | 10/2/2024 |
| Comments | | | | | | F | ield Duplicate | | | | | |
| Metals | | | | | | | | | | | | |
| Arsenic, IVBA | 44.5 | 33.1 | 29.3 | 16.6 | 12.7 | 176 | 162 | 10.4 | 12.3 | 14.4 | 1350 | 1840 |
| Arsenic, Total IVBA | 794 | 650 | 759 | 328 | 1590 | 3440 | 3280 | 221 | 137 | 550 | 5560 | 4420 |
| IVBA fraction: | 0.056 | 0.051 | 0.039 | 0.051 | 0.0080 | 0.051 | 0.049 | 0.047 | 0.090 | 0.026 | 0.24 | 0.42 |
| RBA fraction: | 0.074 | 0.070 | 0.060 | 0.070 | 0.036 | 0.070 | 0.069 | 0.067 | 0.10 | 0.051 | 0.22 | 0.36 |
| RBA: | 0.077 \ | Naste Rock/Nativ | ve Soil | | | | | | | RBA: | 0.36 | Tailings |

Note:

1 All concentrations reported in mg/kg (ppm).

2 Arsenic, IVBA is the bioaccessible arsenic concentration in soil.

3 Arsenic, Total IVBA is the total arsenic concentration in soil.

IVBA = In Vitro Bioaccessibility

Lwr = lower

Mon'tl = monumental

RBA = Relative Bioavailability

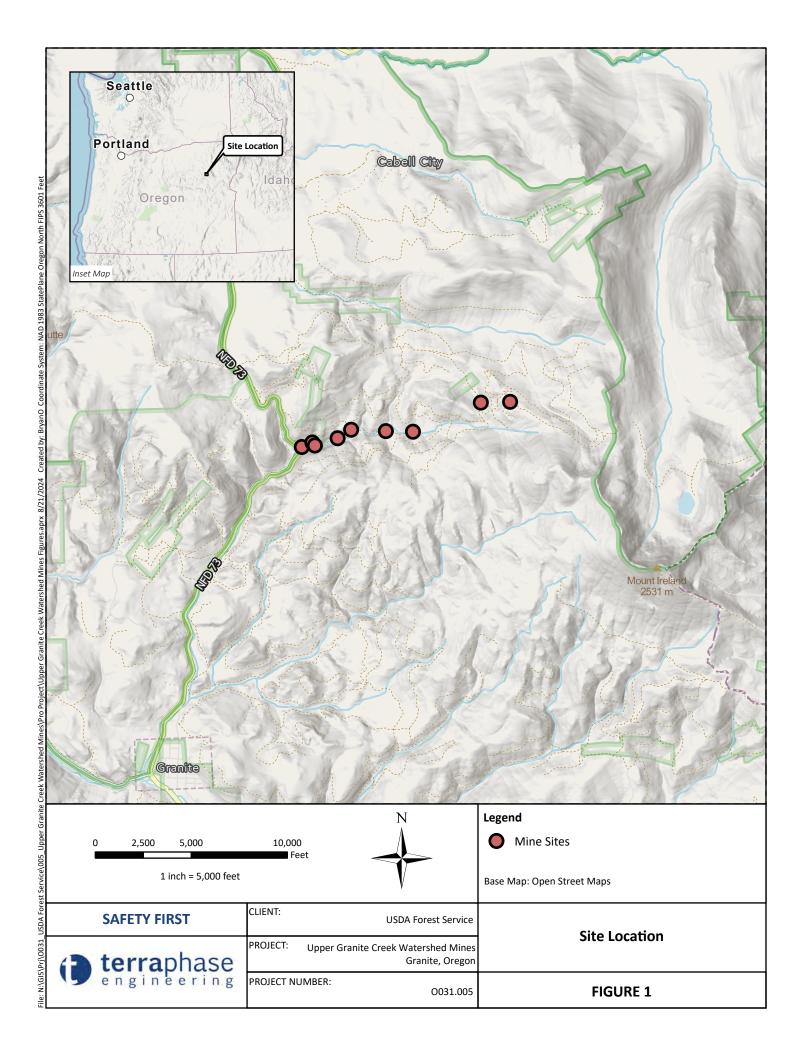
Upr = upper

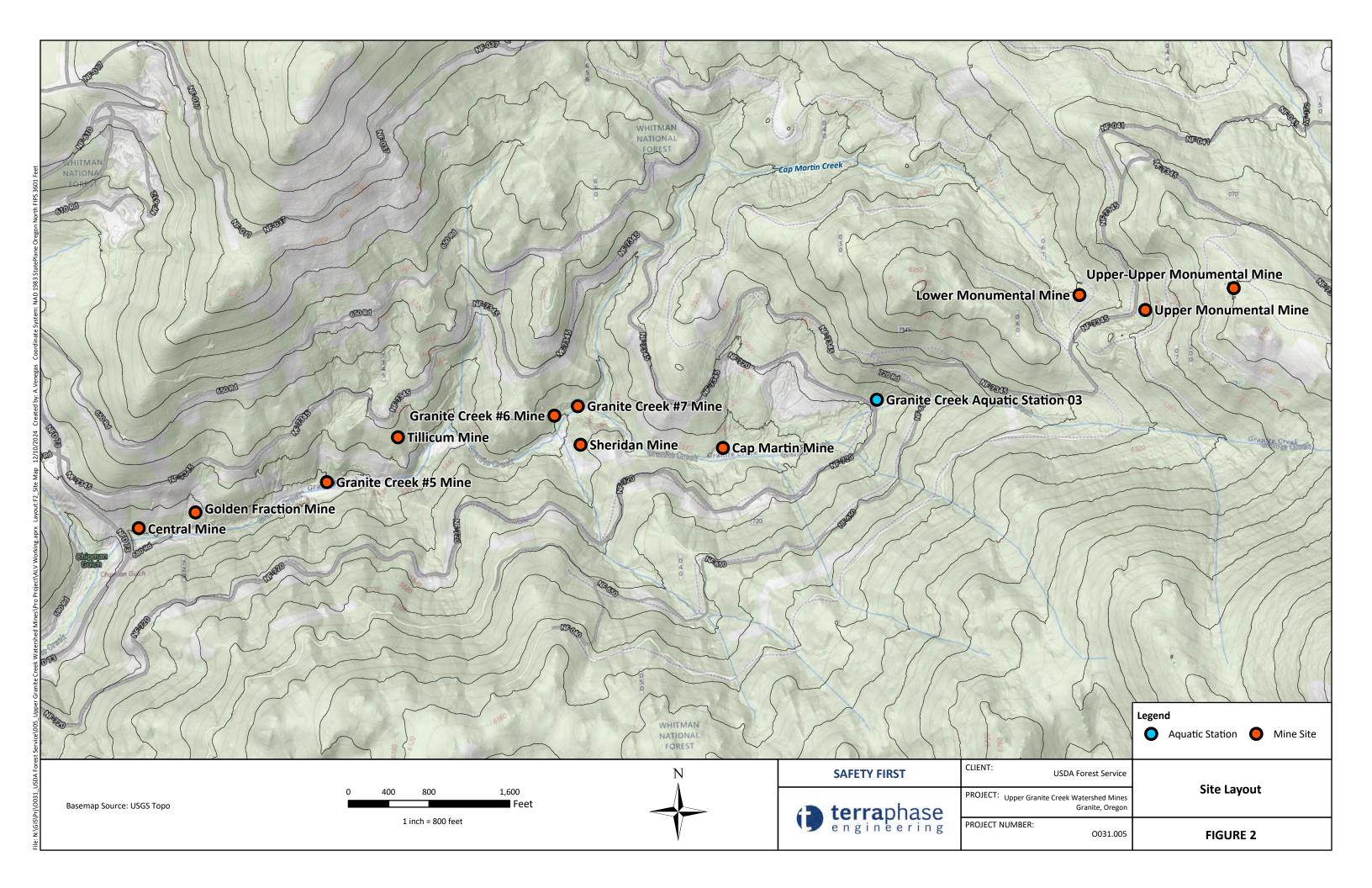
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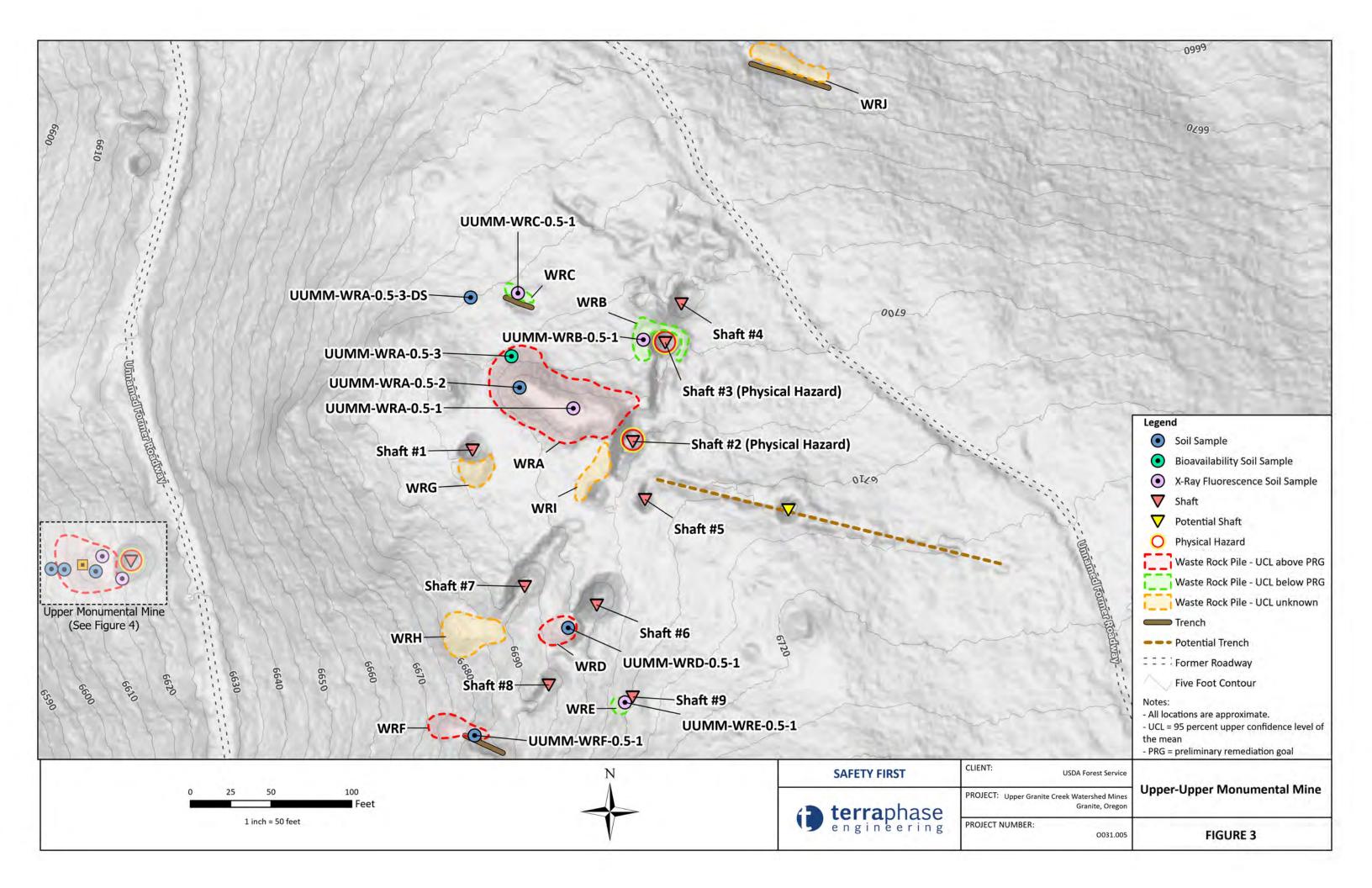
Figures

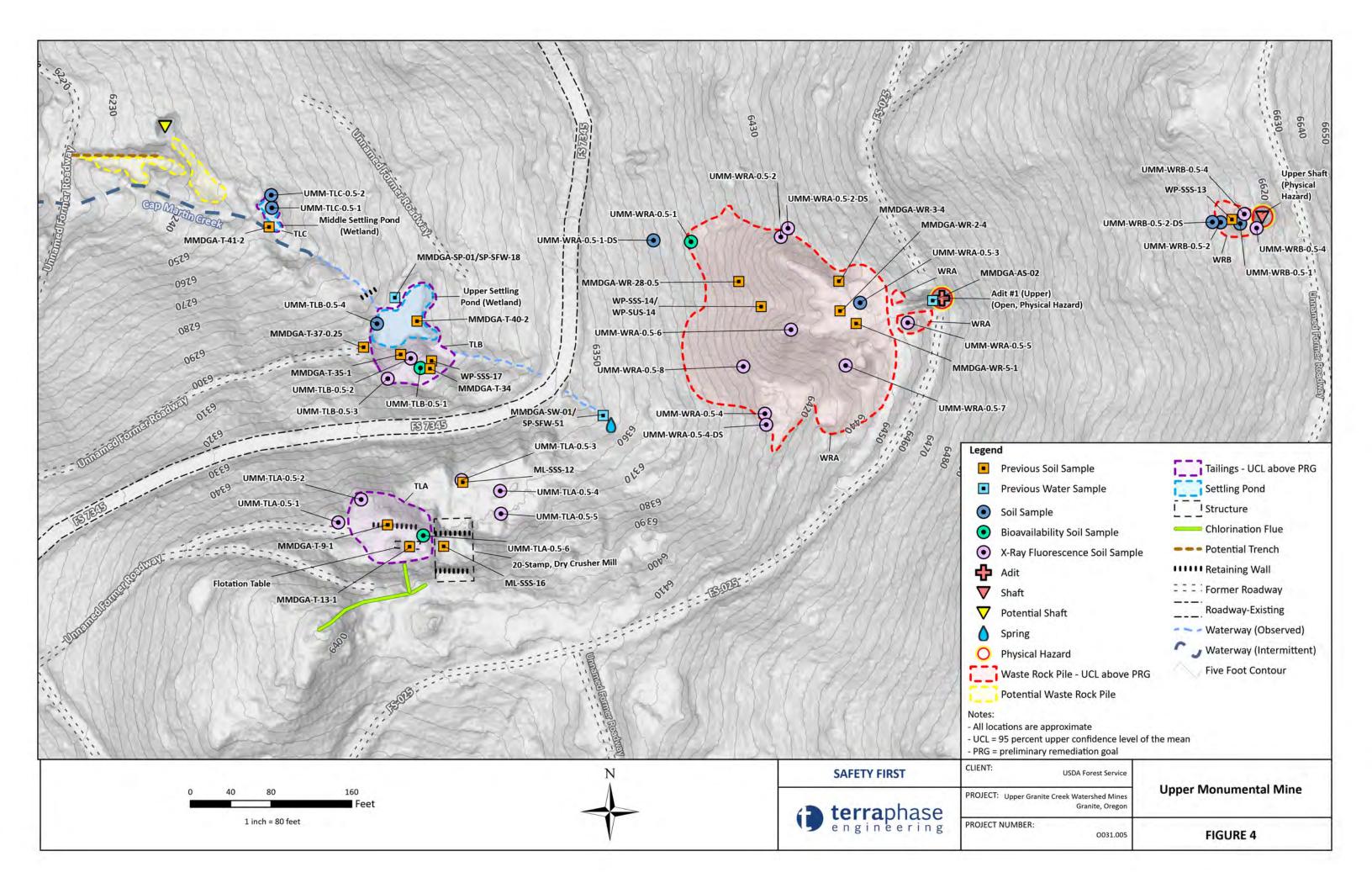
- 1 Site Location
- 2 Site Layout
- 3 Upper-Upper Monumental Mine
- 4 Upper Monumental Mine
- 5 Lower Monumental Mine
- 6 Granite Creek Aquatic Station 03
- 7 Cap Martin Mine
- 8 Sheridan Mine
- 9 Granite Creek #6 Mine
- 10 Granite Creek #7 Mine
- 11 Tillicum Mine
- 12 Granite Creek #5 Mine
- 13 Golden Fraction Mine
- 14 Central Mine
- 15 Background Soil and Surface Water Sampling Locations
- 16 XRF Analytical Data Correlation
- 17 XRF Laboratory Data Comparison Chart
- 18 Surface Water Arsenic Concentration with Distance

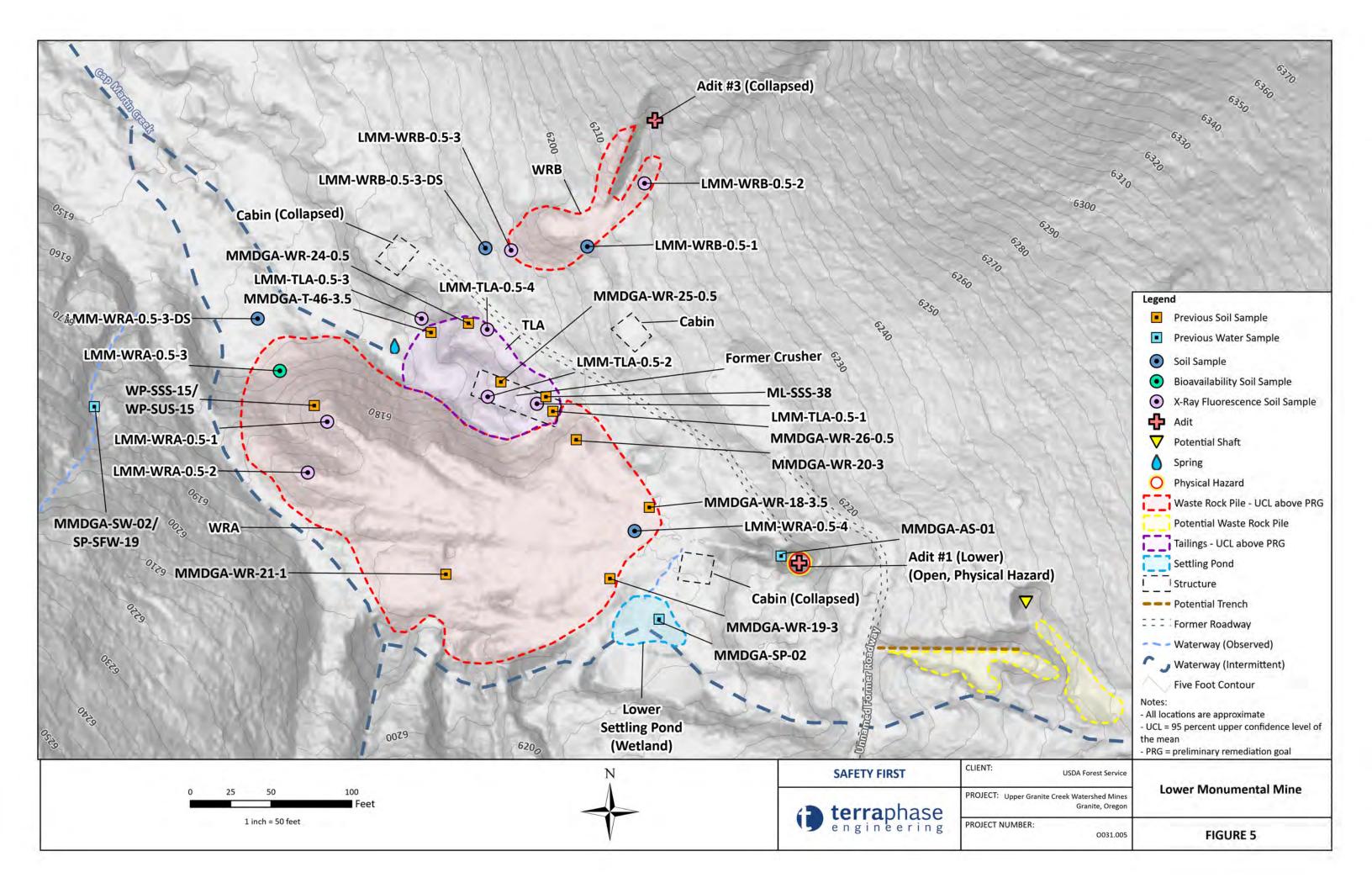


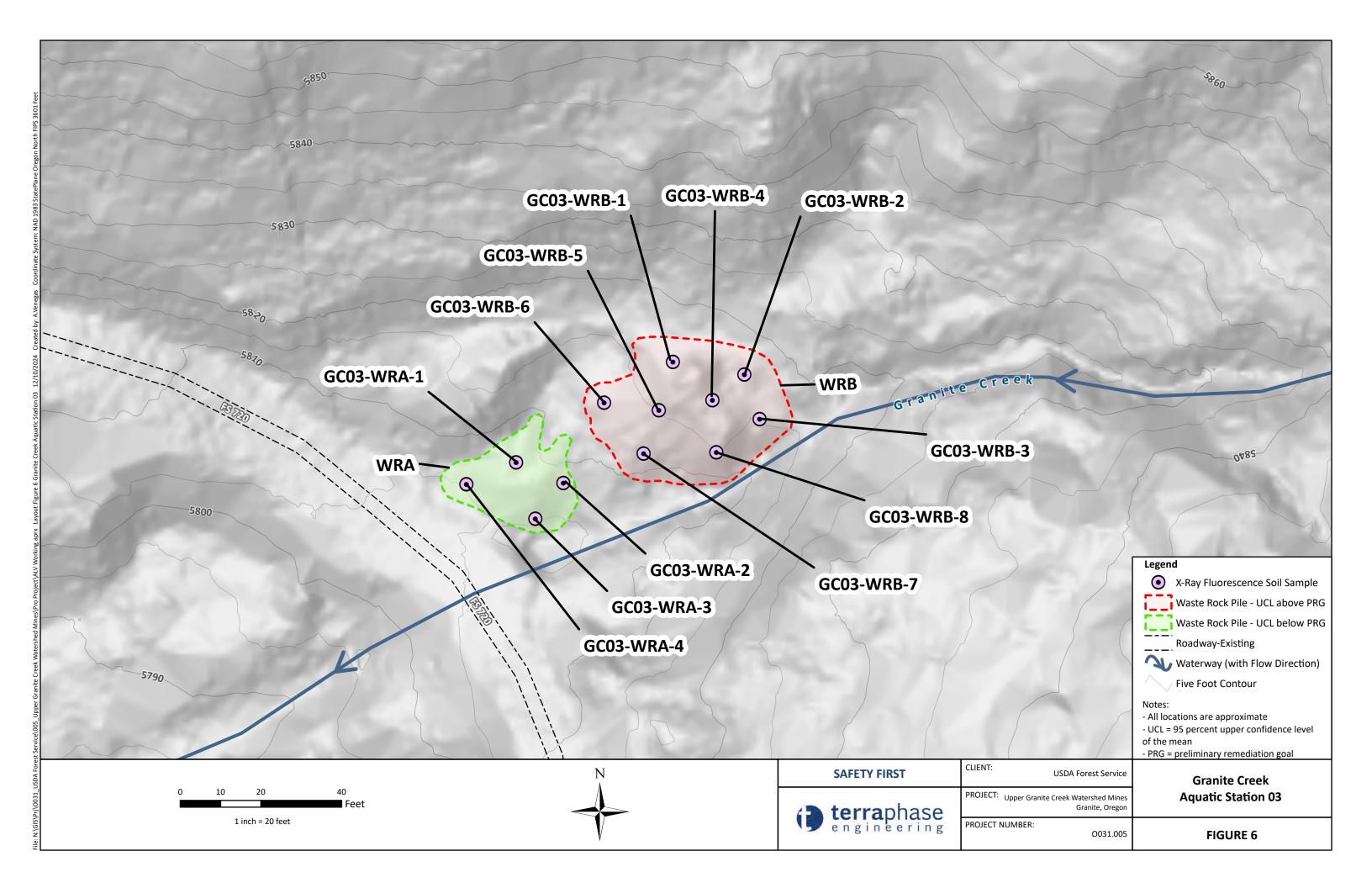


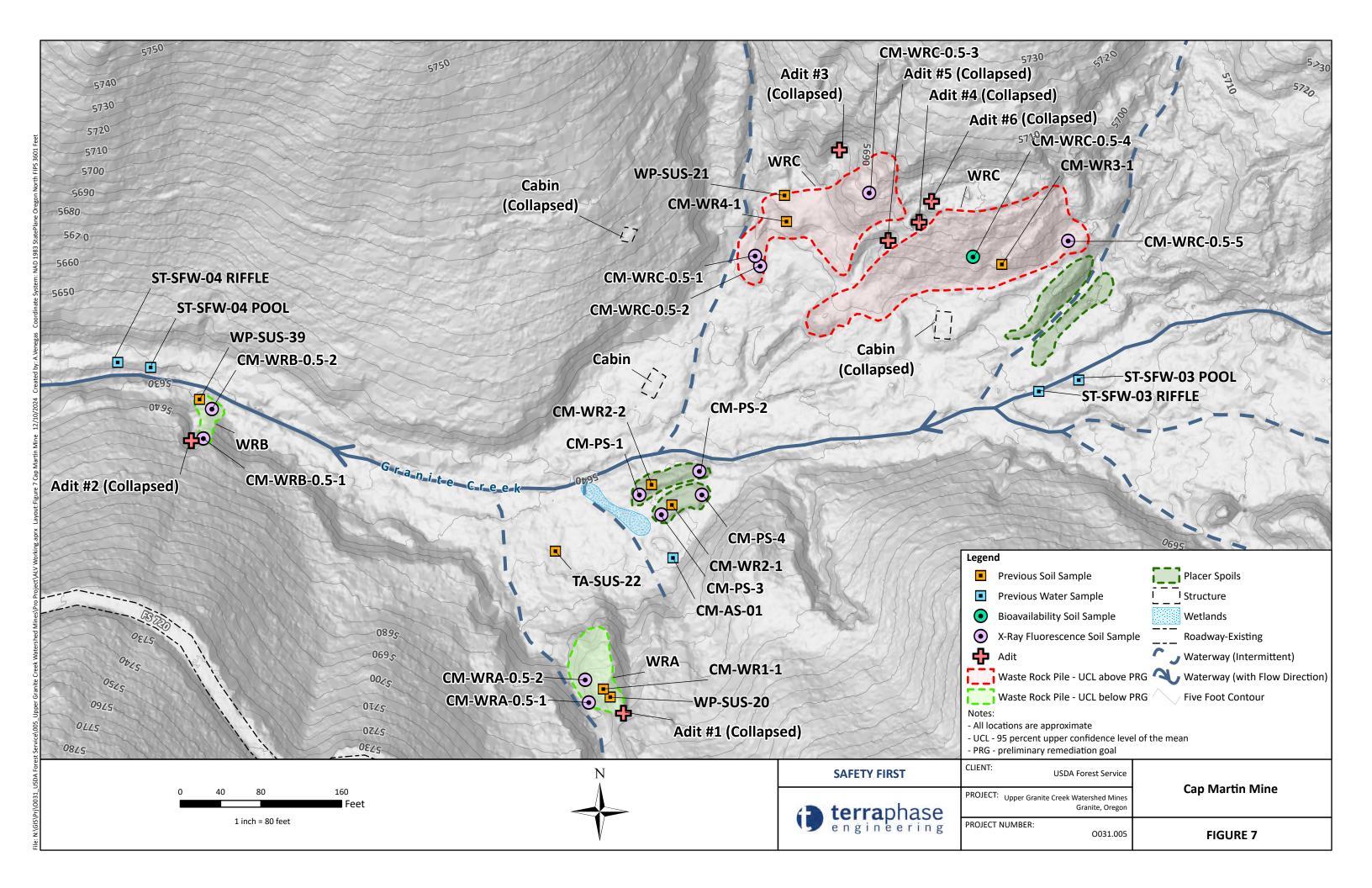


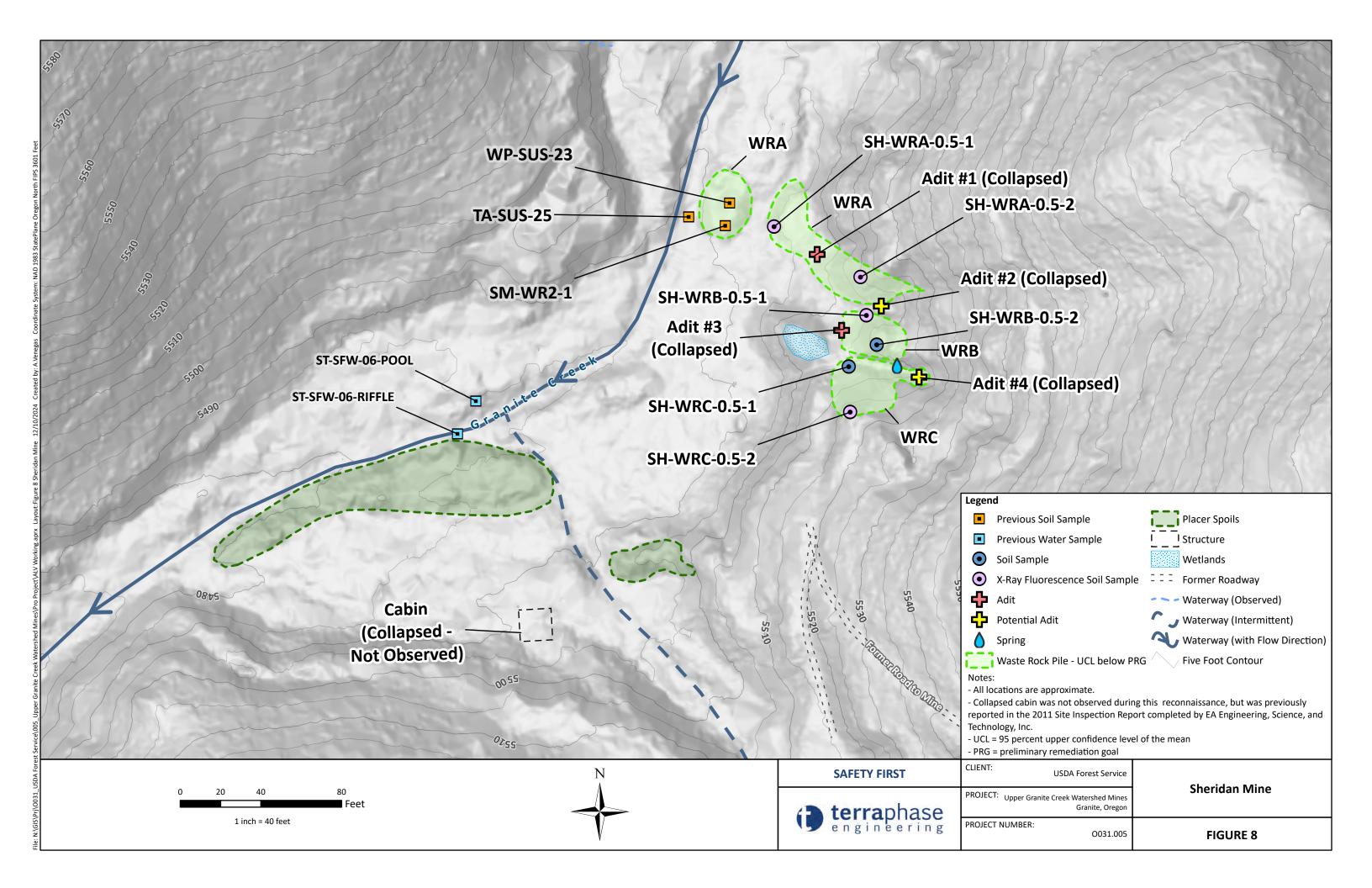


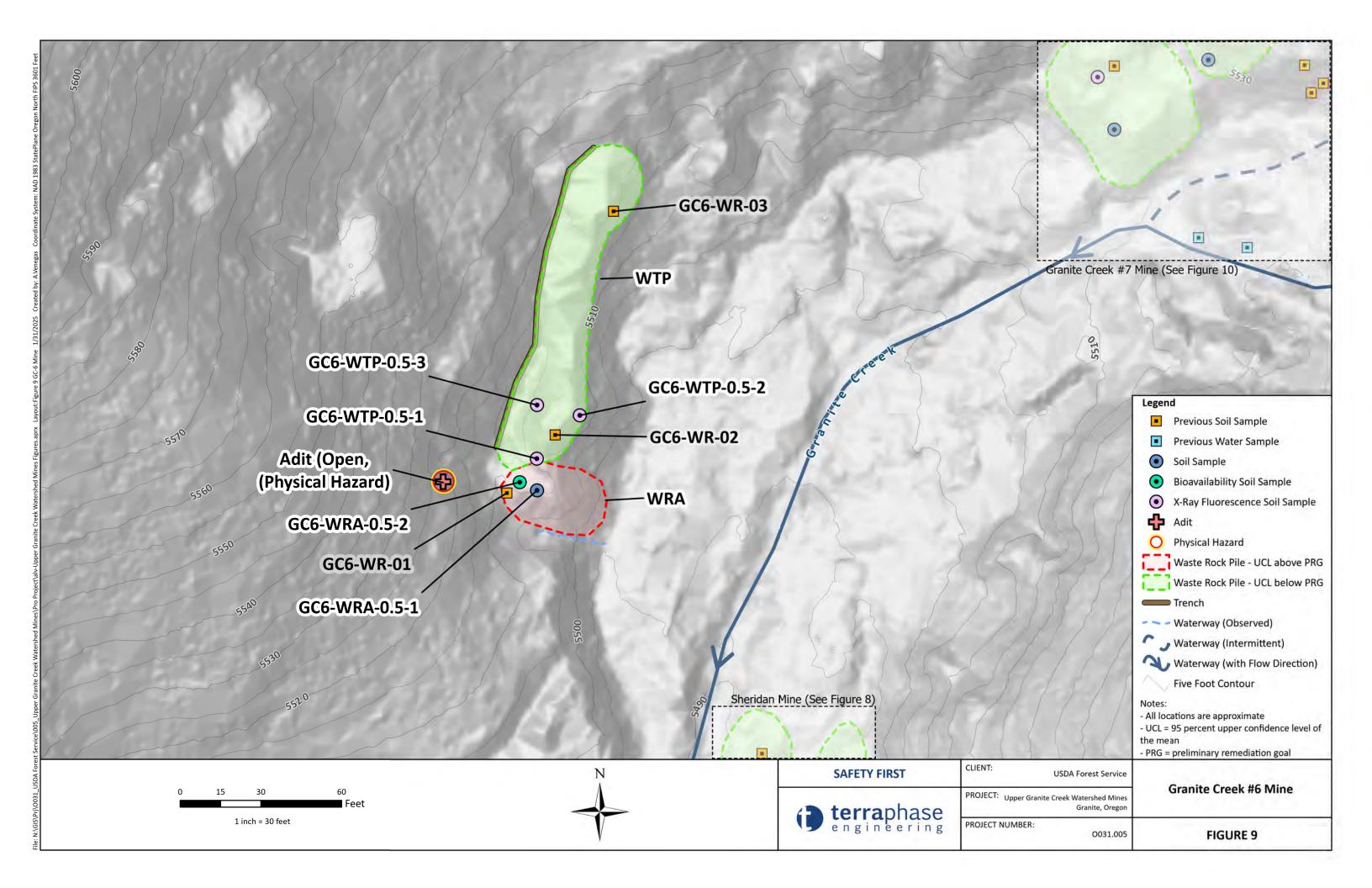


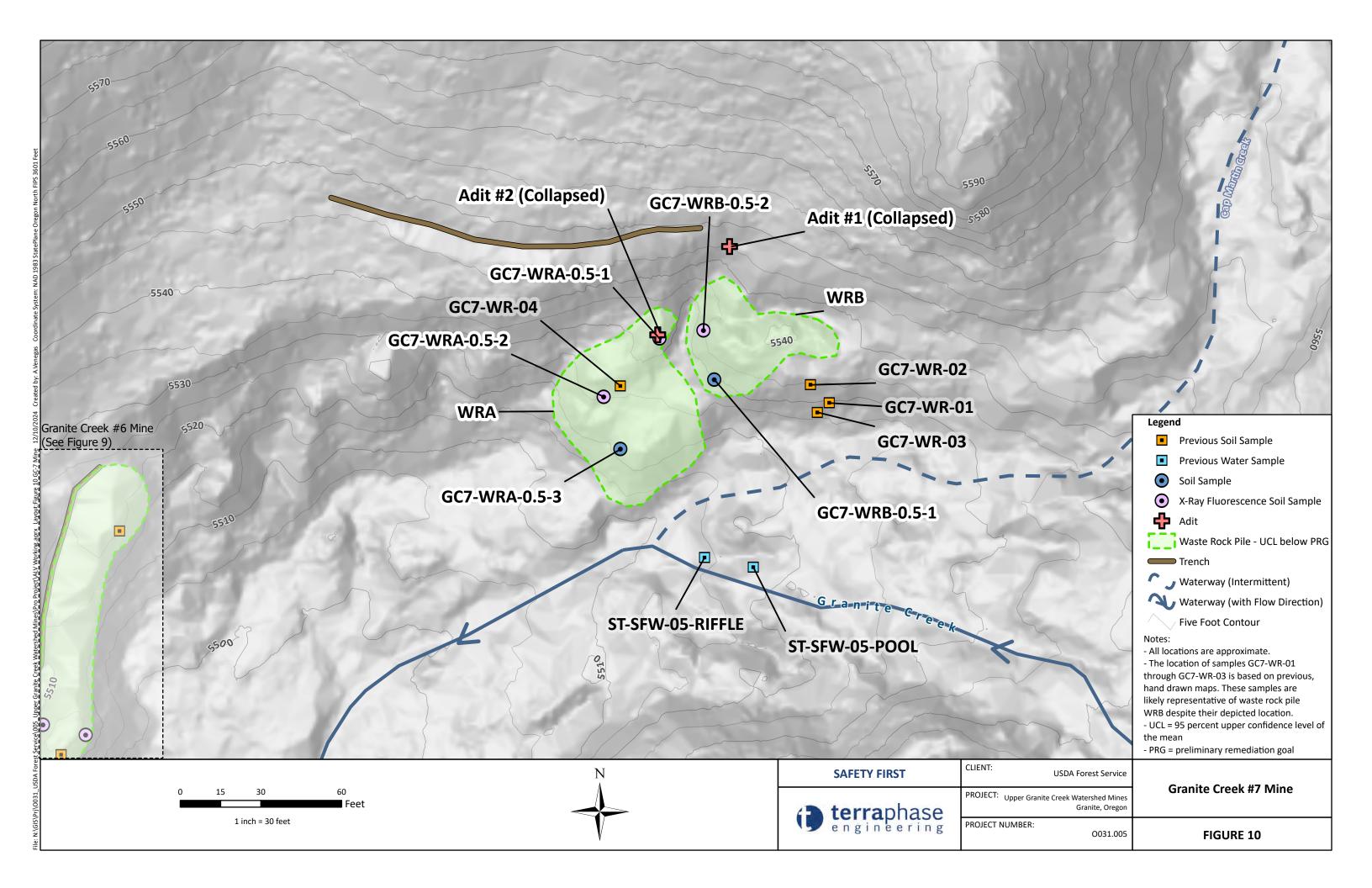


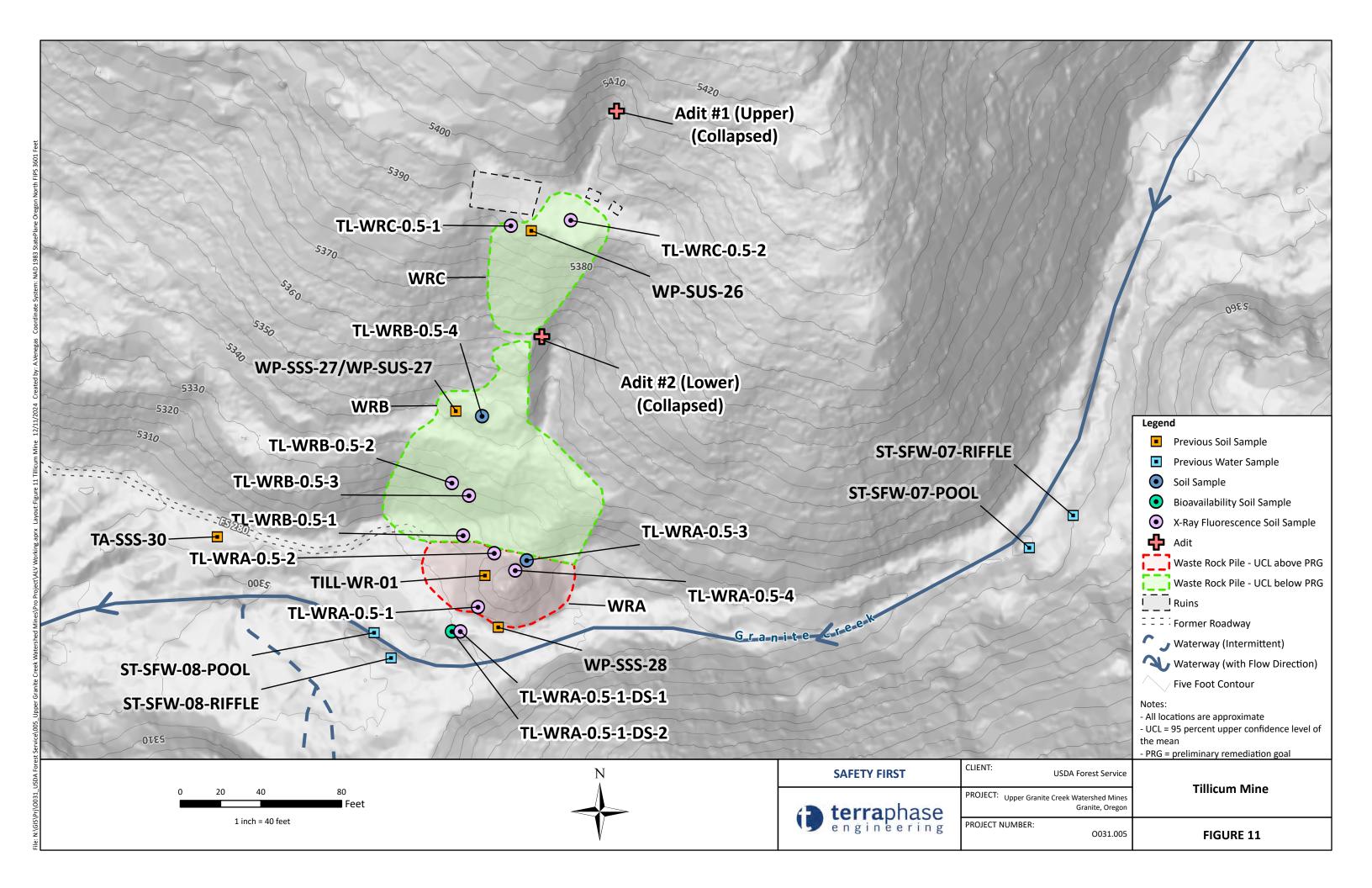


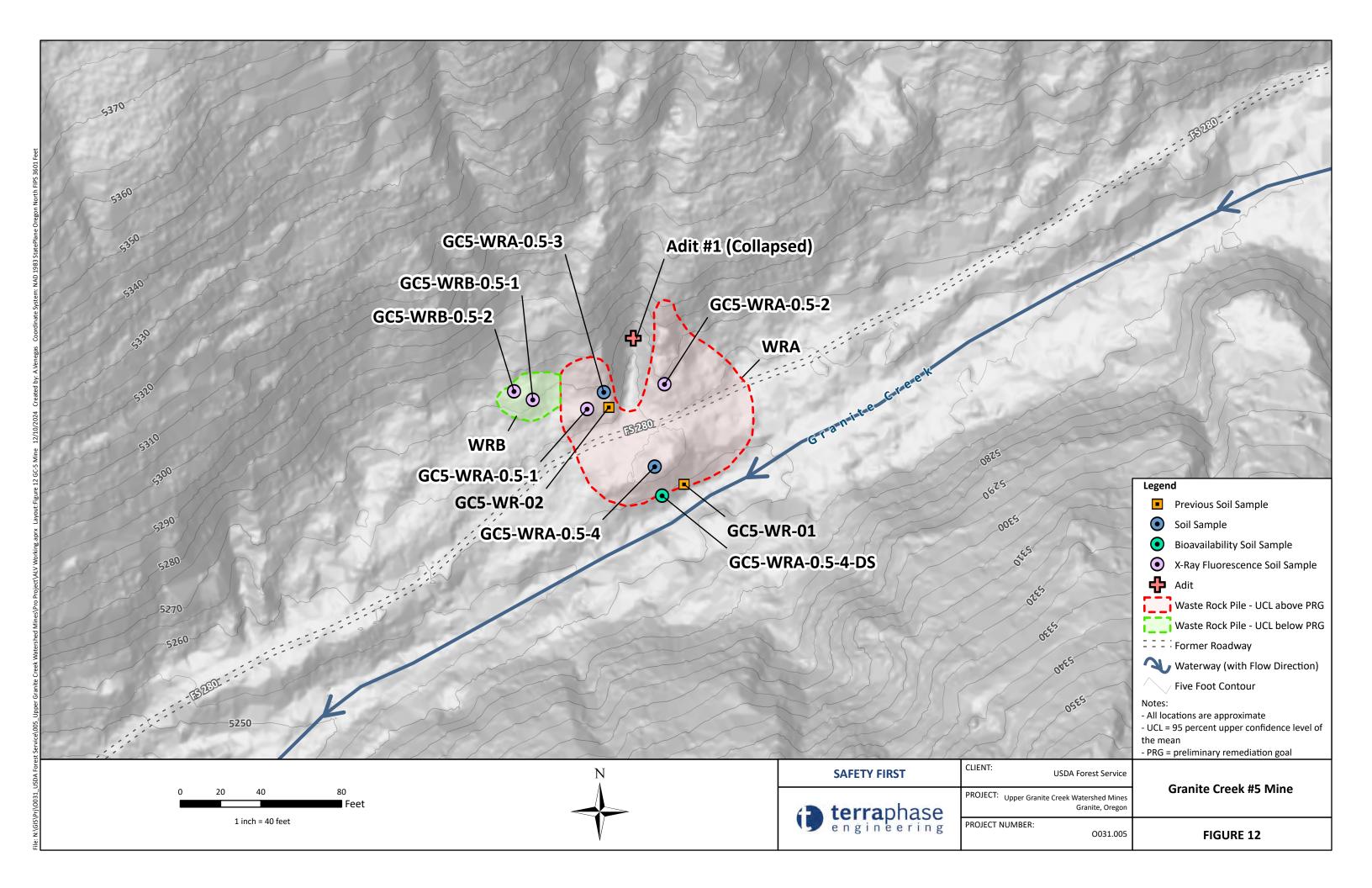


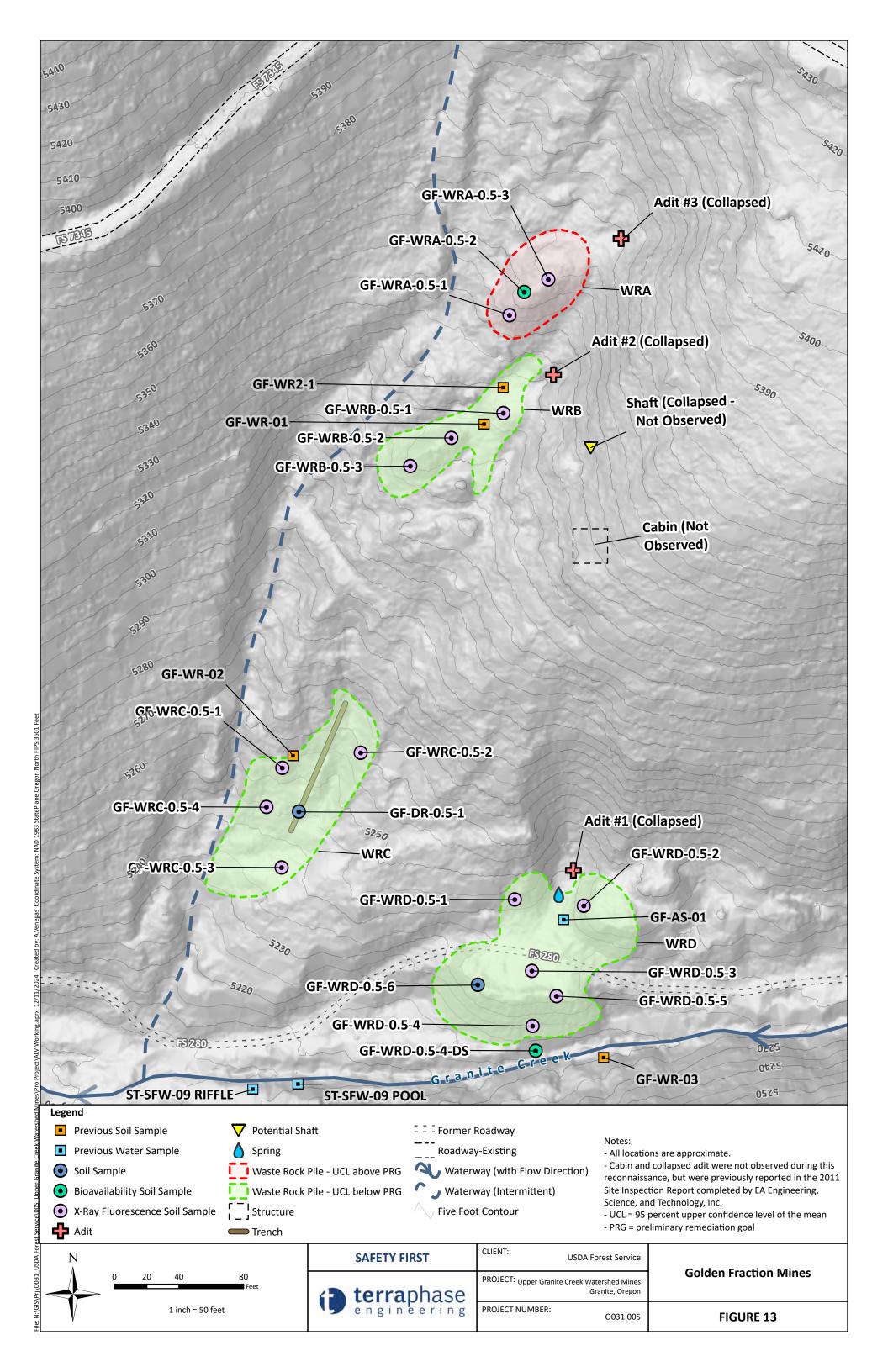


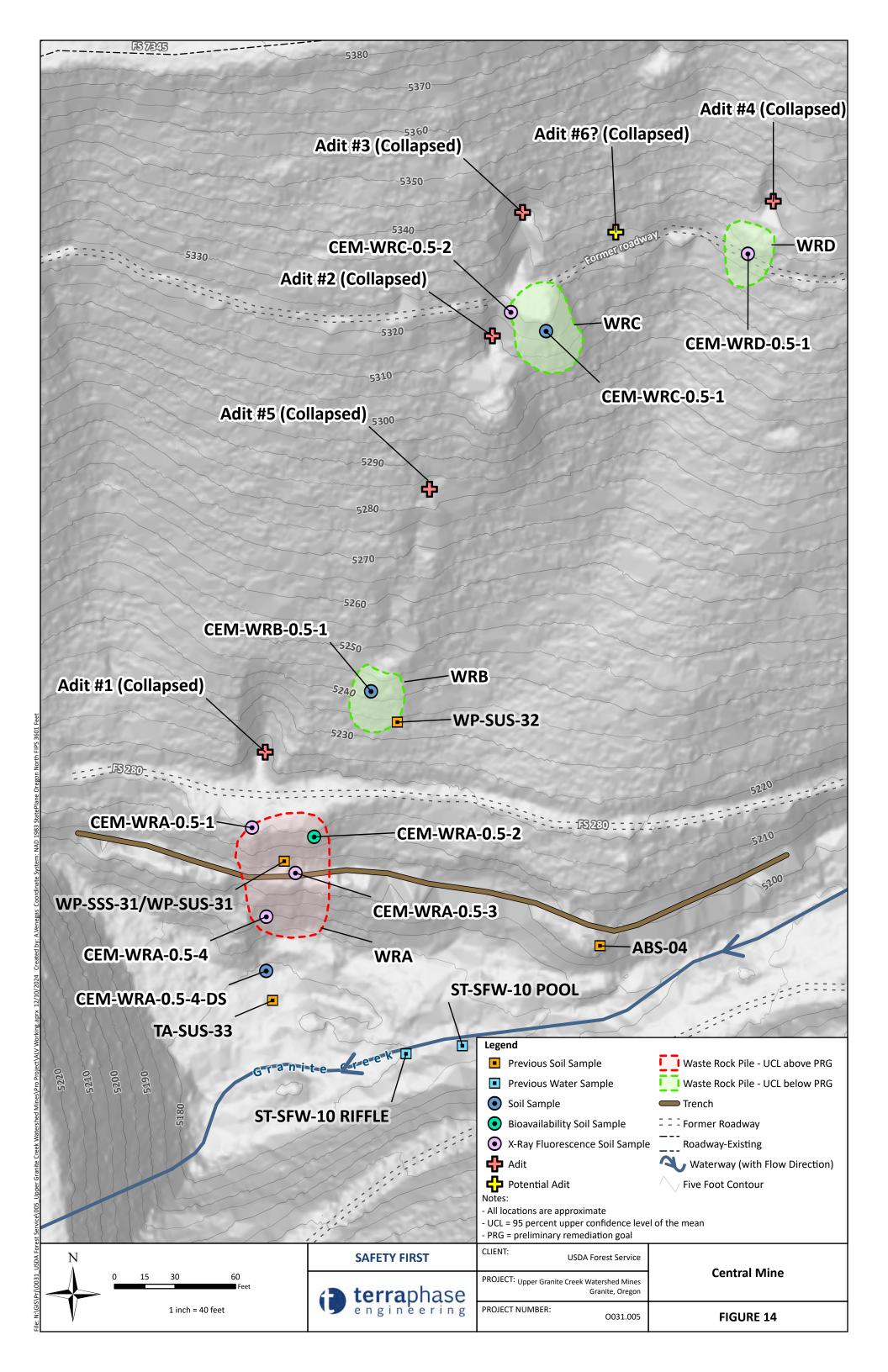


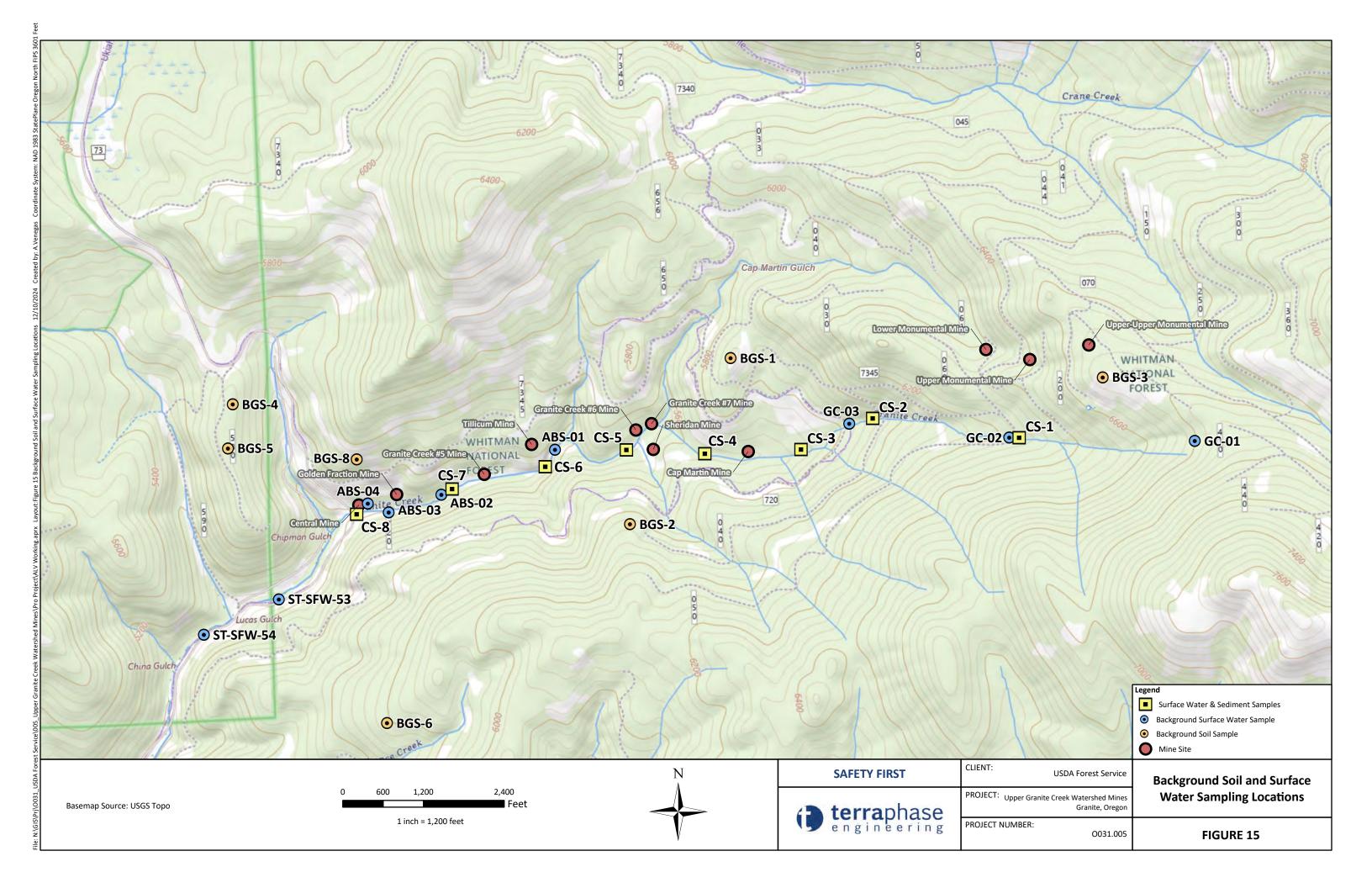


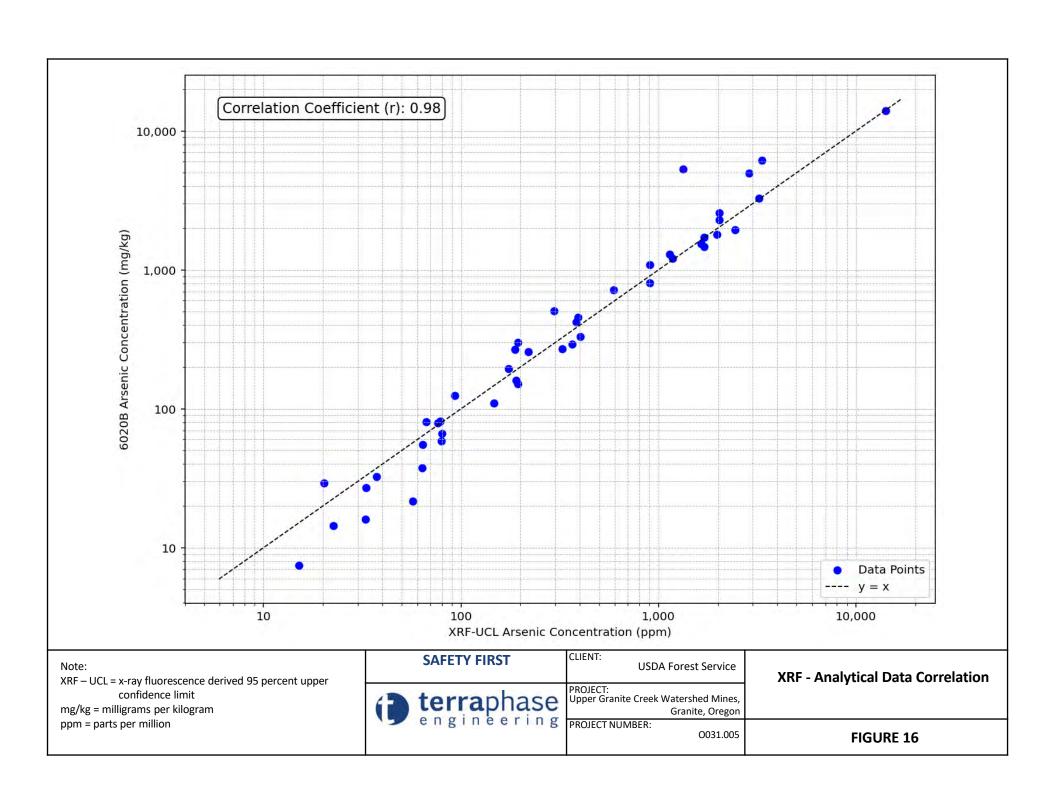


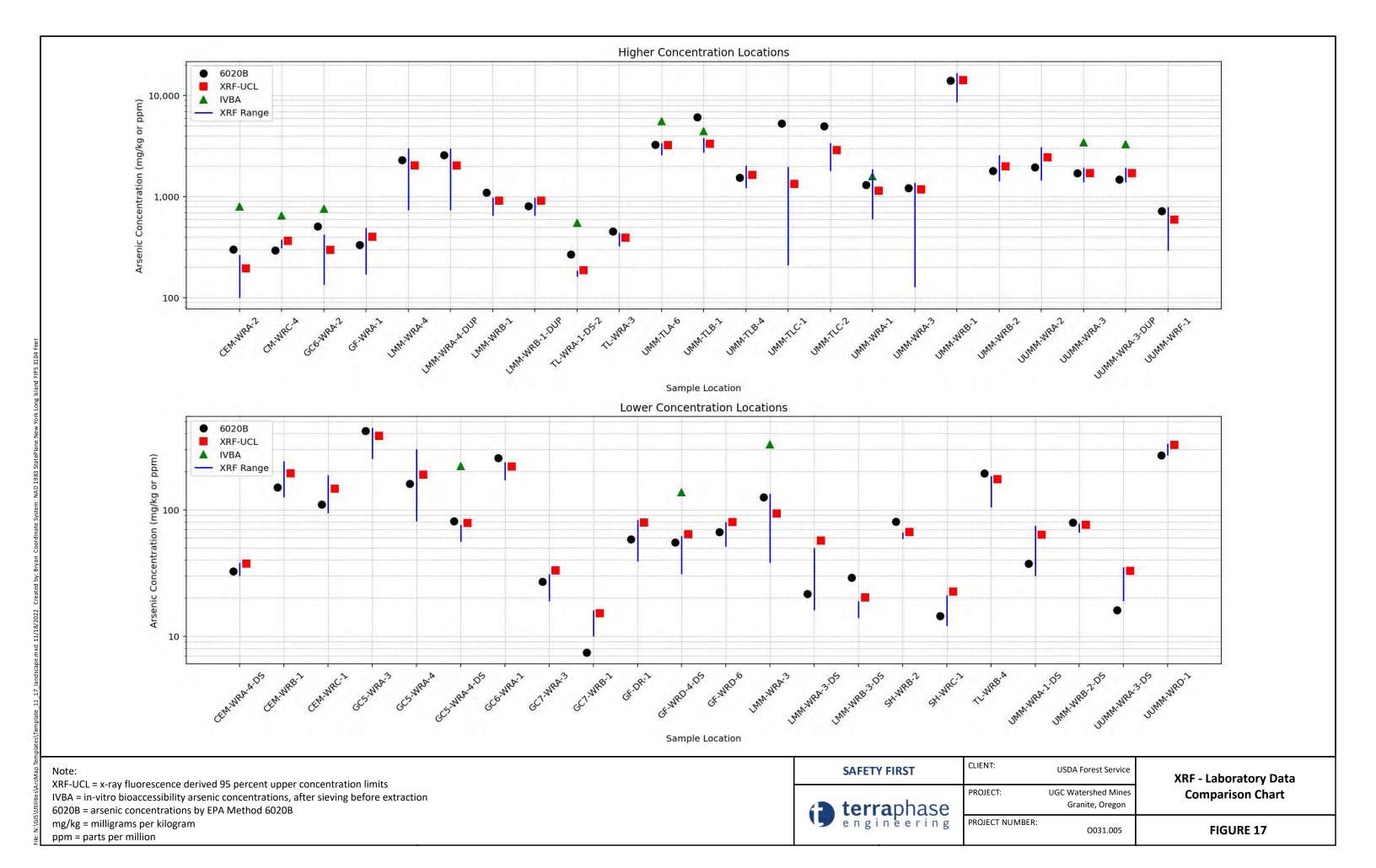




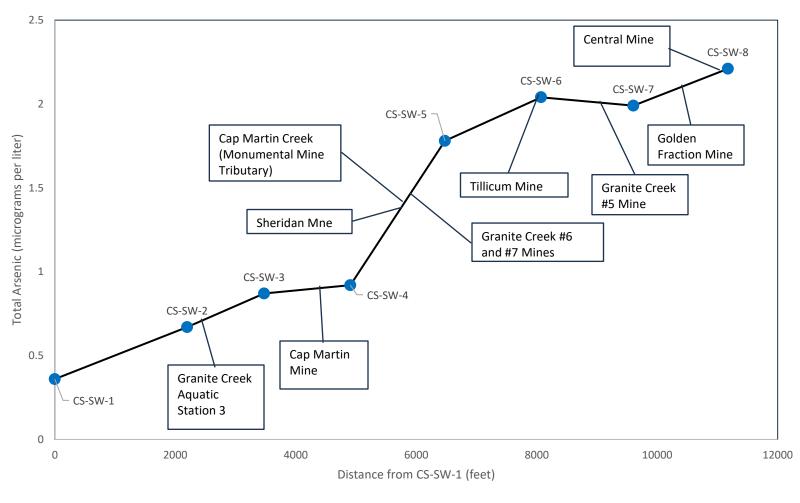












| Notes: | SAFETY FIRST | CLIENT: USDA Forest Service Surface Wa | Surface Water Arsenic |
|--------|--------------------|---|-----------------------|
| | terra phase | PROJECT: Upper Granite Creek Watershed Mines, Granite, Oregon | |
| | engineering | PROJECT NUMBER: 0031.005 | FIGURE 18 |

Appendix A

Field Notes





Project Number: 0031.005

By: Adrienne Venegas

| Date | 10/01/2024 | Contractor | |
|-----------------|--|-------------------|-----|
| Staff On-Site | Adrienne Venegas, Don Malkemus, James Farrow | Crew | |
| Staff From Time | 09:00 | From Time | |
| Staff To Time | 16:30 | To Time | |
| Weather | Sunny | Tailgate Meeting? | YES |
| Equipment | | Remarks | |

Work Summary

Time Notes

09:00 Meet with Mario and Keifer with USFS near Central Mine. Introductions and health and safety meeting



Picture taken at: 09:23

Caption: HASP review and acceptance form

Latitude: 44.85701750773097 Longitude: -118.3942462940675



Picture taken at: 09:24

Caption: DFR

Latitude: 44.85624445584468

Longitude: -118.3936392660795

09:25 Driving to Upper Monumental Mine

Project Number: 0031.005

Time Notes



Picture taken at: 09:57 Caption: Stamp Mill

Latitude: 44.85967547233333 Longitude: -118.3535353385



Picture taken at: 09:57
Caption: Chlorination flue
Latitude: 44.859680902

Longitude: -118.3535841383333



Picture taken at: 09:57 Caption: Flotation table Latitude: 44.85967803

Longitude: -118.3536781416666



Picture taken at: 09:58

Caption: Chlorination flue (foreground) and flotation table

(background)

Latitude: 44.8596509485

Project Number: 0031.005

Time Notes



Picture taken at: 10:02
Caption: Chlorination flue
Latitude: 44.85955154583333
Longitude: -118.3541252503333



Picture taken at: 10:03

Caption: Upper retaining wall
Latitude: 44.85972296566667
Longitude: -118.3537110743333



Picture taken at: 10:09

Caption: Mill remains

Latitude: 44.8599069955

Longitude: -118.3538225465



Picture taken at: 10:09

Caption: Mill remains and tailings Latitude: 44.8599081743333 Longitude: -118.3538226001667

Project Number: 0031.005

Time Notes



Picture taken at: 10:10

Caption: Mill remains and upper and lower retaining walls

Latitude: 44.85990836866666 Longitude: -118.3538222428333



Picture taken at: 10:30 Caption: Upper shaft

Latitude: 44.86059106966667 Longitude: -118.3504906728334



Picture taken at: 10:43

Caption: Shaft above upper monumental shaft (not previously

mapped)

Latitude: 44.86081504183333 Longitude: -118.3496741993333



Picture taken at: 10:48

Caption: Shaft #3 above upper monumental shaft (not previously

mapped). Very deep hole at bottom right

Latitude: 44.86090162483333 Longitude: -118.3492360385

11:36 Lower monumental mine.

Project Number: 0031.005

Time Notes



Picture taken at: 11:37

Caption: Adit from above

Latitude: 44.86108379900001

Longitude: -118.355107257



Picture taken at: 11:41

Caption: Lower monumental adit entrance

Latitude: 44.86105575

Longitude: -118.3554127151667



Picture taken at: 11:41

Caption: Drainage from Lower monumental adit

Latitude: 44.86105649449999 Longitude: -118.3554090786667



Picture taken at: 11:44

Caption: Cabin

Latitude: 44.86130057416667 Longitude: -118.3556658905

Project Number: 0031.005

Time Notes



Picture taken at: 11:47 Caption: Collapsed adit

Latitude: 44.86175704066667 Longitude: -118.3555481198333



Picture taken at: 11:48
Caption: Collapsed adit

Latitude: 44.86176202983334 Longitude: -118.3555403036667



Picture taken at: 11:51

Caption: Former rock crusher. Area of high arsenic concentration

Latitude: 44.86133833333334 Longitude: -118.3560416666667



Picture taken at: 11:53

Caption: Wetland/spring ("unnamed tributaries") below former

crusher area

Latitude: 44.86140766083332 Longitude: -118.3561838248333

Project Number: 0031.005

Time Notes



Picture taken at: 11:54

Caption: Wetland/spring ("unnamed tributaries") below former

crusher area

Latitude: 44.86139036416666 Longitude: -118.3561593996667



Picture taken at: 11:56

Caption: Collapsed cabin (not mapped)

Latitude: 44.86158838266667 Longitude: -118.3560458813333



Picture taken at: 11:57

Caption: Collapsed cabin #2 (not mapped)

Latitude: 44.86176913149999 Longitude: -118.3561870145

12:30 Headed to Cap Martin



Picture taken at: 12:47

Caption: Collapsed cabin

Latitude: 44.85807001800001

Project Number: 0031.005

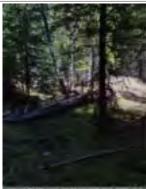
Time Notes



Picture taken at: 12:52

Caption: Settling pond? Second drainage

Latitude: 44.85705450550001 Longitude: -118.3687287458333



Picture taken at: 12:53

Caption: Drainage and waste rock pile

Latitude: 44.85701166666666

Longitude: -118.36885



Picture taken at: 12:58

Caption: Adit #3

Latitude: 44.85732991616666 Longitude: -118.3683959126667



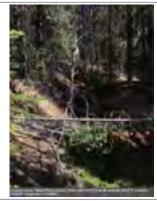
Picture taken at: 12:59

Caption: Adit near #4

Latitude: 44.857037865

Project Number: 0031.005

Time Notes



Picture taken at: 13:00 Caption: Adit near #4

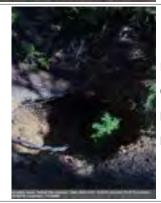


Picture taken at: 13:02

Caption: Drainage from adits

Latitude: 44.85710241966667

Longitude: -118.3681869576667



Picture taken at: 13:05

Caption: Adit #4

Latitude: 44.85717833333333 Longitude: -118.3680633333333



Picture taken at: 13:10

Caption: Cabin

Latitude: 44.85717852233334 Longitude: -118.368063151

13:24 Heading to GC-6

Project Number: 0031.005

Time Notes



Picture taken at: 13:45 Caption: GC-6 adit

Latitude: 44.85765392850001 Longitude: -118.3756544251667



Picture taken at: 13:47

Caption: Wet trench (left-right) with waste pile (not from adit)

beyond at GC-6

Latitude: 44.85768046716667 Longitude: -118.3756259823333

13:59 GC-7



Picture taken at: 14:00

Caption: GC-7 adit and "unnamed tributary"

Latitude: 44.85812620499999 Longitude: -118.3746201356667

14:17 Sheridan



Picture taken at: 14:17

Caption: Sheridan - 1 of several parallel adits? Or "steep slope

with gouges?"

Latitude: 44.85716953533333 Longitude: -118.3750253946667

Project Number: 0031.005

Time Notes



Picture taken at: 14:22

Caption: Sheridan - 2nd of several parallel adits? Or "steep slope

with gouges?"

Latitude: 44.85720707166666 Longitude: -118.3748731503333



Picture taken at: 14:24

Caption: Several rusted drums

Latitude: 44.8571973805

Longitude: -118.3748722141667



Picture taken at: 14:31

Caption: Retaining wall at Sheridan

Latitude: 44.85700116616668 Longitude: -118.3753940575

14:57 Heading to main road to hike NF Rd 680

15:09 Central mine



Picture taken at: 15:09

Caption: Central mine #1

Latitude: 44.85501767533334

Project Number: O031.005

Time Notes

15:18 golden fraction



Picture taken at: 15:18

Caption: Collapsed adit (lower)
Latitude: 44.85510870866667
Longitude: -118.3889174681667



Picture taken at: 15:29

Caption: Retaining wall between lower golden fraction and GC-5

Latitude: 44.85505057416667 Longitude: -118.3879588078333

15:32 GC-5



Picture taken at: 15:33

Caption: GC-5 adit

Latitude: 44.85560349699999 Longitude: -118.3863341225

15:50 Tillicum mine

Project Number: O031.005

Time Notes



Picture taken at: 15:50

Caption: Tillicum adit (lower)
Latitude: 44.856359515

Longitude: -118.3818410655

16:20 Heading to quarry (potential repository site).



Picture taken at: 16:34

Caption: Quarry

Latitude: 44.82991502433662 Longitude: -118.422087232068



Picture taken at: 16:34

Caption: Quarry

Latitude: 44.82992898691602

Longitude: -118.4220694659046

16:30 TEI headed back to Airbnb



Project Number: 0031.005

By: Don Malkemus

| Date | 10/01/2024 | Contractor | |
|-----------------|--|-------------------|-----|
| Staff On-Site | Don Malkemus, Adrienne Venegas, James Farrow | Crew | |
| Staff From Time | 07:55 | From Time | |
| Staff To Time | | To Time | |
| Weather | Clear | Tailgate Meeting? | YES |
| Equipment | Vanya c series XRF | Remarks | |

Work Summary

| Time | Notes |
|-------|--|
| 07:56 | Calibrate XRF. Arsenic reads 22. 17 in a ziplock bag. 18 in ziplock at 30 seconds. |
| 09:01 | Arrive at the site, meet Mario Isaias-Vera and Keifer Nace. At intersection of FS73 and FS7345. Go through introductions. |
| 09:03 | Health and safety tailgate |
| 09:18 | There is a quarry on FS7350. |
| 09:56 | Arrive at upper monumental mine. 3.3 on 7345 from 73. |
| 09:57 | Document upper monumental site features. Find additional previously unmapped shafts and waste rock piles above the upper shaft. Hummocks terrain |
| 11:37 | Visit lower monumental mine |
| 12:47 | Visit cap Martin mine |
| 13:43 | Visit GC-6. Not where describe or mapped |
| 14:11 | Visit GC-7, on the Sheridan map |
| 14:11 | Visit Sheridan |
| 14:15 | Survey marker |
| 15:10 | Visit central mine |
| 15:12 | Claim |
| 15:32 | Visit granite creek 5 |
| 15:49 | Is it Tillicum mine |
| 16:20 | Leave mine sites, head to quarry |
| 16:31 | Arrive at quarry |
| 10.40 | Offsite any goodhya ta Maria and Kaifar |



Project Number: 0031.005

By: Adrienne Venegas

| Date | 10/02/2024 | Contractor | |
|-----------------|--------------------------------|-------------------|--|
| Staff On-Site | Adrienne Venegas, James Farrow | Crew | |
| Staff From Time | 08:40 | From Time | |
| Staff To Time | 17:54 | To Time | |
| Weather | Partly Cloudy | Tailgate Meeting? | |
| Equipment | | Remarks | |

Work Summary

09:30

| Time | Notes |
|-------|--|
| 08:40 | Arrive at Monumental Mine. Walk to Upper Upper Monumental Mine |
| | |

Sampling upper monumental mine waste rock pile and mapping features



Picture taken at: 10:31

Caption: MM-WRA-0.5-2 and -2-DS

Latitude: 44.860653333333333

Longitude: -118.3523166666667



Picture taken at: 10:38

Caption: MM-WRA-0.5-3

Latitude: 44.86041922916667

Longitude: -118.3519728946667



Picture taken at: 10:54

Caption: MM-WRA-0.5-4

Latitude: 44.86008186533333

Project Number: 0031.005

Time Notes



Picture taken at: 11:27 Caption: MM-WRA-0.5-5

Latitude: 44.86031073583334 Longitude: -118.3518727916667



Picture taken at: 11:31 Caption: MM-WRA-0.5-6

Latitude: 44.86034947433333 Longitude: -118.3522562825



Picture taken at: 11:40
Caption: MM-WRA-0.5-7
Latitude: 44.86026666666667

Longitude: -118.35212



Picture taken at: 11:51
Caption: MM-WRA-0.5-8

12:11 Sampling upper upper monumental mine (not previously mapped) waste rock pile and mapping features

Project Number: 0031.005

Time Notes



Picture taken at: 13:18

Caption: UUMM-WRA-0.5-2 (foreground) and 1 (background)



Picture taken at: 13:29

Caption: UUMM-WRC-0.5-1 (left of trench)

Latitude: 44.86105987483333 Longitude: -118.3495929021667



Picture taken at: 13:45

Caption: UUMM-WRD-0.5-1

Latitude: 44.860445

Longitude: -118.3495116666667



Picture taken at: 13:50

Caption: UUMM-WRE-0.5-1

Latitude: 44.86035833333333

Project Number: 0031.005

Time Notes



Picture taken at: 14:03

Caption: UUMM-WRF-0.5-1 (pile to left of trench)

Latitude: 44.86029666666667 Longitude: -118.3497083333333



Picture taken at: 14:03

Caption: UUMM-WRF (pile to downslope of trench)

Latitude: 44.86029666666667 Longitude: -118.349655

14:29 Sampling upper monumental mine waste rock pile and mapping features



Picture taken at: 14:30

Caption: Upper shaft (downslope side)

Latitude: 44.86064166666667 Longitude: -118.3504466666667



Picture taken at: 14:30

Caption: Upper shaft (upslope side)

Latitude: 44.86064166666667

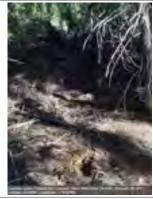
Project Number: 0031.005

Time Notes



Picture taken at: 14:34

Caption: UMM-WRB-0.5-1 (shaft in background)



Picture taken at: 14:46

Caption: UMM-WRB-0.5-2 (farther) and UMM-WRB-0.5-2-DS

(closer)

Latitude: 44.86061166666666 Longitude: -118.3506916666667



Picture taken at: 14:50

Caption: UMM-WRB-0.5-3 (shaft in background)

Latitude: 44.86063

Longitude: -118.3505633333333



Picture taken at: 14:54

Caption: UMM-WRB-0.5-4 (downhill edge of shaft)

Latitude: 44.86057810883334 Longitude: -118.3505025001667

15:48 Upper mine near stamp mill (tailing piles, chlorination flue, flotation table, etc)

Project Number: 0031.005

Time Notes



Picture taken at: 15:49

Caption: Upper and lower retaining walls

Latitude: 44.85992706766667 Longitude: -118.3536460298333



Picture taken at: 15:50

Caption: Erosional chute 1/3

Latitude: 44.859912324

Longitude: -118.3536262888333



Picture taken at: 15:56

Caption: Erosional chute 2/3
Latitude: 44.85984768033333

Longitude: -118.3539777846667



Picture taken at: 15:58

Caption: UMM-TLA-0.5-1

Latitude: 44.85986879083332

Project Number: 0031.005

Time Notes



Picture taken at: 16:00

Caption: UMM-TLA-0.5-2

Latitude: 44.85993446516666

Longitude: -118.3539610836667



Picture taken at: 16:02

Caption: Old road (continues away from mill)

Latitude: 44.85984380066667 Longitude: -118.3543046616666



Picture taken at: 16:04

Caption: Erosional chute 3/3?
Latitude: 44.85982435716666
Longitude: -118.3541982723333



Picture taken at: 16:07

Caption: UMM-TLA-0.5-3

Latitude: 44.85991798333333 Longitude: -118.3535461333333

Project Number: 0031.005

Time Notes



Picture taken at: 16:09

Caption: UMM-TLA-0.5-4

Latitude: 44.85995027166667

Longitude: -118.3534044343333



Picture taken at: 16:11

Caption: UMM-TLA-0.5-5

Latitude: 44.85987502933334

Longitude: -118.353381637



Picture taken at: 16:15
Caption: UMM-TLA-0.5-6
Latitude: 44.85978235633333
Longitude: -118.3537078031667



Picture taken at: 16:21
Caption: Chlorination flue
Latitude: 44.85968069816666
Longitude: -118.3536930685

Project Number: 0031.005

Time Notes



Picture taken at: 16:25

Caption: Upper retaining wall
Latitude: 44.85972560583333
Longitude: -118.3537275328333



Picture taken at: 16:40

Caption: Wetlands on upper settling pond (toward tributary)

Latitude: 44.86033666983333 Longitude: -118.3538482471667



Picture taken at: 16:40

Caption: Wetlands on upper settling pond

Latitude: 44.86033132583334 Longitude: -118.353817384



Picture taken at: 16:58

Caption: UMM-TLB-0.5-4 (near upper settling pond)

Latitude: 44.86037

Project Number: O031.005

Notes Time



Picture taken at: 17:08

Caption: Wetlands on middle settling pond

Latitude: 44.860685072

Longitude: -118.3542392566667



Picture taken at: 17:10 Caption: UMM-TLC-0.5-1

Latitude: 44.86071280166666 Longitude: -118.3542512848333



Picture taken at: 17:12 Caption: UMM-TLC-0.5-2 Latitude: 44.86075874966667



Picture taken at: 17:21

Caption: UMM-TLB-0.5-3 (foreground) and 1 & 2 (background)

Latitude: 44.86023615333333 Longitude: -118.353842624

Project Number: 0031.005

Time Notes



Picture taken at: 17:23 Caption: UMM-TLB-0.5-1 Latitude: 44.86025210999999

Longitude: -118.3536833281667



Picture taken at: 17:24 Caption: UMM-TLB-0.5-2 Latitude: 44.86026880983333

Longitude: -118.3537255115

17:54 TEI off site



Project Number: 0031.005

By: Don Malkemus

| Date | 10/02/2024 | Contractor | |
|-----------------|------------|-------------------|--|
| Staff On-Site | | Crew | |
| Staff From Time | | From Time | |
| Staff To Time | | To Time | |
| Weather | | Tailgate Meeting? | |
| Equipment | | Remarks | |

Work Summary

| Time | Notes |
|-------|---|
| 07:43 | Calibrate PID. Cal check passed. Arsenic in bag 20 +6, arsenic without bag 23+5, blank in bag LE 91.22%, Si 6.27% |
| 08:56 | Arrive at upper monumental mine, prepare equipment |
| 09:30 | Begin soil sampling and collecting XRF readings on WRA |
| 09:44 | Initial XRF in waste rock 809 ppm As. 3 feet downslope in brown soil 64 ppm. |
| 10:23 | Collect sample MM-WRA-0.5-1 from initial downslope boundary. Collect sample MM-WRA-DS-0.5 from native soil downslope of the waste rock pile. |
| 12:11 | Mob to upper shaft area |
| 12:45 | Arrive at upper upper area |
| 13:18 | Begin mapping, collecting soil samples and XRF readings. Appears that the many small waste rock piles would fit within the many holes and shaft openings. |
| 13:35 | Recalibrate XRF. Cal check passed. As in bag 16 +5, out of bag 13+4, blank LE 99.990%, rest is Fe, Zn |
| 13:49 | Continue mapping, XRFing |
| 14:30 | Map and XRF at the upper shaft. Appears that the waste rock would fit in the shaft opening. |
| 15:47 | Arrive at upper monumental mill site |
| 15:56 | XRF at flotation table is out of range, As at 18310 and lead at 25020 ppm |
| 16:20 | XRF bricks, As ranges from 69 to 275 |
| 16:43 | Visit upper and middle settling ponds |
| 17:27 | Leave site |
| | |



Project Number: 0031.005

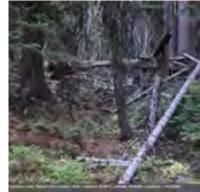
By: Adrienne Venegas

| Date | 10/03/2024 | Contractor | |
|-----------------|--|-------------------|--|
| Staff On-Site | Adrienne Venegas, Don Malkemus, James farrow | Crew | |
| Staff From Time | 08:10 | From Time | |
| Staff To Time | | To Time | |
| Weather | Sunny | Tailgate Meeting? | |
| Equipment | | Remarks | |

Work Summary

| Time | Notes |
|-------|---------------------------------------|
| 08:10 | TEI en route to Lower Monumental mine |
| | |

08:48 Walking to Lower Monumental mine



Picture taken at: 09:00

Caption: Investigating Drainage (not mapped) between middle

and lower settling ponds and tailings

Latitude: 44.86086172083333 Longitude: -118.3550789836667



Picture taken at: 09:26

Caption: Lower settling pond near adit

Latitude: 44.86096666666667

Project Number: 0031.005

Time Notes



Picture taken at: 09:29

Caption: Lower settling pond near adit

Latitude: 44.86088833333334 Longitude: -118.3554833333333



Picture taken at: 09:34 Caption: Former crusher Latitude: 44.86132

Longitude: -118.356055



Picture taken at: 09:38 Caption: Collapsed cabin Latitude: 44.86158

Longitude: -118.35602



Picture taken at: 09:48

Caption: LMM-WRA-0.5-4

Latitude: 44.86108605699999 Longitude: -118.3556077828333

Project Number: 0031.005

Time Notes



Picture taken at: 09:50
Caption: LMM-WRA-0.5-1
Latitude: 44.8612579155

Longitude: -118.3562858703333



Picture taken at: 09:52
Caption: LMM-WRA-0.5-2
Latitude: 44.861181917
Longitude: -118.356342687



Picture taken at: 09:54

Caption: LMM-WRA-0.5-3

Latitude: 44.86134915333334

Longitude: -118.3564625656667



Picture taken at: 09:55

Caption: LMM-WRA-0.5-3-DS Latitude: 44.86148238766667 Longitude: -118.356479084

Project Number: 0031.005

Time Notes



Picture taken at: 10:30

Caption: LMM-TLA-0.5-3

Latitude: 44.86146398514013

Longitude: -118.3562245963152



Picture taken at: 10:40

Caption: LMM-TLA-0.5-1

Latitude: 44.86128392166667

Longitude: -118.3557902623333



Picture taken at: 10:42 Caption: LMM-TLA-0.5-2 Latitude: 44.86129605033334

Longitude: -118.355905148



Picture taken at: 10:43 Caption: LMM-TLA-0.5-4 Latitude: 44.861448196

Project Number: 0031.005

Time Notes



Picture taken at: 10:49
Caption: LMM-WRB-0.5-1
Latitude: 44.86158853133333

Longitude: -118.3557070478333



Picture taken at: 10:50

Caption: LMM-WRB-0.5-2

Latitude: 44.861652572

Longitude: -118.3556089325



Picture taken at: 10:53

Caption: Adit #3

Latitude: 44.861828333333334

Longitude: -118.355505



Picture taken at: 11:11

Caption: LMM-WRB-0.5-3-DS

Latitude: 44.861545

Project Number: 0031.005

Time Notes



Picture taken at: 11:13

Caption: LMM-WRB-0.5-3

Latitude: 44.86156785749999

Longitude: -118.3559074638333

13:20 Cap Martin



Picture taken at: 13:11

Caption: Adit #1 at cap Martin

Latitude: 44.8558286925

Longitude: -118.3692865623333



Picture taken at: 13:17
Caption: CMM-WRA-0.5-2 at cap Martin

Latitude: 44.855906042

Longitude: -118.3694323281667



Project Number: 0031.005

Time Notes



Picture taken at: 13:41
Caption: CMM-WRB-0.5-1
Latitude: 44.85663333333333

Longitude: -118.37088



Picture taken at: 13:42

Caption: Adit #2 - very overgrown Latitude: 44.85661907866667 Longitude: -118.3708862646667



Picture taken at: 13:44

Caption: CMM-WRB-0.5-2

Latitude: 44.85665204683334 Longitude: -118.370809521

14:49 Switching to DAM log



Project Number: 0031.005

By: Adrienne Venegas

| Date | 10/04/2024 | Contractor | |
|-----------------|--|-------------------|--|
| Staff On-Site | Adrienne Venegas, Don Malkemus, James farrow | Crew | |
| Staff From Time | 08:50 | From Time | |
| Staff To Time | 16:45 | To Time | |
| Weather | Sunny | Tailgate Meeting? | |
| Equipment | | Remarks | |

Work Summary

| Time | Notes |
|-------|---|
| 08:50 | Park at Sheridan Mine. Gather equipment |
| 09:25 | Collecting CS-SW-5 (water) and CS-SD-5 (soil) |

09:32 Mapping features and collecting XRF samples at Sheridan



Picture taken at: 09:49

Caption: Adit 1

Latitude: 44.85730202296959 Longitude: -118.3750389692218



Picture taken at: 10:05 Caption: SH-WRA-0.5-1 Latitude: 44.8573153355

Project Number: 0031.005

Time Notes



Picture taken at: 10:09

Caption: SH-WRA-0.5-2 with adit 1 to left

Latitude: 44.85724722433334 Longitude: -118.3749621631667



Picture taken at: 10:11
Caption: Adit 2 (potential)

Latitude: 44.85721433783333 Longitude: -118.3750245023333



Picture taken at: 10:15

Caption: Potential Spring from potential adit 3 (not previously

mapped)

Latitude: 44.85713259083333 Longitude: -118.374928396



Picture taken at: 10:21

Caption: SH-WRB-0.5-2 (adit 2 beyond)

Latitude: 44.85714666666667

Project Number: 0031.005

Time Notes



Picture taken at: 10:22

Caption: SH-WRC-0.5-1 (adit 3 to left)

Latitude: 44.85714017233332 Longitude: -118.374993237



Picture taken at: 10:27 Caption: SH-WRC-0.5-2 Latitude: 44.857058646

Longitude: -118.3749980076667



Picture taken at: 10:31
Caption: SH-WRB-0.5-1

Latitude: 44.85719582983334 Longitude: -118.374995155

10:45 Mapping features and collecting XRF samples at GC-6



Picture taken at: 11:03 Caption: GC6-WTP-0.5-3

Latitude: 44.85770833333333 Longitude: -118.3754883333333

Project Number: 0031.005

Time Notes



Picture taken at: 11:04

Caption: GC6-WTP-0.5-2

Latitude: 44.85771630583334

Longitude: -118.3754872918333



Picture taken at: 11:06

Caption: GC6-WTP-0.5-1

Latitude: 44.85764864383334

Longitude: -118.3755053425



Picture taken at: 11:08
Caption: GC6-WRA-0.5-2
Latitude: 44.85765885849999
Longitude: -118.3755772786667

11:37 Mapping features and collecting XRF samples at GC-7



Picture taken at: 11:52

Caption: GC7-WRA-0.5-1 (adit beyond)

Latitude: 44.85809233066666 Longitude: -118.374635725

Project Number: 0031.005

Time Notes



Picture taken at: 11:54

Caption: GC7-WRA-0.5-2

Latitude: 44.85804985566666

Longitude: -118.3746857153333



Picture taken at: 11:57

Caption: GC7-WRA-0.5-3

Latitude: 44.85799591933334

Longitude: -118.3746669551667



Picture taken at: 12:01

Caption: GC7-WRB-0.5-2 (adit beyond)

Latitude: 44.85810029916667 Longitude: -118.374518634



Picture taken at: 12:13

Caption: GC7-WRB-0.5-1

Latitude: 44.85803943016668

Longitude: -118.3745557091667

12:14 Headed back to car

13:36 Collecting CS-SW-7 (water) and CS-SD-7 (soil) and CS-SD-7-DUP

Project Number: 0031.005

Time Notes



Picture taken at: 14:12

Caption: TL-WRB-0.5-1 at Tillicum Latitude: 44.85622302816667 Longitude: -118.3819868695

14:16 Mapping features and collecting XRF samples at Tillicum



Picture taken at: 14:16 Caption: TL-WRA-0.5-4

Latitude: 44.85618308416667 Longitude: -118.3819032196667



Picture taken at: 14:20 Caption: TL-WRA-0.5-1

Latitude: 44.85609540933334 Longitude: -118.3819744368333



Picture taken at: 14:21

Caption: TL-WRA-0.5-1-DS Latitude: 44.85611688566667 Longitude: -118.3820030815

Project Number: 0031.005

Time Notes



Picture taken at: 14:31 Caption: TL-WRB-0.5-2

Latitude: 44.85629667083333 Longitude: -118.3819895898333



Picture taken at: 14:32 Caption: TL-WRB-0.5-3

Latitude: 44.85628020849999 Longitude: -118.3819784573333



Picture taken at: 14:34 Caption: TL-WRB-0.5-1

Latitude: 44.85638736883334 Longitude: -118.381977674



Picture taken at: 14:44
Caption: TL-WRC-0.5-2
Latitude: 44.8566282265

Project Number: 0031.005

Time Notes



Picture taken at: 14:45 Caption: TL-WRC-0.5-1

Latitude: 44.85664855766667 Longitude: -118.381879152



Picture taken at: 14:47
Caption: Upper adit

Latitude: 44.85665246799999 Longitude: -118.3817636833333



Picture taken at: 15:24

Caption: TL-WRA-0.5-1-DS2 - very close to River

Latitude: 44.85611618883333 Longitude: -118.3819982275

15:10 Collecting CS-SW-6 (water) and CS-SD-6 (soil)



Picture taken at: 15:10

Caption: Collecting CS-SW-6 (water) and CS-SD-6 (soil)

Latitude: 44.8561914445

Project Number: 0031.005

Time Notes



Picture taken at: 15:54

Caption: GC5-WRA-0.5-2

Latitude: 44.85565754716666

Longitude: -118.3862101191667



Picture taken at: 15:55
Caption: GC5-WRA-0.5-1
Latitude: 44.85560845766666
Longitude: -118.386404823



Picture taken at: 15:56
Caption: GC5-WRA-0.5-3
Latitude: 44.85562926750001
Longitude: -118.3863704898333



Picture taken at: 15:57

Caption: GC5-WRB-0.5-1

Latitude: 44.85561375833333

Longitude: -118.3865324223333

Project Number: 0031.005

Time Notes



Picture taken at: 15:58

Caption: GC5-WRB-0.5-2

Latitude: 44.8556561155

Longitude: -118.386513499



Picture taken at: 16:00
Caption: GC5-WRA-0.5-4
Latitude: 44.8555311335

Longitude: -118.3862488983333



Picture taken at: 16:01

Caption: GC5-WRA-0.5-4-DS (along River)

Latitude: 44.85550516116668 Longitude: -118.3862477945

16:45 TEI off site



Project Number: 0031.005

By: Don Malkemus

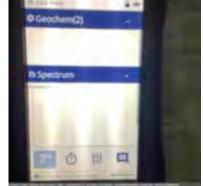
| Date | 10/04/2024 | Contractor | |
|-----------------|--|-------------------|-----|
| Staff On-Site | Don Malkemus, Adrienne Venegas, James Farrow | Crew | |
| Staff From Time | 07:38 | From Time | |
| Staff To Time | | To Time | |
| Weather | Cool Clear | Tailgate Meeting? | YES |
| Equipment | Vanya C Series | Remarks | |

Work Summary

Sheridan, GC 6, GC 7

Time Notes

07:38 Calibrate XRF. Cal check passed. Standard in bag As: 21+6, Standard outside bag As: 24+9, blank in bag: LE + Si 99.99%



Picture taken at: 07:41 Caption: Cal check pass

Latitude: 44.83628551642082 Longitude: -118.467842598333

09:24 Arrive at Sheridan, collect CS-SW-5 and CS-SD-5



Picture taken at: 09:28

Caption: Surface water sampling Latitude: 44.85694383449999 Longitude: -118.376280228

09:41 Begin mapping, sampling at Sheridan. Unable to find collapsed cabin

10:38 Finish mapping Sheridan, mob to GC #6

Project Number: O031.005

Time Notes



Picture taken at: 10:40

Caption: Old car on abandoned road

Latitude: 44.85751116408795

Longitude: -118.3753651356147

| 10:46 | Begin | mapping | GC-6 |
|-------|--------|----------|------|
| 10.70 | Degiii | Παρριπια | 00-0 |

11:40 Begin mapping GC-7

12:33 Finish mapping GC-7, mob to car.

13:09 Mob to Tillicum.

13:34 Collect CS-SW-7, SC-SD-7, and CS-SD-7-DUP. Move location slightly down gradient of GC-5



Picture taken at: 13:41

Caption: CS-7 sampling location Latitude: 44.85536237658032

Longitude: -118.3866192263865

14:02 Calibrate XRF. Bagged standard As: 20+5, unbagged standard As: 18+5, blank in bag: no As, LE + Si 99.99%



Picture taken at: 14:04

Caption: Cal check pass

Latitude: 44.85623720983082

Longitude: -118.3821642251675

14:10 Begin mapping and sampling at Tillicum

15:39 Begin mapping and sampling at GC-5



Project Number: 0031.005

Time Notes



Picture taken at: 15:49

Caption: Collecting bioavailability sample at GC-05

Latitude: 44.85564769512642 Longitude: -118.3862886946638

16:27 Finish sampling, mapping GC-5.

16:47 Offsite



Project Number: 0031.005

By: Adrienne Venegas

| Date | 10/05/2024 | Contractor | |
|-----------------|--|-------------------|--|
| Staff On-Site | Adrienne Venegas, Don Malkemus, James Farrow | Crew | |
| Staff From Time | 08:30 | From Time | |
| Staff To Time | 14:15 | To Time | |
| Weather | Sunny | Tailgate Meeting? | |
| Equipment | | Remarks | |

Work Summary

| Time | Notes |
|-------|---------------|
| 08:30 | Decon trowels |
| | |

09:16 Gather equipment and walk to golden fraction



Picture taken at: 09:29

Caption: Spring at lower GF
Latitude: 44.85520674366666
Longitude: -118.3888165911667



Picture taken at: 09:44

Caption: GF-WRA-0.5-1

Latitude: 44.85616642316666 Longitude: -118.3889246321667

Project Number: 0031.005

Time Notes



Picture taken at: 09:45 Caption: GF-WRA-0.5-2

Latitude: 44.85620611816667 Longitude: -118.3888719275



Picture taken at: 09:46 Caption: GF-WRA-0.5-3

Latitude: 44.85624380833332 Longitude: -118.3888295021667



Picture taken at: 09:58
Caption: GF-WRB-0.5-3

Latitude: 44.85590156533333 Longitude: -118.3891905096667



Picture taken at: 09:59

Caption: GF-WRB-0.5-2

Latitude: 44.85597949566667 Longitude: -118.3890238976667

Project Number: 0031.005

Time Notes



Picture taken at: 10:00 Caption: GF-WRB-0.5-1 Latitude: 44.85599451

Longitude: -118.3889499636667



Picture taken at: 10:02

Caption: Potential adit (previously mapped)

Latitude: 44.85586653533334 Longitude: -118.388989579



Picture taken at: 10:05

Caption: Area marked as cabin - no evidence of cabin

Latitude: 44.85566333333333 Longitude: -118.3887783333333



Picture taken at: 10:32

Caption: Dredge trench

Latitude: 44.85531067533334 Longitude: -118.3894149395

Project Number: 0031.005

Time Notes



Picture taken at: 10:34 Caption: GF-WRC-0.5-3

Latitude: 44.85522059733333 Longitude: -118.3895098273333



Picture taken at: 10:36 Caption: GF-WRC-0.5-4 Latitude: 44.855318473

Longitude: -118.3895803691667



Picture taken at: 10:37 Caption: GF-WRC-0.5-1

Latitude: 44.85541364683333 Longitude: -118.3895121963333



Picture taken at: 10:42 Caption: GF-WRC-0.5-2

Latitude: 44.85540267983333 Longitude: -118.3892824981667

Project Number: 0031.005

Time Notes



Picture taken at: 10:45 Caption: GF-DR-0.5 Latitude: 44.855296252

Longitude: -118.3894022528333

12:18 At Central mine, line feature is "excavation"



Picture taken at: 12:18

Caption:

Latitude: 44.8554148365

Longitude: -118.3910947703333

12:26 Find adit 2



Picture taken at: 12:26

Caption:

Latitude: 44.85567245033334 Longitude: -118.3907950745

12:26 Find adit 3, above adit 2

Project Number: 0031.005

Time Notes



Picture taken at: 12:27

Caption:

Latitude: 44.855650223

Longitude: -118.3907830961667

12:28 Find adit 4, east of Adit 3



Picture taken at: 12:29

Caption:

Latitude: 44.85578229566666 Longitude: -118.3904338358333

12:28 A trench connects adit 3 and adit 4, mapped as a line parallel with contours on Field maps



Picture taken at: 12:29

Caption:

Latitude: 44.8557745765 Longitude: -118.3904351065

13:53 Heading back to vehicle

14:15 TEI off site

Appendix B

ProUCL Outputs



| | A B C D E | F | G H I J K L |
|----------|--|---------------|---|
| 2 | UCL Statis | stics for Unc | ensored Full Data Sets |
| 3 | User Selected Options Date/Time of Computation ProUCL 5.2 11/18/2024 | 10.17.40 444 | |
| 5 | Date/Time of Computation ProUCL 5.2 11/18/2024 From File WorkSheet.xls | 10:17:49 AIVI | |
| 6 7 | Full Precision OFF Confidence Coefficient 95% | | |
| 8 | Number of Bootstrap Operations 2000 | | |
| 9 | | | |
| 11 | CEM-WRA | | |
| 12 13 | | General | Statistics |
| 14 | Total Number of Observations | | Number of Distinct Observations 7 |
| 15 16 | Minimum | 44.72 | Number of Missing Observations 0 Mean 162.2 |
| 17 | Maximum | 299 | Median 150 |
| 18 19 | SD Coefficient of Variation | | Std. Error of Mean 39.78 Skewness 0.39 |
| 20 | | | |
| 21 22 | | | I using incremental sampling methodology (ISM) approach, C 2020 and ITRC 2012) for additional guidance, |
| 23 24 | but note that ITRC may recommend the | he t-UCL or t | he Chebyshev UCL for small sample sizes (n < 7). |
| 25 | | | in gross overestimates of the mean. e for a discussion of the Chebyshev UCL. |
| 26 27 | | | • |
| 28 | Shapiro Wilk Test Statistic | | GOF Test Shapiro Wilk GOF Test |
| 29 30 | 1% Shapiro Wilk Critical Value | 0.73 | Data appear Normal at 1% Significance Level |
| 31 | Lilliefors Test Statistic 1% Lilliefors Critical Value | | Lilliefors GOF Test Data appear Normal at 1% Significance Level |
| 32 33 | Data appe | ar Normal at | 1% Significance Level |
| 34 | Note GOF tests | may be unre | eliable for small sample sizes |
| 35 36 | | suming Nor | mal Distribution |
| 37 | 95% Normal UCL 95% Student's-t UCL | 239.5 | 95% UCLs (Adjusted for Skewness) 95% Adjusted-CLT UCL (Chen-1995) 233.9 |
| 38 39 | | | 95% Modified-t UCL (Johnson-1978) 240.5 |
| 40 | | Gamma | GOF Test |
| 41 42 | A-D Test Statistic 5% A-D Critical Value | | Anderson-Darling Gamma GOF Test Detected data appear Gamma Distributed at 5% Significance Level |
| 43 | K-S Test Statistic | | Kolmogorov-Smirnov Gamma GOF Test |
| 44 45 | 5% K-S Critical Value | | Detected data appear Gamma Distributed at 5% Significance Level stributed at 5% Significance Level |
| 46 | | | eliable for small sample sizes |
| 47 48 | | Gamma | Statistics |
| 49 | k hat (MLE) | 2.462 | k star (bias corrected MLE) 1.502 |
| 50 51 | Theta hat (MLE) nu hat (MLE) | | Theta star (bias corrected MLE) 108 nu star (bias corrected) 21.03 |
| 52 | MLE Mean (bias corrected) | | MLE Sd (bias corrected) 132.4 |
| 53 54 | Adjusted Level of Significance | 0.0158 | Approximate Chi Square Value (0.05) 11.61 Adjusted Chi Square Value 9.572 |
| 55 | | • | |
| 56 57 | As 95% Approximate Gamma UCL | | ma Distribution 95% Adjusted Gamma UCL 356.4 |
| 58 59 | | • | |
| 60 | Shapiro Wilk Test Statistic | | GOF Test Shapiro Wilk Lognormal GOF Test |
| 61 62 | 10% Shapiro Wilk Critical Value | 0.838 | Data appear Lognormal at 10% Significance Level |
| 63 | Lilliefors Test Statistic 10% Lilliefors Critical Value | | Lilliefors Lognormal GOF Test Data appear Lognormal at 10% Significance Level |
| 64 65 | Data appear | Lognormal a | at 10% Significance Level |
| 66 | Note GOF tests | may be unre | eliable for small sample sizes |
| 67 68 | Minimum of Land 15 | | I Statistics |
| 69 | Minimum of Logged Data Maximum of Logged Data | | Mean of logged Data 4.872 SD of logged Data 0.747 |
| 70 71 | | umina l cara | |
| 72 | 95% H-UCL | 433.5 | prmal Distribution 90% Chebyshev (MVUE) UCL 305.3 |
| 73 74 | 95% Chebyshev (MVUE) UCL 99% Chebyshev (MVUE) UCL | 368.9 | 97.5% Chebyshev (MVUE) UCL 457.3 |
| 75 | | | |
| 76 77 | | | tion Free UCL Statistics Discernible Distribution |
| 78 | | | |
| 79 80 | Nonpa 95% CLT UCL | | tribution Free UCLs 95% BCA Bootstrap UCL 232.4 |
| 81 | 95% Standard Bootstrap UCL | 225.5 | 95% Bootstrap-t UCL 260.7 |
| 82 | 95% Hall's Bootstrap UCL | | 95% Percentile Bootstrap UCL 230.5 |

| | A B C D E | F | G H I J K | L |
|------------|--|--------------------|--|----------------|
| 83 | 90% Chebyshev(Mean, Sd) UCL | 281.6 | 95% Chebyshev(Mean, Sd) UCL | 335.6 |
| 84 | 97.5% Chebyshev(Mean, Sd) UCL | 410.7 | 99% Chebyshev(Mean, Sd) UCL | 558 |
| 85 | | | | |
| 86 87 | 95% Student's-t UCL | Suggested 239.5 | UCL to Use | |
| 88 | 95% Students-t OCL | 239.5 | <u> </u> | |
| 89 | Note: Suggestions regarding the selection of a 95% | 6 UCL are pr | ovided to help the user to select the most appropriate 95% UCL. | |
| 90 | Recommendations are based upon data size | , data distribi | ution, and skewness using results from simulation studies. | |
| 91 | However, simulations results will not cover all Real W | Vorld data se | ts; for additional insight the user may want to consult a statisticia | n. |
| 92 93 | | | | |
| | CEM-WRB | | | |
| 95 | SEM WILD | | | |
| 96 | | General | Statistics | |
| 97 98 | Total Number of Observations | 13 | Number of Distinct Observations | 12 |
| 99 | Minimum | 106 | Number of Missing Observations Mean | 0 165.3 |
| 100 | Maximum | | Median | 151 |
| 101 | SD | 41.37 | Std. Error of Mean | 11.47 |
| 102 | Coefficient of Variation | 0.25 | Skewness | 0.452 |
| 103 104 | | | | |
| 104 | Shapiro Wilk Test Statistic | 0.953 | GOF Test Shapiro Wilk GOF Test | |
| 106 | 1% Shapiro Wilk Critical Value | | Data appear Normal at 1% Significance Level | |
| 107 | Lilliefors Test Statistic | | Lilliefors GOF Test | |
| 108 | 1% Lilliefors Critical Value | 0.271 | Data appear Normal at 1% Significance Level | |
| 109 110 | Data appe | ar Normal at | 1% Significance Level | |
| 111 | Λ. | eumina Nor | nal Distribution | |
| 112 | 95% Normal UCL | Summy Non | 95% UCLs (Adjusted for Skewness) | |
| 113 | 95% Student's-t UCL | 185.8 | 95% Adjusted-CLT UCL (Chen-1995) | 185.7 |
| 114 | | | 95% Modified-t UCL (Johnson-1978) | 186 |
| 115 116 | | 0 | 205 T | |
| 117 | A-D Test Statistic | | GOF Test Anderson-Darling Gamma GOF Test | |
| 118 | 5% A-D Critical Value | | Detected data appear Gamma Distributed at 5% Significance | e l evel |
| 119 | K-S Test Statistic | | Kolmogorov-Smirnov Gamma GOF Test | 2010. |
| 120 | 5% K-S Critical Value | | Detected data appear Gamma Distributed at 5% Significance | e Level |
| 121 122 | Detected data appear | r Gamma Di | stributed at 5% Significance Level | |
| 123 | | Gamma | Statistics | |
| 124 | k hat (MLE) | | k star (bias corrected MLE) | 13.62 |
| 125 | Theta hat (MLE) | | Theta star (bias corrected MLE) | 12.14 |
| 126 | nu hat (MLE) | | nu star (bias corrected) | 354.1 |
| 127 128 | MLE Mean (bias corrected) | 165.3 | MLE Sd (bias corrected) | 44.79 |
| 129 | Adjusted Level of Significance | 0.0301 | Approximate Chi Square Value (0.05) Adjusted Chi Square Value | 311.5 305.8 |
| 130 | Adjusted Edver of digrillicance | 0.0001 | Adjusted offi oquale value | 303.0 |
| 131 | | | ma Distribution | |
| 132 | 95% Approximate Gamma UCL | 187.9 | 95% Adjusted Gamma UCL | 191.4 |
| 133 134 | | Lognormod | COE Toot | |
| 135 | Shapiro Wilk Test Statistic | | GOF Test Shapiro Wilk Lognormal GOF Test | |
| 136 | 10% Shapiro Wilk Critical Value | 0.889 | Data appear Lognormal at 10% Significance Level | |
| 137 | Lilliefors Test Statistic | 0.137 | Lilliefors Lognormal GOF Test | |
| 138 | 10% Lilliefors Critical Value | | Data appear Lognormal at 10% Significance Level | |
| 139 140 | Data appear | Lognormal a | at 10% Significance Level | |
| 141 | | Lognorma | I Statistics | |
| 142 | Minimum of Logged Data | 4.663 | Mean of logged Data | 5.079 |
| 143 | Maximum of Logged Data | | SD of logged Data | 0.249 |
| 144 145 | | | most Distribution | |
| 145 | | | ormal Distribution 90% Chebyshev (MVUE) UCL | 199.8 |
| 147 | 95% Chebyshev (MVUE) UCL | | 90% Chebyshev (MVUE) UCL 97.5% Chebyshev (MVUE) UCL | 237 |
| 148 | 99% Chebyshev (MVUE) UCL | | 57.575 Shobyanov (mvoz.) OOL | |
| 149 | | | | |
| 150 151 | | | tion Free UCL Statistics | |
| 152 | Data appea | ai to tollow a | Discernible Distribution | |
| 153 | Nonpa | rametric Dist | tribution Free UCLs | |
| 154 | 95% CLT UCL | 184.2 | 95% BCA Bootstrap UCL | 183.9 |
| 155 | 95% Standard Bootstrap UCL | | 95% Bootstrap-t UCL | 187.6 |
| 156 157 | 95% Hall's Bootstrap UCL 90% Chebyshev(Mean, Sd) UCL | | 95% Percentile Bootstrap UCL | 183.7 |
| 158 | 90% Chebyshev(Mean, Sd) UCL 97.5% Chebyshev(Mean, Sd) UCL | | 95% Chebyshev(Mean, Sd) UCL 99% Chebyshev(Mean, Sd) UCL | 215.3 279.5 |
| 159 | 57.5% Shebyshev(Weah, Od) OCE | , | OUT CHOSYSHOV(MCCH, OU) OCL | _, |
| 160 | | | UCL to Use | |
| 161 | 95% Student's-t UCL | 185.8 | | |
| 162 163 | Note: Suggestions regarding the collection of a OEO | (IICI 252 55 | ovided to help the user to calent the most energiate OEO/ LICI | |
| 164 | | | ovided to help the user to select the most appropriate 95% UCL. ution, and skewness using results from simulation studies. | |
| 1 | riccommendations are pased upon data size | , aata distribl | ation, and one micoo doing results from simulation studies. | |

| 165 | A B C D E However simulations results will not cover all Real Wo | F orld data se | G H I J K ts; for additional insight the user may want to consult a statisticia | L |
|--------------------------|---|--------------------|--|----------------|
| 166 | Tiewerer, eminateme researce will not cover all research | 0114 4444 00 | e, for additional molgit the door may want to constant a stational | |
| 167 168 | CEM-WRC | | | |
| 169 | OEIM-WITO | | | |
| 170 171 | T. IN | | Statistics | -10 |
| 172 | Total Number of Observations | 16 | Number of Distinct Observations Number of Missing Observations | 16 0 |
| 173 | Minimum | 52 | Mean | 107 |
| 174 175 | Maximum | 187 | Median | 106.5 |
| 176 | SD Coefficient of Variation | 39.88 0.373 | Std. Error of Mean Skewness | 9.969 0.439 |
| 177 | Godinoloni di Valiationi | | | 0.100 |
| 178 179 | Shapiro Wilk Test Statistic | Normal 0 0.952 | GOF Test | |
| 180 | 1% Shapiro Wilk Critical Value | 0.952 | Shapiro Wilk GOF Test Data appear Normal at 1% Significance Level | |
| 181 | Lilliefors Test Statistic | 0.145 | Lilliefors GOF Test | |
| 182 183 | 1% Lilliefors Critical Value | 0.248 | Data appear Normal at 1% Significance Level t 1% Significance Level | |
| 184 | Data appea | ii inviiliai ai | . 1 % Significance Level | |
| 185 | | suming Norr | mal Distribution | |
| 186 187 | 95% Normal UCL 95% Student's-t UCL | 124.5 | 95% UCLs (Adjusted for Skewness) 95% Adjusted-CLT UCL (Chen-1995) | 124.6 |
| 188 | 33 % Student 3-t OCL | 127.0 | 95% Modified-t UCL (Johnson-1978) | 124.7 |
| 189 190 | | | 0057 | |
| 190 | A-D Test Statistic | 0.292 | GOF Test Anderson-Darling Gamma GOF Test | |
| 192 | 5% A-D Critical Value | 0.74 | Detected data appear Gamma Distributed at 5% Significance | e Level |
| 193 194 | K-S Test Statistic | 0.156 | Kolmogorov-Smirnov Gamma GOF Test | o Level |
| 195 | 5% K-S Critical Value Detected data appear | 0.215 Gamma Dis | Detected data appear Gamma Distributed at 5% Significand stributed at 5% Significance Level | e Levei |
| 196 | Dottotion until appear | | | |
| 197 198 | I. bot (MI E) | | Statistics | 0.151 |
| 199 | k hat (MLE) Theta hat (MLE) | 7.52 14.24 | k star (bias corrected MLE) Theta star (bias corrected MLE) | 6.151 17.4 |
| 200 | nu hat (MLE) | 240.6 | nu star (bias corrected) | 196.8 |
| 201 202 | MLE Mean (bias corrected) | 107 | MLE Sd (bias corrected) | 43.16 165.4 |
| 203 | Adjusted Level of Significance | 0.0335 | Approximate Chi Square Value (0.05) Adjusted Chi Square Value | 162.1 |
| 204 | | | | |
| 205 206 | Ass 95% Approximate Gamma UCL | | nma Distribution 95% Adjusted Gamma UCL | 130 |
| 207 | 95 % Approximate Gamina OCL | 127.4 | 95 % Aujusteu Gaitilla OCL | 130 |
| 208 | | | I GOF Test | |
| 209 210 | Shapiro Wilk Test Statistic 10% Shapiro Wilk Critical Value | 0.955 0.906 | Shapiro Wilk Lognormal GOF Test Data appear Lognormal at 10% Significance Level | |
| 211 | Lilliefors Test Statistic | 0.147 | Lilliefors Lognormal GOF Test | |
| 212 213 | 10% Lilliefors Critical Value | 0.196 | Data appear Lognormal at 10% Significance Level | |
| 214 | Data appear L | <u>Lognormai a</u> | at 10% Significance Level | |
| 215 | | Lognorma | l Statistics | |
| 216 217 | Minimum of Logged Data | 3.951 | Mean of logged Data | 4.605 |
| 218 | Maximum of Logged Data | 5.231 | SD of logged Data | 0.387 |
| 219 | | | ormal Distribution | |
| 220 221 | 95% H-UCL 95% Chebyshev (MVUE) UCL | 130.9 153.4 | 90% Chebyshev (MVUE) UCL | 139.1 173.4 |
| 221 222 223 | 95% Chebyshev (MVUE) UCL 99% Chebyshev (MVUE) UCL | 212.7 | 97.5% Chebyshev (MVUE) UCL | 1/3.4 |
| 223 | | | | |
| 224 225 226 | | | tion Free UCL Statistics Discernible Distribution | |
| 226 | Data appear | to follow a | DISCOTTIBUE DISCIBULION | |
| 227 | | | tribution Free UCLs | 1010 |
| 228 229 | 95% CLT UCL 95% Standard Bootstrap UCL | 123.4 123.3 | 95% BCA Bootstrap UCL 95% Bootstrap-t UCL | 124.9 127.7 |
| 230 231 232 233 | 95% Hall's Bootstrap UCL | 127.2 | 95% Percentile Bootstrap UCL | 123.5 |
| 231 | 90% Chebyshev (Mean, Sd) UCL | 137 | 95% Chebyshev (Mean, Sd) UCL | 150.5 |
| 233 | 97.5% Chebyshev(Mean, Sd) UCL | 169.3 | 99% Chebyshev(Mean, Sd) UCL | 206.2 |
| 234 | | | UCL to Use | |
| 235 236 | 95% Student's-t UCL | 124.5 | | |
| 237 | Note: Suggestions regarding the selection of a 95% | UCL are pro | ovided to help the user to select the most appropriate 95% UCL. | |
| 238 | Recommendations are based upon data size, | data distribi | ution, and skewness using results from simulation studies. | |
| 239 240 | However, simulations results will not cover all Real Wo | orld data se | ts; for additional insight the user may want to consult a statisticia | n. |
| 241 | | | | |
| 242 | CEM-WRD | | | |
| 243 244 | | General | Statistics | |
| 245 | Total Number of Observations | 4 | Number of Distinct Observations | 4 |
| 246 | | | Number of Missing Observations | 0 |

| | Α | | В | | С | | D | E | | F | G | | Н | | I | | J | K | | L |
|------------|---|-------|----------|--------|----------|----------|------------|------------------------------------|---------|---------------------------------------|--------------|-------|----------|--------|-----------|---------------|------------------------------------|--------------------------------|----------|----------------|
| 247 | | | | | | • | | Minimu | | 56 | | | | | | | | Me | | 66.5 |
| 248 249 | | | | | | | | Maximu | | 87 | | | | | | | 0.1 | Medi | | 61.5 |
| 250 | | | | | | <u> </u> | officion | t of Variati | SD | 13.92 0.209 | | | | | | | Sta. | Error of Me Skewne | | 6.958 1.781 |
| 251 | | | | | | | enicien | it Oi Vailati | IUII | 0.203 | | | | | | | | Skewile | 33 | 1.701 |
| 252 | | | Note: Sa | mple : | size is | smal | l (e.g., · | <10), if dat | ta a | re collected | using inc | emen | tal sar | mplin | g meth | nodolo | gy (ISN | 1) approach | , | |
| 253 | | | | | | | | | | n ISM (ITR | | | | | | | | | | |
| 254 255 | | | t | but no | te that | | | | | e t-UCL or t | | | | | | | zes (n < | < 7). | | |
| 256 | | | | | Re | | | | | ten results i nnical Guide | | | | | | | <u> </u> | | | |
| 257 | | | | | 110 | ,101 10 | uio i ic | JOOL 0.2 | 1001 | iiiicai Gaia | , ioi a aisc | 40010 | 11 OI UI | 011 | CDYGII | ., | <u></u> | | | |
| 258 259 | | | | | | | | | | Normal C | OF Test | | | | | | | | | |
| 260 | | | | | | | | Test Statis | | 0.793 | | | | | | | GOF Te | | | |
| 261 | | | | | 1% 5 | | | <u>Critical Val</u> Test Statis | | 0.687 0.377 | | U | ата ар | | | | <u>% Signit</u>)F Tes t | icance Leve | <u> </u> | |
| 262 | | | | | 1 | | | Critical Val | | 0.413 | | D | ata ap | | | | | icance Leve | el | |
| 263 | | | | | | | | | | r Normal at | | | | | | | | | | |
| 264 265 | | | | | | | Not | te GOF tes | sts n | nay be unre | liable for s | mall | sample | e size | s | | | | | |
| 266 | | | | | | | | | Δεε | suming Norr | nal Dietrih | ution | | | | | | | | |
| 266 267 | | | | | 95% N | lorma | IUCL | | / 100 | dining Hon | ilai Disaib | uuon | 95 | % UC | CLs (A | djuste | d for SI | (ewness) | | |
| 268 | | | | | | | | ıdent's-t U | CL | 82.88 | | | | 95% | % Adju | sted-0 | CLT UC | L (Chen-199 | | 84.57 |
| 269 270 | | | | | | | | | | | | | | 95 | % Mod | dified- | t UCL (J | Johnson-197 | 78) | 83.91 |
| 270 | | | | | | | | | | Gamma (| GOF Test | | | | | | | | | |
| 272 | | | | | | | A-D | Test Statis | stic | 0.562 | JOI TEST | | And | ersor | n-Darli | ng Ga | mma G | OF Test | | |
| 273 | | | | | | 5 | % A-D (| Critical Val | lue | 0.657 | Detec | ed da | ta app | ear G | amma | Distri | buted a | t 5% Signific | canc | e Level |
| 274 | | | | | | | | Test Statis | _ | 0.385 | | | | | | | | GOF Test | | |
| 275 276 | | | | | | | | <u>Critical Val</u> | | 0.394 Gamma Dis | | | | | | | buted a | t 5% Signific | canc | e Level |
| 277 | | | | | | L | | | | nay be unre | | | | | | | | | | |
| 278 | | | | | | | | | | nay be anne | | | Julii pi | | | | | | | |
| 279 | | | | | | | | | | Gamma | Statistics | | | | | | | | | |
| 280 281 | | | | | | | The | k hat (ML | | 33.76 1.97 | | | | | The | | | orrected ML orrected ML | | 8.606 |
| 282 | | | | | | | | eta hat (ML nu hat (ML | | 270.1 | | | | | rne | | _ | orrected ML | | 7.727 68.85 |
| 283 | | | | | М | 1LE M | | as correcte | | 66.5 | | | | | | | | oias correcte | | 22.67 |
| 284 | | | | | | | • | | | | | | | App | oroxim | | | e Value (0.0 | | 50.75 |
| 285 286 | | | | | Adju | isted L | _evel of | Significan | nce | N/A | | | | | | Adjus | sted Chi | Square Val | ue | N/A |
| 287 | | | | | | | | | Δος | uming Gam | ma Dietrih | ution | | | | | | | | |
| 288 | | | | | 95% A | Approx | ximate (| Gamma U | | 90.22 | ma Distric | ulion | | | | 95% A | Adjusted | d Gamma U | CL | N/A |
| 289 | | | | | | | | | | | | | | | | | | | | |
| 290 291 | | | | | | Ol :- | \A/:II- | T4 04-4'- | | Lognormal | GOF Tes | | O.L. | | \A#!II. I | | | NE T4 | | |
| 292 | | | | | 10% S | Shanir | O Wilk | <u>Test Statis</u> Critical Val | lue | 0.824 0.792 | | Data | | | | | | DF Test nificance Le | vel | |
| 293 | | | | | 10 /0 0 | | | Test Statis | | 0.362 | | Date | | | | | nal GOF | | VOI | |
| 294 | | | | | 10 | 0% Lil | | Critical Val | | 0.346 | | | | | | at 10 | % Signi | ficance Lev | el | |
| 295 296 | | | | | | | | | | imate Logno | | | | | | | | | | |
| 297 | | | | | | | INOI | e GOF tes | sis n | nay be unre | ilable for s | maii | sample | SIZE | :5 | | | | | |
| 298 | | | | | | | | | | Lognorma | Statistics | | | | | | | | | |
| 299 | | | | | | | | Logged Da | | 4.025 | | | | | | | | of logged Da | | 4.182 |
| 300 301 | | | | | | Maxir | num of | Logged Da | ata | 4.466 | | | | | | | SD | of logged Da | ata | 0.194 |
| 302 | | | | | | | | А | SSU | ming Logno | rmal Distr | butio | n | | | | | | | |
| 303 | | | | | | | | 95% H-U | CL | 87.85 | | | | | | | | / (MVUE) U | | 85.76 |
| 304 | | | | | | | | (MVUE) U | | 94.5 | | | | | 97.5 | % Ch | ebyshe | / (MVUE) U | CL | 106.6 |
| 305 306 | | | | | 99% | Cheb | yshev (| (MVUE) U | UL | 130.5 | | | | | | | | | | |
| 307 | | | | | | | | Nonpara | met | tric Distribut | tion Free l | JCL S | tatistic | s | | | | | | |
| 308 | | | | | | | | | | to follow a | | | | | | | | | | |
| 309 | | | | | - | | | | | | | | | | | | | | | |
| 310 311 | | | | | | | O | Non 5% CLT U | para | ametric Dist 77.95 | ribution F | ee U(| JLS | | | 050 | % BC \ ' | Bootstrap U | ~ T | N/A |
| 312 | | | | | 95% | 6 Stan | | ootstrap U | | 77.95 N/A | | | | | | 307 | | ootstrap U | | N/A N/A |
| 313 | | | | | | | | ootstrap U | | N/A | | | | | 95 | <u>% Pe</u> r | | Bootstrap U | | N/A |
| 314 | | | | | | | | ean, Sd) U | - | 87.37 | | | | | 95% | Cheb | yshev(N | lean, Sd) U | CL | 96.83 |
| 315 316 | | | | 97 | .5% Cl | nebys | nev(Me | ean, Sd) U | CL | 110 | | | | | 99% | Cheb | yshev(N | lean, Sd) U | JL | 135.7 |
| 317 | | | | | | | | | | Suggested | UCL to He | e | | | | | | | | |
| 318 | | | | | | 9 | 95% Stu | ıdent's-t U | | 82.88 | | | | | | | | | | |
| 319 | | | | | | | | | .= | | | | | | | | | | | |
| 320 321 | | Not | | | | | | | | | | | | | | | | oriate 95% L | ICL. | |
| 322 | | Howe | | | | | | | | <u>data distribu</u> orld data set | | | | | | | | n studies. nsult a statis | ticia | n. |
| 323 | | .5446 | | | J . 03ul | **** | | . J. J. T. T. C. | , , , (| | | | | | .551 111 | ., wa | | .oun a otatio | | |
| | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | |

| | A B C | D E | F | G H I | J K | L |
|----------|--------------------------------|------------------------------|---------------|-------------------------------------|---|----------------|
| 1 | | UCL Statis | tics for Unce | nsored Full Data Sets | | |
| 2 | User Selected Options | , | | | | |
| 3 | Date/Time of Computation | ProUCL 5.2 11/18/2024 1 | I0·24·45 AM | | | |
| 4 | From File | WorkSheet.xls | 10.24.40 AW | | | |
| 5 | Full Precision | OFF | | | | |
| 6 7 | Confidence Coefficient | 95% | | | | |
| 8 | Number of Bootstrap Operations | 2000 | | | | |
| 9 | | | | | | |
| 10 | | | | | | |
| 11 | CM-PS | | | | | |
| 12 | | | | | | |
| 13 | | | General | | _ | |
| 14 | Total | I Number of Observations | 7 | | er of Distinct Observations | 6 |
| 15 | | | | Numbe | er of Missing Observations | 0 |
| 16 | | Minimum | 9.7 | | Mean | 29.26 |
| 17 | | Maximum | 38.61 | | Median | 33 |
| 18 | | SD Coefficient of Variation | 10.01 | | Std. Error of Mean | 3.782 |
| 19 | | Coefficient of Variation | 0.342 | | Skewness | -1.42 |
| 20 | Note: Sample size is | small (a.g. <10) if data a | re collected | using incremental sampling metho | dology (ISM) approach | |
| 21 | | , - , | | 2020 and ITRC 2012) for addition | ** | |
| 22 | | <u> </u> | • | e Chebyshev UCL for small samp | • | |
| 23 24 | Dat note that | | | n gross overestimates of the mean | | |
| 25 | Re | <u> </u> | | for a discussion of the Chebyshev | | |
| 26 | | | | <u> </u> | | |
| 27 | | | Normal C | OF Test | | |
| 28 | S | Shapiro Wilk Test Statistic | 0.857 | Shapiro W | /ilk GOF Test | |
| 29 | 1% S | Shapiro Wilk Critical Value | 0.73 | Data appear Normal | at 1% Significance Level | |
| 30 | | Lilliefors Test Statistic | 0.217 | Lilliefors | GOF Test | |
| 31 | 1 | 1% Lilliefors Critical Value | 0.35 | Data appear Normal | at 1% Significance Level | |
| 32 | | | | 1% Significance Level | | |
| 33 | | Note GOF tests r | may be unre | iable for small sample sizes | | |
| 34 | | | | and Polymerity and | | |
| 35 | OFO/ N | Ass ormal UCL | suming Norn | al Distribution | unted for Chaumana' | |
| 36 | 95% N | 95% Student's-t UCL | 36.61 | ` • | usted for Skewness) ed-CLT UCL (Chen-1995) | 33.31 |
| 37 | | 30 /0 Student S-t UCL | 30.01 | | ried-t UCL (Johnson-1978) | 36.27 |
| 38 | | | | 95 /0 IVIOUII | .53 (55) | |
| 39 40 | | | Gamma (| OF Test | | |
| 41 | | A-D Test Statistic | 0.734 | | g Gamma GOF Test | |
| 42 | | 5% A-D Critical Value | 0.709 | | ited at 5% Significance Leve | ; |
| 43 | | K-S Test Statistic | 0.255 | | ov Gamma GOF Test | |
| 44 | | 5% K-S Critical Value | 0.313 | Detected data appear Gamma D | Distributed at 5% Significance | e Level |
| 45 | | Detected data follow App | or. Gamma I | istribution at 5% Significance Leve | əl | |
| 46 | | Note GOF tests r | may be unre | iable for small sample sizes | | |
| 47 | | | | | | |
| 48 | | | Gamma | | | |
| 49 | | k hat (MLE) | 6.549 | | star (bias corrected MLE) | 3.838 |
| 50 | | Theta hat (MLE) | 4.468 | Theta | star (bias corrected MLE) | 7.624 |
| 51 | | nu hat (MLE) | 91.69 | | nu star (bias corrected) | 53.73 |
| 52 | M | LE Mean (bias corrected) | 29.26 | Α | MLE Sd (bias corrected) | 14.94 |
| 53 | ٨ ـــانــ ٨ | sted Level of Significance | 0.0158 | | e Chi Square Value (0.05) Adjusted Chi Square Value | 37.89 33.91 |
| 54 | | sieu Level OI Significance | 0.0108 | μ | aujusteu oni square value | 33.91 |
| 55 | | | | | | |

| | Α | | В | | С | | D | | E | F | Con | G nma Distrib | hutio | Н | | I | | | J | \perp | K | (| L |
|----------|--------------|-------|--------|--------|---------|------------------------|------------|---------|-------------------------------------|--|---|---|--------|------------|-------|---------|--------|---------------------|------------------|---------|---------|--------|----------------|
| 56 | | | | | 050 | /- Ann | rovimato | . Can | nma UCL | | | nma Distrit | Dutio | n ——— | | | 050 | 0/ ₋ Λ d | ljusted | 1 G a | mms | , LICI | 46.35 |
| 57 | | | | | 957 | o App | IOXIIIIale | Gail | IIIIa UCL | 41.5 | | | | | | | 33. | 70 Au | Justeu | - Ga | 1111110 | OCL | 40.55 |
| 58 | i i | | | | | | | | | Logn | orma | I GOF Tes | :t | | | | | | | | | | |
| 59 | İ | | | | | Sha | piro Wilk | k Tes | t Statistic | | | 1 401 100 | | Sha | apiro | Wilk | Loa | norn | nal GC |)F 1 | lest | | |
| 60 | | | | | 10% | | | | cal Value | | | | | Data Not | _ | | | | | | | evel | |
| 61 62 | [| | | | | | | | t Statistic | | | | | | | | | | I GOF | | | | |
| 63 | | | | | | 10% | Lilliefors | Criti | cal Value | | | | | Data Not | | | - | | | | | evel | |
| 64 | . <u> </u> | | | | | | | D | ata Not L | _ognorm | al at | ⊥ : 10% Signi | | | | | | | | | | | |
| 65 | | | | | | | | | | | | | | | | | | | | | | | |
| 66 | | | | | | | | | | Logn | orma | al Statistics | S | | | | | | | | | | |
| 67 | [| | | | | Mii | nimum o | of Log | ged Data | 2.2 | 72 | | | | | | | N | Mean c | of lo | gged | Data | 3.298 |
| 68 | | | | | | Ma | ximum o | of Log | ged Data | 3.6 | 54 | | | | | | | | SD | of lo | gged | l Data | 0.481 |
| 69 | | | | | | | | | | | | | | | | | | | | | | | |
| 70 | | | | | | | | | Ass | uming l | .ogno | ormal Distr | ributi | on | | | | | | | | | |
| 71 | | | | | | | | 95 | % H-UCL | 48.8 | 36 | | | | | 90 | 0% (| Cheb | yshev | / (M) | VUE) |) UCL | 46.19 |
| 72 | L | | | | | | • | • | UE) UCL | | 9 | | | | | 97.5 | 5% (| Cheb | yshev | / (M) | VUE) |) UCL | 63.87 |
| 73 | <u> </u> | | | | 99 | % Ch | ebyshev | v (MV | UE) UCL | . 84.0 |)6 | | | | | | | | | | | | |
| 74 | | | | _ | | _ | | | | navamatria Distribution Fron IIOI Otatiotica | | | | | | | | | | | | | |
| 75 | <u> </u> | | | | | | | | - | nparametric Distribution Free UCL Statistics | | | | | | | | | | | | | |
| 76 | ļ | | | | | | | D | ata appe | ar to foll | ow a | Discernib | le Di | stributio | n | | | | | | | | |
| 77 | | | | | | | | | | | | | • • | 10. | | | | | | | | | |
| 78 | | | | | | | | 0501 | - | | | stribution Free UCLs | | | | | | | | | | | |
| 79 | | | | | | 5 0/ 0 : | | | CLT UCL | | | 95% BCA Bo | | | | | | | | | | 33.94 | |
| 80 | | | | | 9: | | | | trap UCL | | | 95% Bootstrap-t 95% Percentile Bootstrap | | | | | | | | 34.88 | | | |
| 81 | | | | | 000/ | | | | trap UCL | | | | | | | | | | | | | | 34.59 |
| 82 | | | | | | | | | Sd) UCL Sd) UCL | | | | | | | | | - | shev(M shev(M | | | | 45.74 66.89 |
| 83 | | | | | 17.5% | Cheb | ysnev(iv | /iean, | Sa) UCL | 52.8 | 57 | | | | | 99% | Ch | ebys | nev(IVI | iear | ı, Su) | UCL | 00.89 |
| 84 | | | | | | | | | | Sugge | eted | UCL to Us | | | | | | | | | | | |
| 85 | <u> </u> | | | | | | 95% St | tuder | nt's-t UCL | | | 002 10 03 | | | | | | | | | | | |
| 86 87 | <u> </u> | | | | | | 3070 01 | tuuoi | | . 00.0 | | | | | | | | | | — | | | |
| 88 |] | Note | : Sua | estio | ns rea | ardino | the sele | ection | n of a 95° | % UCL a | re pr | rovided to h | nelp t | the user t | to se | lect th | ne m | nost a | approp | oriat | e 95% | % UCL | |
| 89 | [| | | | | | | | | | | oution, and | | | | | | | | | | | |
| 90 | | Howev | | | | | | | | | | ets; for addi | | | | | | | | | | | an. |
| 91 | <u> </u> | | | | | | | | | | | <u> </u> | | | | | | | | | | | |
| 92 | | No | ote: F | or hig | hly ne | gative | ely-skew | ved d | ata, conf | idence | imits | e.g., Che | en, Jo | ohnson, l | Logr | orma | I, an | nd Ga | amma` |) ma | ay no | t be | |
| 93 | | | | r | eliable | e. Ch | en's and | d Joh | nson's m | ethods | provi | ide adjustn | nent | s for pos | itvel | y skev | wed | data | sets. | | | | |
| 94 | [| | | | | | | | | | | | | | | | | | | | | | |
| 95 | | | | | | | | | | | | | | | | | | | | | | | |
| 96 | CM-WRA | | | | | | | | | | | | | | | | | | | | | | |
| 97 | | | | | | | | | | | | | | | | | | | | | | | |
| 98 | | | | | | | | | | | eral | Statistics | | | | | | | | | | | |
| 99 | | | | | To | otal N | umber of | f Obs | oservations 12 Number of Distinct (| | | | | | | | | 9 | | | | | |
| 100 | <u> </u> | | | | | | | | | | Number of Missing Observat | | | | | | | 0 | | | | | |
| 101 | <u> </u> | Mir | | | | | | | | | | | | | | | | | | | | Mean | 10.64 |
| 102 | <u> </u> | | | | | | | ľ | Maximum | | | | | | | | | | | | | edian | 10.55 |
| 103 | | | | | | | | | SD | | | | | | | | | | Std. | | | Mean | 1.099 |
| 104 | | | | | | (| Coefficie | ent of | Variation | 0.3 | 58 | | | | | | | | | | Skev | vness | 0.924 |
| 105 | | | | | | | | | | | | 0055 | | | | | | | | | | | |
| 106 | | | | | | <u>C'</u> | mine 1877 | L T | 4 C4-4' '' | | | GOF Test | | | | | \A /** | II. 01 | | | | | |
| 107 | <u> </u> | | | | 40 | | | | t Statistic | | | | | Doto == | | | | | OF Tes | | | 0.40 | |
| 108 | <u> </u> | | | | 1% | | | | cal Value | | | | | Data app | | | | | Signiti Test | | ce Le | evel . | |
| 109 | | | | | | | | | t Statistic | | | | | Doto co | | | | | | | | 0)(0) | |
| 110 | | | | | | 1 70 | LIIIIEIUIS | o Cittl | cai value | 0.2 | 0.281 Data appear Normal at 1% Significance Level | | | | | | | | | | | | |

| 111 | A B C D E Data appea | F ar Normal at | G H I J K 1 | L |
|------------|--|-------------------|---|---------|
| 112 | <u> </u> | | | |
| 113 | Ass | suming Norr | nal Distribution | |
| 114 | 95% Normal UCL | | 95% UCLs (Adjusted for Skewness) | |
| 115 | 95% Student's-t UCL | 12.61 | 95% Adjusted-CLT UCL (Chen-1995) | 12.76 |
| 116 | | | 95% Modified-t UCL (Johnson-1978) | 12.66 |
| 117 | | | | |
| 118 | | Gamma (| GOF Test | |
| 119 | A-D Test Statistic | 0.25 | Anderson-Darling Gamma GOF Test | |
| 120 | 5% A-D Critical Value | 0.731 | Detected data appear Gamma Distributed at 5% Significand | e Level |
| 121 | K-S Test Statistic | 0.151 | Kolmogorov-Smirnov Gamma GOF Test | |
| 122 | 5% K-S Critical Value | 0.246 | Detected data appear Gamma Distributed at 5% Significance | e Level |
| 123 | Detected data appear | Gamma Dis | stributed at 5% Significance Level | |
| 124 | | | | |
| 125 | | Gamma | Statistics | |
| 126 | k hat (MLE) | 8.767 | k star (bias corrected MLE) | 6.631 |
| 127 | Theta hat (MLE) | 1.213 | Theta star (bias corrected MLE) | 1.604 |
| 128 | nu hat (MLE) | 210.4 | nu star (bias corrected) | 159.1 |
| 129 | MLE Mean (bias corrected) | 10.64 | MLE Sd (bias corrected) | 4.13 |
| 130 | | | Approximate Chi Square Value (0.05) | 131 |
| 131 | Adjusted Level of Significance | 0.029 | Adjusted Chi Square Value | 127.1 |
| 132 | | | | |
| 133 | | | ma Distribution | |
| 134 | 95% Approximate Gamma UCL | 12.92 | 95% Adjusted Gamma UCL | 13.32 |
| 135 | | | | |
| 136 | | | GOF Test | |
| 137 | Shapiro Wilk Test Statistic | 0.969 | Shapiro Wilk Lognormal GOF Test | |
| 138 | 10% Shapiro Wilk Critical Value | 0.883 | Data appear Lognormal at 10% Significance Level | |
| 139 | Lilliefors Test Statistic | 0.153 | Lilliefors Lognormal GOF Test | |
| 140 | 10% Lilliefors Critical Value | 0.223 | Data appear Lognormal at 10% Significance Level | |
| 141 | Data appear L | Lognormai a | at 10% Significance Level | |
| 142 | | Lognorma | I Statistica | |
| 143 | Minimum of Logged Data | 1.609 | Mean of logged Data | 2.306 |
| 144 | Maximum of Logged Data | 2.976 | SD of logged Data | 0.36 |
| 145 | Maximum of Logged Data | 2.970 | 3D of logged Data | |
| 146 | Деен | mina Loans | rmal Distribution | |
| 147 | 95% H-UCL | 13.28 | 90% Chebyshev (MVUE) UCL | 14.01 |
| 148 | 95% Chebyshev (MVUE) UCL | 15.53 | 97.5% Chebyshev (MVUE) UCL | 17.64 |
| 149 | 99% Chebyshev (MVUE) UCL | 21.79 | 57.576 Chebyshev (MVGE) GGE | -17.04 |
| 150 | 55 % S.1.55 (MV SE) 50E | • | | |
| 151 152 | Nonparamet | tric Distribu | tion Free UCL Statistics | |
| 153 | <u> </u> | | Discernible Distribution | |
| 153 | | | | |
| 155 | Nonpar | ametric Dist | tribution Free UCLs | |
| 156 | 95% CLT UCL | 12.44 | 95% BCA Bootstrap UCL | 12.46 |
| 157 | 95% Standard Bootstrap UCL | 12.34 | 95% Bootstrap-t UCL | 12.92 |
| 158 | 95% Hall's Bootstrap UCL | 13.55 | 95% Percentile Bootstrap UCL | 12.38 |
| 159 | 90% Chebyshev(Mean, Sd) UCL | 13.93 | 95% Chebyshev(Mean, Sd) UCL | 15.43 |
| 160 | 97.5% Chebyshev(Mean, Sd) UCL | 17.5 | 99% Chebyshev(Mean, Sd) UCL | 21.57 |
| 161 | · | | · | |
| 162 | | Suggested | UCL to Use | |
| 163 | 95% Student's-t UCL | 12.61 | | |
| 164 | | | | |
| 165 | Note: Suggestions regarding the selection of a 95% | UCL are pro | ovided to help the user to select the most appropriate 95% UCL. | |
| .00 | | | | |

| 166 | Α | B Rec | C commendation | ons are | D based up | E oon data size | F e, data distrib | G ution, and s | H kewness usi | I ing results fro | J om simulation s | K tudies. | L |
|------------|---------|------------|-------------------|-----------|---------------|-------------------------------|----------------------|--|------------------|----------------------|----------------------|------------------|----------|
| 167 | H | owever, si | imulations re | esults wi | Il not cov | er all Real V | Vorld data se | ts; for addit | ional insight | the user may | want to consu | lt a statisticia | in. |
| 168 | | | | | | | | | | | | | |
| 169 | | | | | | | | | | | | | |
| 170 | CM-WRB | | | | | | | | | | | | |
| 171 | | | | | | | | | | | | | |
| 172 | | | | | | | General | Statistics | | | | | |
| 173 | | | Te | otal Nur | mber of C | Observations | 11 | | | Numbe | er of Distinct Ob | servations | 8 |
| 174 | | | | | | | | | | Numbe | r of Missing Ob | servations | 0 |
| 175 | 1 | | | | | Minimum | 5 | | | | | Mean | 11.46 |
| 176 | | | | | | Maximum | | | | | | Median | 11 |
| 177 | | | | | | SD | | | | | Std. Err | or of Mean | 0.992 |
| 178 | | | | С | oefficient | t of Variation | 0.287 | | | | | Skewness | -0.203 |
| 179 | | | | | | | | | | | | | |
| 180 | <u></u> | | | | | | | GOF Test | | | | | |
| 181 | | | | | | Test Statistic | | | | - | ilk GOF Test | | |
| 182 | | | 19 | | | Critical Value | | | Data apr | | at 1% Significar | nce Level | |
| 183 | | | | | | Test Statistic | | | | | GOF Test | | |
| 184 | | | | 1% L | illiefors C | Critical Value | | | | | at 1% Significar | nce Level | |
| 185 | | | | | | Data appe | ear Normal a | t 1% Signifi | cance Level | | | | |
| 186 | | | | | | | | | | | | | |
| 187 | | | | | | As | ssuming Nor | mal Distribu | | | | | |
| 188 | | | 95% | 6 Norma | | | | | 959 | | usted for Skew | • | |
| 189 | | | | | 95% Stu | dent's-t UCL | 13.26 | | | | ed-CLT UCL (C | · . | 13.03 |
| 190 | | | | | | | | | | 95% Modif | ied-t UCL (Johr | nson-1978) | 13.25 |
| 191 | | | | | | | | | | | | | |
| 192 | | | | | 4 D 3 | T+ O+-+:-+: | | GOF Test | Ad | D | . 0 005 | · T | |
| 193 | | | | | | Test Statistic | | Detect | | | Gamma GOF | | a Lavial |
| 194 | | | | | | Critical Value Test Statistic | | Detecte | | | oistributed at 5% | | e Level |
| 195 | | | | | | Critical Value | | Datast | | | ov Gamma GC | | no Lovel |
| 196 | | | | | | | r Gamma Di | | | | istributed at 5% | 6 Significand | e Level |
| 197 | | | | | Detected | i uata appea | II Gaillilla Di | suibuleu al | 376 Signific | ance Level | | | |
| 198 | | | | | | | Gamma | Statistics | | | | | |
| 199 | | | | | | k hat (MLE) | | | | k | star (bias corre | ected MLF) | 8.35 |
| 200 | | | | | The | ta hat (MLE) | | | | | star (bias corre | <i>'</i> | 1.373 |
| 201 | | | | | | nu hat (MLE) | | | | 711010 | nu star (bias | 1 | 183.7 |
| 202 | | | | MLE N | | as corrected) | | | | | MLE Sd (bias | 1 | 3.967 |
| 203 | | | | | (| | | | | Approximat | e Chi Square V | <i>'</i> | 153.4 |
| 204 205 | · | | A | djusted | Level of | Significance | 0.0278 | | | | djusted Chi Sq | ` ′ | 148.8 |
| 206 | | | | , | | | | <u> </u> | | | , | | |
| 207 | | | | | | As | suming Gan | ıma Distrib | ution | | | | |
| 208 | | | 959 | % Appro | oximate C | Gamma UCL | | | | 9: | 5% Adjusted Ga | amma UCL | 14.15 |
| 209 | | | | - | | | | 1 | | | | | |
| 210 | | | | | | | Lognorma | I GOF Test | | | | | |
| 211 | | | | Shap | iro Wilk 7 | Test Statistic | 0.897 | | Sha | apiro Wilk Lo | gnormal GOF | Test | |
| 212 | | | 10% | % Shapi | ro Wilk C | Critical Value | 0.876 | | Data appe | ar Lognormal | at 10% Signific | cance Level | |
| 213 | | | | L | illiefors 7 | Test Statistic | 0.231 | | L | illiefors Logr | ormal GOF Te | st | |
| 214 | | | | 10% L | illiefors C | Critical Value | 0.231 | | Data Not | Lognormal a | t 10% Significa | nce Level | |
| 215 | | | | | Data a | ppear Appro | ximate Logn | ormal at 10 | % Significar | nce Level | | | |
| 216 | | | | | | | | | | | | | |
| 217 | | | | | | | Lognorma | I Statistics | | | | | |
| 218 | | | | | | Logged Data | | | | | | ogged Data | 2.395 |
| 219 | | | | Maxi | mum of l | Logged Data | 2.862 | | | | SD of lo | ogged Data | 0.331 |
| 220 | | | | | | | | · | | | | | |
| | | | | | | | | | | | | | |

| | Α | В | С | D | E Assu | F ming Logno | G ormal Distri | H oution | I | J | K | L |
|--|--------|-------------|--|---|--|--|--|--|---|---|---|-------------------------------------|
| 221 222 | | | | 9 | 5% H-UCL | 14.25 | | | 90% | Chebyshev (M | VUE) UCL | 15.01 |
| 223 | | | 95% | Chebyshev (M | VUE) UCL | 16.58 | | | 97.5% | Chebyshev (M | VUE) UCL | 18.77 |
| 224 | | | 99% | Chebyshev (M | IVUE) UCL | 23.07 | | | | | | |
| 225 | | | | | | | l | | | | | |
| 226 | | | | ı | Nonparame | tric Distribu | tion Free U | CL Statistics | 3 | | | |
| 227 | | | | 1 | Data appear | to follow a | Discernible | Distribution | 1 | | | |
| 228 | | | | | | | | | | | | |
| 229 | | | | | Nonpara | ametric Dis | tribution Fr | ee UCLs | | | | |
| 230 | | | | | 6 CLT UCL | 13.1 | | | | 95% BCA Boo | tstrap UCL | 13 |
| 231 | | | | Standard Boo | | 13.02 | | | | 95% Boots | • | 13.19 |
| 232 | | | | 95% Hall's Boo | • | 13.32 | | | | Percentile Boo | · | 13.01 |
| 233 | | | | nebyshev(Mear | | 14.44 | | | | nebyshev(Mear | , | 15.79 |
| 234 | | | 97.5% Ch | nebyshev(Mear | n, Sd) UCL | 17.66 | | | 99% CI | nebyshev(Mear | n, Sd) UCL | 21.33 |
| 235 | | | | | | | | | | | | |
| 236 | | | | | | Suggested | UCL to Us | • | | | | |
| 237 | | | | 95% Stude | ent's-t UCL | 13.26 | | | | | | |
| 238 | | | | | | | | | | | | |
| 239 | 1 | | | | | | | - | | nost appropriat | | |
| 240 | | | | • | | | | | | m simulation st | | |
| 241 | Но | wever, simu | lations result | ts will not cove | r all Real W | orld data se | ts; for addit | onal insight | the user may | want to consul | t a statisticia | an. |
| 242 | | | | | | | | | | | | |
| 243 | | Note: For | | | * | | | | | nd Gamma) m | ay not be | |
| 244 | | | reliable. | Chen's and Jo | hnson's me | thods provi | de adjustm | ents for posi | tvely skewed | l data sets. | | |
| 245 | | | | | | | | | | | | |
| 246 | | | | | | | | | | | | |
| 247 | CM-WRC | | | | | | | | | | | |
| 248 | | | | | | | | | | | | |
| 249 | | | | | | General | Statistics | | | | | |
| 250 | | | Total | Number of Ob | servations | 9 | | | Nlumbo | r of Dictinct Ob | servations | |
| 251 | | | | | | | | | | | | 9 |
| 050 | | | | | | | | | | r of Missing Ob | servations | 0 |
| 252 | | | | | Minimum | 63.42 | | | | | servations Mean | 0 177.5 |
| 253 | | | | | Maximum | 365.8 | | | | r of Missing Ob | Mean Median | 0 177.5 131 |
| 253 | | | | | Maximum SD | 365.8 106.5 | | | | r of Missing Ob Std. Err | Mean Median or of Mean | 0 177.5 131 35.49 |
| 252253254255 | | | | Coefficient c | Maximum SD | 365.8 | | | | r of Missing Ob Std. Err | Mean Median | 0 177.5 131 |
| 253 254 | | | | | Maximum SD of Variation | 365.8 106.5 0.6 | | | Numbe | r of Missing Ob Std. Err | Mean Median or of Mean Skewness | 0 177.5 131 35.49 |
| 253 254 255 256 257 | | Note: Sa | | small (e.g., <1 | Maximum SD of Variation 0), if data a | 365.8 106.5 0.6 | | | Numbe | r of Missing Ob Std. Err | Mean Median or of Mean Skewness | 0 177.5 131 35.49 |
| 253 254 255 256 257 | | | refer also t | small (e.g., <1 o ITRC Tech F | Maximum SD of Variation 0), if data a Reg Guide o | 365.8 106.5 0.6 re collected | C 2020 and | ITRC 2012 | Numbe | Std. Err | Mean Median or of Mean Skewness | 0 177.5 131 35.49 |
| 253 254 255 256 257 258 259 | | | refer also t | small (e.g., <1 o ITRC Tech F ITRC may rec | Maximum SD of Variation 0), if data a Reg Guide of | 365.8 106.5 0.6 re collected on ISM (ITR | C 2020 and | ITRC 2012 hev UCL for | Number | Std. Err | Mean Median or of Mean Skewness | 0 177.5 131 35.49 |
| 253 254 255 256 257 258 259 260 | | | refer also to | small (e.g., <1 o ITRC Tech F ITRC may rec The Chebys | Maximum SD of Variation 0), if data a Reg Guide of commend the shev UCL of | 365.8 106.5 0.6 re collected on ISM (ITR e t-UCL or t | C 2020 and he Chebys in gross ov | ITRC 2012 hev UCL for erestimates | Number spling method for addition small sample of the mean. | Std. Err dology (ISM) a al guidance, e sizes (n < 7). | Mean Median or of Mean Skewness | 0 177.5 131 35.49 |
| 253 254 255 256 257 258 259 260 261 | | | refer also to | small (e.g., <1 o ITRC Tech F ITRC may rec | Maximum SD of Variation 0), if data a Reg Guide of commend the shev UCL of | 365.8 106.5 0.6 re collected on ISM (ITR e t-UCL or t | C 2020 and he Chebys in gross ov | ITRC 2012 hev UCL for erestimates | Number spling method for addition small sample of the mean. | Std. Err dology (ISM) a al guidance, e sizes (n < 7). | Mean Median or of Mean Skewness | 0 177.5 131 35.49 |
| 253 254 255 256 257 258 259 260 261 262 | | | refer also to | small (e.g., <1 o ITRC Tech F ITRC may rec The Chebys | Maximum SD of Variation 0), if data a Reg Guide of commend the shev UCL of | 365.8 106.5 0.6 re collected on ISM (ITR e t-UCL or to iten results hnical Guide | C 2020 and he Chebys in gross ov e for a disc | ITRC 2012 hev UCL for erestimates | Number spling method for addition small sample of the mean. | Std. Err dology (ISM) a al guidance, e sizes (n < 7). | Mean Median or of Mean Skewness | 0 177.5 131 35.49 |
| 253 254 255 256 257 258 259 260 261 262 263 | | | refer also to the that Ref | small (e.g., <1 o ITRC Tech F ITRC may rec The Chebys fer to the ProU | Maximum SD of Variation 0), if data a Reg Guide of commend the shev UCL of ICL 5.2 Tecl | 365.8 106.5 0.6 re collected on ISM (ITRe et-UCL or to the results of the collected on ISM (ITRe et-UCL or to the results of the collected on ISM (ITRe et-UCL or to the results of the collected on ISM (ITRe et-UCL or to the collected on ISM (ITRE | C 2020 and he Chebys in gross ov | ITRC 2012 hev UCL for erestimates | npling method for addition small samplof the mean. | Std. Err | Mean Median or of Mean Skewness | 0 177.5 131 35.49 |
| 253 254 255 256 257 258 259 260 261 262 263 264 | | | refer also to the court note that Ref | small (e.g., <1 o ITRC Tech F ITRC may rec The Chebys fer to the ProU | Maximum SD of Variation 0), if data a Reg Guide of commend the shev UCL of ICL 5.2 Tecles ast Statistic | 365.8 106.5 0.6 re collected on ISM (ITRe et-UCL or titen results innical Guide Normal C | C 2020 and he Chebys in gross ov e for a disc | ITRC 2012 hev UCL for erestimates ussion of the | npling method for addition small sampl of the mean. Chebyshev | Std. Err dology (ISM) a al guidance, e sizes (n < 7). UCL. | Mean Median or of Mean Skewness pproach, | 0 177.5 131 35.49 |
| 253 254 255 256 257 258 259 260 261 262 263 264 265 | | | refer also to the court note that Ref | small (e.g., <1 o ITRC Tech F ITRC may rec The Chebys fer to the ProU Shapiro Wilk Te | Maximum SD of Variation 0), if data a Reg Guide of commend the shev UCL of ICL 5.2 Tecles est Statistic itical Value | 365.8 106.5 0.6 re collected on ISM (ITRe et-UCL or to the results of the collected on ISM (ITRE et-UCL) Normal Collected on ISM (ITRE et-UCL) | C 2020 and he Chebys in gross ov e for a disc | ITRC 2012 hev UCL for erestimates ussion of the | npling method of for addition small sample of the mean. of Chebyshev Shapiro W pear Normal a | Std. Err | Mean Median or of Mean Skewness pproach, | 0 177.5 131 35.49 |
| 253 254 255 256 257 258 259 260 261 262 263 264 265 266 | | | refer also to but note that Ref S 1% S | small (e.g., <1 o ITRC Tech F ITRC may rec The Chebys fer to the ProU Shapiro Wilk Te hapiro Wilk Cri Lilliefors Te | Maximum SD of Variation O), if data a Reg Guide of commend the shev UCL of ICL 5.2 Tecl est Statistic litical Value est Statistic | 365.8 106.5 0.6 re collected on ISM (ITRe et-UCL or the results of the results o | C 2020 and he Chebys in gross ov e for a disc | hev UCL for erestimates ussion of the Data app | npling method for addition small sampl of the mean. Chebyshev Shapiro W pear Normal a | Std. Err dology (ISM) a al guidance, e sizes (n < 7). UCL. ilk GOF Test at 1% Significar GOF Test | Mean Median or of Mean Skewness pproach, | 0 177.5 131 35.49 |
| 253 254 255 256 257 258 259 260 261 262 263 264 265 266 267 | | | refer also to but note that Ref S 1% S | small (e.g., <1 o ITRC Tech F ITRC may rec The Chebys fer to the ProU Shapiro Wilk Te hapiro Wilk Cri Lilliefors Te | Maximum SD of Variation 0), if data a Reg Guide of commend the shev UCL of ICL 5.2 Tecl est Statistic litical Value est Statistic litical Value | 365.8 106.5 0.6 re collected on ISM (ITRe et-UCL or the results innical Guide 0.905 0.764 0.224 0.316 | C 2020 and he Chebys in gross ov e for a disc | hev UCL for erestimates ussion of the Data app | npling method for addition small sampl of the mean. Chebyshev Shapiro W pear Normal a Lilliefors | Std. Err | Mean Median or of Mean Skewness pproach, | 0 177.5 131 35.49 |
| 253 254 255 256 257 258 259 260 261 262 263 264 265 266 267 268 | | | refer also to but note that Ref S 1% S | small (e.g., <1 o ITRC Tech F ITRC may rec The Chebys fer to the ProU Shapiro Wilk Te hapiro Wilk Cri Lilliefors Te % Lilliefors Cri | Maximum SD of Variation 0), if data a Reg Guide of commend the shev UCL of ICL 5.2 Tecl est Statistic stical Value est Statistic stical Value Data appear | 365.8 106.5 0.6 re collected on ISM (ITRe et-UCL or to the results) hnical Guide Normal C 0.905 0.764 0.224 0.316 re Normal at | C 2020 and he Chebys in gross ov e for a disc GOF Test | hev UCL for erestimates ussion of the Data app | pling method for addition small sampl of the mean. Chebyshev Shapiro W pear Normal a | Std. Err dology (ISM) a al guidance, e sizes (n < 7). UCL. ilk GOF Test at 1% Significar GOF Test | Mean Median or of Mean Skewness pproach, | 0 177.5 131 35.49 |
| 253 254 255 256 257 258 260 261 262 263 264 265 266 267 268 | | | refer also to but note that Ref S 1% S | small (e.g., <1 o ITRC Tech F ITRC may rec The Chebys fer to the ProU Shapiro Wilk Te hapiro Wilk Cri Lilliefors Te % Lilliefors Cri | Maximum SD of Variation 0), if data a Reg Guide of commend the shev UCL of ICL 5.2 Tecl est Statistic stical Value est Statistic stical Value Data appear | 365.8 106.5 0.6 re collected on ISM (ITRe et-UCL or to the results) hnical Guide Normal C 0.905 0.764 0.224 0.316 re Normal at | C 2020 and he Chebys in gross ov e for a disc GOF Test | hev UCL for erestimates ussion of the Data app | pling method for addition small sampl of the mean. Chebyshev Shapiro W pear Normal a | Std. Err dology (ISM) a al guidance, e sizes (n < 7). UCL. ilk GOF Test at 1% Significar GOF Test | Mean Median or of Mean Skewness pproach, | 0 177.5 131 35.49 |
| 253 254 255 256 257 258 260 261 262 263 264 265 266 267 268 269 270 | | | refer also to but note that Ref S 1% S | small (e.g., <1 o ITRC Tech F ITRC may rec The Chebys fer to the ProU Shapiro Wilk Te hapiro Wilk Cri Lilliefors Te % Lilliefors Cri | Maximum SD of Variation 0), if data a Reg Guide of commend the shev UCL of ICL 5.2 Tecl est Statistic litical Value est Statistic litical Value Data appear | 365.8 106.5 0.6 re collected on ISM (ITRe et-UCL or the results in the results of the results o | C 2020 and he Chebys in gross ov e for a disc GOF Test 1% Signifi eliable for s | hev UCL for erestimates ussion of the Data appropriate appropriate procession appropriate p | pling method for addition small sampl of the mean. Chebyshev Shapiro W pear Normal a | Std. Err dology (ISM) a al guidance, e sizes (n < 7). UCL. ilk GOF Test at 1% Significar GOF Test | Mean Median or of Mean Skewness pproach, | 0 177.5 131 35.49 |
| 253 254 255 256 257 258 260 261 262 263 264 265 267 268 269 270 271 | | | refer also to that Ref | small (e.g., <1 o ITRC Tech F ITRC may rec The Chebys fer to the ProU Shapiro Wilk Te hapiro Wilk Cri Lilliefors Te % Lilliefors Cri | Maximum SD of Variation 0), if data a Reg Guide of commend the shev UCL of ICL 5.2 Tecl est Statistic litical Value est Statistic litical Value Data appear | 365.8 106.5 0.6 re collected on ISM (ITRe et-UCL or to the results) hnical Guide Normal C 0.905 0.764 0.224 0.316 re Normal at | C 2020 and he Chebys in gross ov e for a disc GOF Test 1% Signifi eliable for s | hev UCL for erestimates ussion of the Data appropriate Data appropriate Data appropriate Data appropriate Level mall sample ution | Number spling method for addition small sample of the mean. Chebyshev sear Normal a Lilliefors sear Normal a sizes | Std. Err dology (ISM) a al guidance, e sizes (n < 7). UCL. ilk GOF Test at 1% Significar GOF Test at 1% Significar | Mean Median or of Mean Skewness pproach, nce Level | 0 177.5 131 35.49 |
| 253 254 255 256 257 258 260 261 262 263 264 265 266 267 268 269 270 271 272 | | | refer also to that Ref | small (e.g., <1 o ITRC Tech F ITRC may rec The Chebys fer to the ProU Shapiro Wilk Te hapiro Wilk Cri Lilliefors Te % Lilliefors Cri Note | Maximum SD of Variation 0), if data a Reg Guide of commend the shev UCL of ICL 5.2 Tecl est Statistic stical Value est Statistic stical Value Data appear GOF tests r | 365.8 106.5 0.6 re collected on ISM (ITRe et-UCL or the results of the results o | C 2020 and he Chebys in gross ov e for a disc GOF Test 1% Signifi eliable for s | hev UCL for erestimates ussion of the Data appropriate Data appropriate Data appropriate Data appropriate Level mall sample ution | npling method for addition small sampl of the mean. Chebyshev Shapiro W pear Normal a Lilliefors pear Normal a sizes | Std. Errost. Std. Errost. Gology (ISM) a al guidance, e sizes (n < 7). UCL. IIK GOF Test at 1% Significant GOF Test at 1% Significant | mean Median or of Mean Skewness pproach, mice Level mice Level mess) | 0 177.5 131 35.49 0.717 |
| 253 254 255 256 257 258 260 261 262 263 264 265 266 267 268 269 270 271 272 273 | | | refer also to that Ref | small (e.g., <1 o ITRC Tech F ITRC may rec The Chebys fer to the ProU Shapiro Wilk Te hapiro Wilk Cri Lilliefors Te % Lilliefors Cri Note | Maximum SD of Variation 0), if data a Reg Guide of commend the shev UCL of ICL 5.2 Tecl est Statistic litical Value est Statistic litical Value Data appear | 365.8 106.5 0.6 re collected on ISM (ITRe et-UCL or the results in the results of the results o | C 2020 and he Chebys in gross ov e for a disc GOF Test 1% Signifi eliable for s | hev UCL for erestimates ussion of the Data appropriate Data appropriate Data appropriate Data appropriate Level mall sample ution | Shapiro W ear Normal a Lilliefors ear Normal a sizes 6 UCLs (Adju- | Std. Errodology (ISM) and guidance, se sizes (n < 7). UCL. Illk GOF Test at 1% Significant 1% | mess) Chen-1995) | 0 177.5 131 35.49 0.717 |
| 253 254 255 256 257 258 260 261 262 263 264 265 266 267 268 269 270 271 272 | | | refer also to that Ref | small (e.g., <1 o ITRC Tech F ITRC may rec The Chebys fer to the ProU Shapiro Wilk Te hapiro Wilk Cri Lilliefors Te % Lilliefors Cri Note | Maximum SD of Variation 0), if data a Reg Guide of commend the shev UCL of ICL 5.2 Tecl est Statistic stical Value est Statistic stical Value Data appear GOF tests r | 365.8 106.5 0.6 re collected on ISM (ITRe et-UCL or the results of the results o | C 2020 and he Chebys in gross ov e for a disc GOF Test 1% Signifi eliable for s | hev UCL for erestimates ussion of the Data appropriate Data appropriate Data appropriate Data appropriate Level mall sample ution | Shapiro W ear Normal a Lilliefors ear Normal a sizes 6 UCLs (Adju- | Std. Errost. Std. Errost. Gology (ISM) a al guidance, e sizes (n < 7). UCL. IIK GOF Test at 1% Significant GOF Test at 1% Significant | mess) Chen-1995) | 0 177.5 131 35.49 0.717 |

| | Α | В | С | | D | E | | F | G | Н | I | ı | J | | ŀ | (| L |
|------------|---|-------------|------------|----------|-------------------------|------------|---------|---------------|------------------|-------------|------------|---------|-----------|----------|----------|----------|----------|
| 276 | | | | | | | | | GOF Test | | | | | | | | |
| 277 | | | | | | Test Sta | | 0.306 | | | derson-Da | • | | | | | |
| 278 | | | | | 5% A-D (| | | 0.726 | Detected | d data app | | | | | | | ce Level |
| 279 | | | | | | Test Sta | | 0.182 | Datasta | | ogorov-S | | | | | | 11 |
| 280 | | | | | 5% K-S (| | | 0.281 | | d data app | | | stribute | e at 5 | % Sigi | nifican | ce Level |
| 281 | | | | | | | • | | stributed at 5 | | | vei | | | | | |
| 282 | | | | | NOU | e GOF | lesis i | nay be unre | eliable for sm | an sample | e sizes | | | | | | |
| 283 | | | | | | | | Gamma | Statistics | | | | | | | | |
| 284 | | | | | | k hat (f | MI E) | 3.183 | | | | k | star (bia | as corr | rected | MI E) | 2.196 |
| 285 | | | | | The | eta hat (I | - | 55.75 | | | т | | star (bia | | | | 80.8 |
| 286 | | | | | | nu hat (I | | 57.3 | | | | | • | ar (bias | | , | 39.53 |
| 287 | | | | MIF | Mean (bia | • | | 177.5 | | | | | MLE S | • | | , | 119.7 |
| 288 | | | | | | | olou) | 177.0 | | | Approx | | | | | - | 26.13 |
| 289 290 | | | | Adjusted | Level of | Signific | ance | 0.0231 | | | 7,00107 | | djusted | | | | 23.85 |
| 291 | | | | | | | | | | | | | , | | 10000 | | |
| 292 | | | | | | | Ass | uming Gam | ıma Distribut | ion | | | | | | | |
| 293 | | | 95 | | oximate (| Gamma | | 268.5 | | | | 95° | % Adju | sted G | amma | a UCL | 294.1 |
| 294 | | | | | | | | | | | | | | | | | |
| 295 | | | | | | | | Lognormal | GOF Test | | | | | | | | |
| 296 | | | | Shap | iro Wilk | Test Sta | atistic | 0.95 | | Sh | napiro Wil | lk Log | norma | I GOF | Test | | |
| 297 | | | 10 |)% Shap | iro Wilk C | Critical \ | /alue | 0.859 | | Data appe | ear Logno | ormal a | at 10% | Signifi | icance | Level | |
| 298 | | | | L | _illiefors ⁻ | Test Sta | itistic | 0.144 | | ı | Lilliefors | Logno | rmal C | OF To | est | | |
| 299 | | | | 10% L | illiefors C | Critical \ | /alue | 0.252 | ! | Data appe | ear Logno | rmal a | at 10% | Signifi | icance | Level | |
| 300 | | | | | - | Data ap | pear l | Lognormal a | at 10% Signif | icance Le | evel | | | - | | - | |
| 301 | | | | | Not | e GOF | tests r | may be unre | eliable for sm | all sample | e sizes | | | | | | |
| 302 | | | | | | | | | | | | | | | | | |
| 303 | | | | | | | | Lognorma | l Statistics | | | | | | | | |
| 304 | | | | | imum of l | | | 4.15 | | | | | | ean of I | | | 5.014 |
| 305 | | | | Maxi | imum of l | Logged | Data | 5.902 | | | | | | SD of I | ogged | I Data | 0.616 |
| 306 | | | | | | | | | | | | | | | | | |
| 307 | | | | | | | | | rmal Distribu | ution | | | | | | 1 | |
| 308 | | | | | | 95% H- | | 311.7 | | | | | Chebys | ` | | , | 289.3 |
| 309 | | | | | ebyshev (| | | 339.9 | | | 9. | 7.5% (| Chebys | shev (N | NVUE |) UCL | 410.2 |
| 310 | | | | 39% Cne | ebyshev (| (MIVUE) | UCL | 548.1 | | | | | | | | | |
| 311 | | | | | | Nonne | | trio Diotribu | tion Free UC | L Statistic | | | | | | | |
| 312 | | | | | | | | | Discernible | | | | | | | | |
| 313 | | | | | | | ippeai | - to lollow a | Discernible | | | | | | | | |
| 314 | | | | | | N | onpar | ametric Dist | tribution Free | e UCLs | | | | | | | |
| 315 316 | | | | | 95 | 5% CLT | - | 235.8 | | | | | 95% BC | CA Bor | otstrar |) UCL | 241.8 |
| 317 | | | | 95% Sta | ındard Bo | | | 232.9 | | | | | | % Boot | | | 259.7 |
| 318 | | | | | Hall's Bo | | | 237.9 | | | ! | 95% F | Percent | | | | 238 |
| 319 | | | 90° | | /shev(Me | an, Sd) | UCL | 283.9 | | | 95 | | ebyshe | ev(Mea | an, Sd |) UCL | 332.1 |
| 320 | | | | | /shev(Me | | | 399.1 | | | | | ebyshe | • | | • | 530.5 |
| 321 | | | | | | | | | | | | | | | | | |
| 322 | | | | | | | | Suggested | UCL to Use | | | | | | | | |
| 323 | | | | | 95% Stu | dent's-t | UCL | 243.5 | | | | | | | | | |
| 324 | | | | | | | | | | | | | | | | | |
| 325 | | Note: Sugge | estions re | garding | the selec | ction of | a 95% | UCL are pro | ovided to help | p the user | to select | the m | ost ap | propria | ite 95° | % UCL | |
| 326 | | Recor | nmendat | ions are | based up | oon data | size, | data distribu | ution, and ske | ewness us | sing resul | ts fror | n simul | lation s | studies | S. | |
| 327 | Н | owever, sim | ulations r | esults w | ill not cov | ver all R | eal W | orld data set | ts; for addition | nal insight | t the user | may | want to | consu | ılt a st | atistici | an. |
| 328 | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |

| | A B C | D E | F | G H I J K | L |
|----------|--------------------------------|---------------------------------------|----------------|---|----------------|
| 1 | | UCL Statis | Stics for Unce | ensored Full Data Sets | |
| 2 | User Selected Options | , | | | |
| 3 | Date/Time of Computation | ProUCL 5.2 11/18/2024 1 | 10·46·30 AM | | |
| 4 | From File | WorkSheet.xls | 10.10.007. | | |
| 5 6 | Full Precision | OFF | | | |
| 7 | Confidence Coefficient | 95% | | | |
| 8 | Number of Bootstrap Operations | 2000 | | | |
| 9 | | | | | |
| 10 | | | | | |
| 11 | GC03-WRA | | | | |
| 12 | | | | | |
| 13 | | | General | | |
| 14 | Total | Number of Observations | 4 | Number of Distinct Observations | 4 |
| 15 | | | | Number of Missing Observations | 0 |
| 16 | <u> </u> | Minimum | 30 | Mean | 35.5 |
| 17 | | Maximum SD | 45 6.856 | Median Std. Fyrar of Mann | 33.5 |
| 18 | | Coefficient of Variation | 0.193 | Std. Error of Mean Skewness | 1.241 |
| 19 | | Coemcient of Variation | 0.193 | Skewness | 1.241 |
| 20 | Note: Sample size is | small (e.g., <10) if data a | are collected | using incremental sampling methodology (ISM) approach, | |
| 21 22 | | , - , | | C 2020 and ITRC 2012) for additional guidance, | |
| 23 | | _ | • | ne Chebyshev UCL for small sample sizes (n < 7). | |
| 24 | | = | | n gross overestimates of the mean. | |
| 25 | Ref | | | e for a discussion of the Chebyshev UCL. | |
| 26 | | | | | |
| 27 | | | Normal C | GOF Test | |
| 28 | S | Shapiro Wilk Test Statistic | 0.881 | Shapiro Wilk GOF Test | |
| 29 | 1% S | hapiro Wilk Critical Value | 0.687 | Data appear Normal at 1% Significance Level | |
| 30 | | Lilliefors Test Statistic | 0.244 | Lilliefors GOF Test | |
| 31 | 1 | % Lilliefors Critical Value | 0.413 | Data appear Normal at 1% Significance Level | |
| 32 | | | | 1% Significance Level | |
| 33 | | Note GOF tests | may be unre | liable for small sample sizes | |
| 34 | | Λοι | eumina Norr | nal Distribution | |
| 35 | 95% N | ormal UCL | summy Non | 95% UCLs (Adjusted for Skewness) | |
| 36 | | 95% Student's-t UCL | 43.57 | 95% Adjusted-CLT UCL (Chen-1995) | 43.41 |
| 37 38 | | | | 95% Modified-t UCL (Johnson-1978) | 43.92 |
| 39 | | | | , , , , , | |
| 40 | | | Gamma (| GOF Test | |
| 41 | | A-D Test Statistic | 0.371 | Anderson-Darling Gamma GOF Test | |
| 42 | | 5% A-D Critical Value | 0.656 | Detected data appear Gamma Distributed at 5% Significance | e Level |
| 43 | | K-S Test Statistic | 0.277 | Kolmogorov-Smirnov Gamma GOF Test | |
| 44 | | 5% K-S Critical Value | 0.394 | Detected data appear Gamma Distributed at 5% Significance | e Level |
| 45 | | | | stributed at 5% Significance Level | |
| 46 | | Note GOF tests | may be unre | liable for small sample sizes | |
| 47 | | | | 7. d.d. | |
| 48 | | 1. L /A AL> | Gamma | | 0.604 |
| 49 | | k hat (MLE) | 38.07 | k star (bias corrected MLE) | 9.684 |
| 50 | | Theta hat (MLE) | 0.932 304.6 | Theta star (bias corrected MLE) nu star (bias corrected) | 3.666 77.47 |
| 51 | N.A. | nu hat (MLE) LE Mean (bias corrected) | 304.6 | nu star (blas corrected) MLE Sd (bias corrected) | 11.41 |
| 52 | <u></u> | LE IVIGATI (DIAS COTTECTED) | JJ.J | Approximate Chi Square Value (0.05) | 58.2 |
| 53 54 | Adina | sted Level of Significance | N/A | Adjusted Chi Square Value Adjusted Chi Square Value | N/A |
| 54 55 | Aujus | | (| , agasted om oquare value | |
| ეე | | | | | |

| 56 | А | | В | | С | | D | | E A | \ssumi | F ing Gam | G nma Distrib | bution | H 1 | | ı | | J | | | K | | L |
|------------|-------------|------|---------|--------|---------|---------|----------------------|--------|------------|---------------------------------|----------------|------------------|----------|-------------|--------|----------|-----------------|--------|------------|-------------|-----------|--------|----------------|
| 57 | | | | | 959 | % Apı | oroximate | e Gar | nma UC | L 4 | 17.26 | | | | | 9 | 95% | Adjus | sted C | Samn | na UCI | | N/A |
| 58 | · | | | | | | | | | | | 1 | | | | | | | | | | | |
| 59 | | | | | | | | | | | | I GOF Tes | st | | | | | | | | | | |
| 60 | | | | | | | apiro Wilk | | | | 0.9 | | | | - | Vilk L | | | | | | | |
| 61 | | | | | 109 | % Sha | piro Wilk | | | | 0.792 | | Da | ta appea | _ | | | | - | | ce Leve | el | |
| 62 | | | | | | 100/ | Lilliefors | | | | 0.246 | | | | | rs Log | | | | | | | |
| 63 | | | | | | 10% | Lilliefors | | | | 0.346 | 1 100/ 01: | | ta appea | | norma | al at | 10% | Signit | icano | e Leve | el | |
| 64 | | | | | | | Nia | | | | | at 10% Sig | | | | | | | | | | | |
| 65 | | | | | | | INC | ole C | OF LESI | ъ пау | De unit | eliable ioi s | Siliali | Sample | SIZE | • | | | | | | — | |
| 66 | | | | | | | | | | Lc | anorme | al Statistics | <u> </u> | | | | | | | | | | |
| 67 68 | | - | | | | M | inimum o | of Loc | ged Dat | | 3.401 | | | | | | | Me | an of | logge | ed Data | a | 3.556 |
| 69 | | | | | | | aximum o | | - | | 3.807 | | | | | | | | | | ed Data | | 0.185 |
| 70 | | | | | | | | | | | | | | | | | | | | | | | |
| 71 | | | | | | | | | As | sumin | g Logna | ormal Distr | ributio | on | | | | | | | | | |
| 72 | | | | | | | | 95 | % H-UC | L 4 | 16.14 | | | | | 90% | % Ch | nebys | hev (| MVUI | E) UCI | | 45.3 |
| 73 | · | | | | 9 | 5% C | hebyshev | v (MV | /UE) UC | ;L 4 | 19.74 | | | | | 97.5% | % Ch | nebys | hev (| MVU | E) UCI | | 55.91 |
| 74 | | | | | 99 | 9% C | hebyshev | v (MV | /UE) UC | E C | 88.02 | | | | | | | | | | | | |
| 75 | | | | | | | | | | | | | | | | | | | | | | | |
| 76 | | | | | | | | | | | | ition Free l | | | | | | | | | | | |
| 77 | | | | | | | | D | ata app | ear to | follow a | Discernib | le Dis | stribution | 1 | | | | | | | | |
| 78 | | | | | | | | | | | | | | | | | | | | | | | |
| 79 | | | | | | | | | | | | tribution F | ree U | CLs | | | | 0/ 50 | | | | | |
| 80 | | | | | | NEO/ 0 | | | CLT UC | | 11.14 | | | | | | 95 | | | | ap UCI | | N/A |
| 81 | | | | | 9 | | tandard E | | - | | I/A | | | | | 050 | | | | | p-t UCL | | N/A |
| 82 | | | | | 000/ | | % Hall's E | | • | | I/A | | | | | | | | | | ap UCI | | N/A |
| 83 | | | | | | | byshev(M byshev(M | | , | | 15.78 56.91 | | | | | | | • | • | | d) UCL | | 50.44 69.61 |
| 84 | <u> </u> | | | | 97.5% | o Che | bysnev(iv | nean, | , Su) UC | ,L 3 | | | | | | 99% (| Juen | Jysne | v(ivie | an, S | u) UCI | | 09.01 |
| 85 | | | | | | | | | | Suc | ngested | UCL to Us | se | | | | | | | | | | |
| 86 87 | | | | | | | 95% St | tuder | nt's-t UC | | 13.57 | | | | | | | | | | | \top | |
| 88 | | | | | | | | | | | | | | | | | | | | | | | |
| 89 | | Note | : Sug | gestic | ons reg | gardir | g the sele | ectio | n of a 95 | 5% UC | L are pr | ovided to h | nelp th | ne user to | o sele | ect the | mos | st app | oropri | ate 9! | 5% UC | L. | |
| 90 | | | Reco | omme | endatio | ons ar | e based ı | upon | data siz | ze, dat | a distrib | ution, and | skew | ness usir | ng re | sults fr | om s | simul | ation | studi | es. | | |
| 91 | Н | owev | er, sin | nulat | ons re | esults | will not co | over | all Real | World | data se | ts; for addi | itional | l insight t | he us | er ma | ıy wa | ant to | cons | ult a s | statistic | cian | 1. |
| 92 | · | | | | | | | | | | | | | | | | | | | | | | |
| 93 | | | | | | | | | | | | | | | | | | | | | | | |
| 94 | GC03-WR | В | | | | | | | | | | | | | | | | | | | | | |
| 95 | | | | | | | | | | | | <u> </u> | | | | | | | | | | | |
| 96 | | | | | | -1-1- | استار | · O' | | | | Statistics | | | | NI. | | 1 D: - | i | <u></u> | | | |
| 97 | | | | | - 1 | otal iv | lumber of | ODS | ervation | is s | 9 | | | | | | | | | | vations | | 8 |
| 98 | | | | | | | | | Minimu | Number of Missing Obse um 75 | | | | | | ser | vations Mear | | 0 230.9 | | | | |
| 99 | | | | | | | | | Maximu | | | | | | | | Mediar | | 222 | | | | |
| 100 | | | | | | | | | S | | 26.6 | | | | | | | | | 42.19 | | | |
| 101 | | | | | | | Coefficie | ent of | | | 0.548 | | | | | | | | | | ewness | | 0.971 |
| 102 103 | | | | | | | | - 01 | | | | | | | | | | | | | | | |
| 103 | | N | ote: S | Samp | le size | e is sr | nall (e.g., | , <10 |), if data | a are c | ollected | d using inc | reme | ntal sam | pling | metho | odol | ogy (| ISM) | apprı | oach, | — | |
| 104 | | | | | | | | | - | | | C 2020 an | | | | | | | | | | | |
| 106 | | | | but | note t | hat IT | RC may | reco | mmend | the t-l | JCL or 1 | the Chebys | shev | UCL for | smal | l samp | ole s | izes | (n < 7 | ') . | | | |
| 107 | | | | | | | The Che | ebysh | nev UCL | often | results | in gross ov | veres | timates | of the | mear | n. | | | | | | |
| 108 | | | | | | Refe | to the P | roUC | CL 5.2 T | echnic | al Guid | e for a disc | cussi | on of the | Che | byshe | v UC | CL. | | | | | |
| 109 | | | | | | | | | | | | | | | | | | | | | | | |
| 110 | | | | | | | | | | N | lormal (| GOF Test | | | | | | | | | | | |
| . • | | _ | | | | | | | | | | | | | | | | | _ | _ | | _ | |

| 112 1% Shapiro Wilk Critical Value 0.764 Data appear Normal at 1% Significance Level Lilliefors Test Statistic 0.195 Lilliefors GOF Test 114 1% Lilliefors Critical Value 0.316 Data appear Normal at 1% Significance Level Data appear Normal at 1% Significance Level Note GOF tests may be unreliable for small sample sizes Note GOF tests may be unreliable for small sample sizes Assuming Normal Distribution 119 95% Normal UCL 95% UCLs (Adjusted for Skewness) 120 95% Student's-t UCL 309.3 95% Adjusted-CLT UCL (Chen-1995) 121 95% Modified-t UCL (Johnson-1978) | 314.9 311.6 |
|---|-------------|
| 114 1% Lilliefors Critical Value 0.316 Data appear Normal at 1% Significance Level 115 Data appear Normal at 1% Significance Level 116 Note GOF tests may be unreliable for small sample sizes 117 118 Assuming Normal Distribution 119 95% Normal UCL 95% UCLs (Adjusted for Skewness) 120 95% Student's-t UCL 309.3 95% Adjusted-CLT UCL (Chen-1995) 121 95% Modified-t UCL (Johnson-1978) | |
| Data appear Normal at 1% Significance Level Note GOF tests may be unreliable for small sample sizes Assuming Normal Distribution Symmetry Symmet | |
| Note GOF tests may be unreliable for small sample sizes | |
| 117 | |
| 118 Assuming Normal Distribution | |
| 119 95% Normal UCL 95% UCLs (Adjusted for Skewness) 120 95% Student's-t UCL 309.3 95% Adjusted-CLT UCL (Chen-1995) 121 95% Modified-t UCL (Johnson-1978) 122 95% Modified tuck | |
| 120 95% Student's-t UCL 309.3 95% Adjusted-CLT UCL (Chen-1995) 121 95% Modified-t UCL (Johnson-1978) 122 | |
| 121 95% Modified-t UCL (Johnson-1978) 122 | |
| 122 | |
| 0 00== : | |
| 123 Gamma GOF Test | |
| 124 A-D Test Statistic 0.239 Anderson-Darling Gamma GOF Test | |
| 125 5% A-D Critical Value 0.725 Detected data appear Gamma Distributed at 5% Significance | e Level |
| 126 K-S Test Statistic 0.175 Kolmogorov-Smirnov Gamma GOF Test | |
| 127 5% K-S Critical Value 0.281 Detected data appear Gamma Distributed at 5% Significance | e Level |
| Detected data appear Gamma Distributed at 5% Significance Level | |
| Note GOF tests may be unreliable for small sample sizes | |
| 130 | |
| 131 Gamma Statistics | |
| k hat (MLE) 3.853 k star (bias corrected MLE) | 2.643 |
| Theta hat (MLE) 59.92 Theta star (bias corrected MLE) | 87.37 |
| nu hat (MLE) 69.35 nu star (bias corrected) | 47.57 |
| MLE Mean (bias corrected) 230.9 MLE Sd (bias corrected) Approximate Chi Square Value (0.05) | 32.74 |
| 130 A.F 14 - 140 G 17 - 0.0004 | 30.17 |
| | 30.17 |
| 138 Assuming Gamma Distribution | |
| 139 Assuming Gamma Distribution 140 95% Approximate Gamma UCL 335.5 95% Adjusted Gamma UCL | 364.1 |
| | |
| 141 Lognormal GOF Test | |
| 143 Shapiro Wilk Test Statistic 0.97 Shapiro Wilk Lognormal GOF Test | |
| 10% Shapiro Wilk Critical Value 0.859 Data appear Lognormal at 10% Significance Level | |
| Lilliefors Test Statistic 0.151 Lilliefors Lognormal GOF Test | |
| 146 10% Lilliefors Critical Value 0.252 Data appear Lognormal at 10% Significance Level | |
| Data appear Lognormal at 10% Significance Level | |
| Note GOF tests may be unreliable for small sample sizes | |
| 149 | |
| Lognormal Statistics | F 207 |
| Minimum of Logged Data 4.317 Mean of logged Data Maximum of Logged Data 6.184 | 5.307 |
| 152 Maximum of Logged Data 6.184 SD of logged Data | 0.563 |
| 153 Assuming Lognormal Distribution | |
| 000/ 01 1 000 | 364.5 |
| 050 OF 1 1 1 (AD415) 101 7 07 50 OF 1 1 (AD415) 101 | 508.2 |
| 156 95% Chebyshev (MVUE) UCL 424.7 97.5% Chebyshev (MVUE) UCL 157 99% Chebyshev (MVUE) UCL 672.2 | |
| 158 | |
| Nonparametric Distribution Free UCL Statistics | |
| 160 Data appear to follow a Discernible Distribution | |
| 161 | |
| 162 Nonparametric Distribution Free UCLs | |
| 95% CLT UCL 300.3 95% BCA Bootstrap UCL | 307.9 |
| 95% Standard Bootstrap UCL 296.8 95% Bootstrap-t UCL | 342.8 |
| 95% Hall's Bootstrap UCL 341 95% Percentile Bootstrap UCL | 301.9 |

| | Α | В | С | D | E | F | G | Н | | J | K | L |
|-----|----|--------------|----------------|----------------|---------------|----------------|-----------------|----------------|----------------|--------------|-----------------|-------|
| 166 | | | 90% Ch | ebyshev(Mea | an, Sd) UCL | 357.5 | | | 95% Ch | ebyshev(Me | an, Sd) UCL | 414.8 |
| 167 | | | 97.5% Ch | ebyshev(Mea | an, Sd) UCL | 494.4 | | | 99% Ch | ebyshev(Me | an, Sd) UCL | 650.7 |
| 168 | | | | | | | | | | | | |
| 169 | | | | | | Suggested | UCL to Use | | | | | |
| 170 | | | | 95% Stud | dent's-t UCL | 309.3 | | | | | | |
| 171 | | | | | | | | | | | | |
| 172 | 1 | Note: Sugges | stions regard | ing the selec | tion of a 95% | 6 UCL are pr | ovided to hel | p the user to | select the m | ost appropri | ate 95% UCL | |
| 173 | | Recom | mendations | are based up | on data size | , data distrib | ution, and sk | ewness usin | g results fror | n simulation | studies. | |
| 174 | Но | wever, simu | lations result | s will not cov | er all Real W | orld data se | ts; for additio | nal insight th | ne user may | want to cons | ult a statistic | ian. |
| 175 | | | | | | | | | | | | |

| | A B C | D E | F | G H I J K | L |
|----------|--------------------------------|----------------------------------|----------------|---|----------|
| 1 | | UCL Statis | Stics for Unce | ensored Full Data Sets | |
| 2 | User Selected Options | , | | | |
| 3 | Date/Time of Computation | ProUCL 5.2 11/18/2024 | 10·50·06 AM | | |
| 4 | From File | WorkSheet.xls | 10.00.007 ((1) | | |
| 5 6 | Full Precision | OFF | | | |
| 7 | Confidence Coefficient | 95% | | | |
| 8 | Number of Bootstrap Operations | 2000 | | | |
| 9 | | | | | |
| 10 | | | | | |
| 11 | GC5-WRA | | | | |
| 12 | | | | | |
| 13 | | | General | | |
| 14 | Total | Number of Observations | 8 | Number of Distinct Observations | 8 |
| 15 | | | | Number of Missing Observations | 0 |
| 16 | | Minimum | 82.14 | Mean | 211 |
| 17 | | Maximum | 421 | Median | 165 |
| 18 | | SD Coefficient of Variation | 122.8 | Std. Error of Mean | 43.43 |
| 19 | | Coemicient of Variation | 0.582 | Skewness | 1.159 |
| 20 | Note: Sample size is | small (e.a. <10) if data s | are collected | using incremental sampling methodology (ISM) approach, | |
| 21 | · · | , | | C 2020 and ITRC 2012) for additional guidance, | |
| 22 23 | | _ | • | ne Chebyshev UCL for small sample sizes (n < 7). | |
| 24 | | | | n gross overestimates of the mean. | |
| 25 | Re | | | e for a discussion of the Chebyshev UCL. | |
| 26 | | | | · | |
| 27 | | | Normal C | GOF Test | |
| 28 | S | Shapiro Wilk Test Statistic | 0.814 | Shapiro Wilk GOF Test | |
| 29 | 1% S | hapiro Wilk Critical Value | 0.749 | Data appear Normal at 1% Significance Level | |
| 30 | | Lilliefors Test Statistic | 0.318 | Lilliefors GOF Test | |
| 31 | 1 | % Lilliefors Critical Value | 0.333 | Data appear Normal at 1% Significance Level | |
| 32 | | | | 1% Significance Level | |
| 33 | | Note GOF tests | may be unre | liable for small sample sizes | |
| 34 | | | | | |
| 35 | 050/ N | | suming Norr | nal Distribution | |
| 36 | 90% NO | ormal UCL 95% Student's-t UCL | 293.2 | 95% UCLs (Adjusted for Skewness) 95% Adjusted-CLT UCL (Chen-1995) | 301.4 |
| 37 | | 90 /0 Student S-t UCL | ∠3J.∠ | 95% Adjusted-CLT OCL (Chen-1995) 95% Modified-t UCL (Johnson-1978) | 296.2 |
| 38 | | | | 3370 Modified-t OCE (301115011-1370) | 200.2 |
| 39 40 | <u> </u> | | Gamma (| GOF Test | |
| 41 | | A-D Test Statistic | 0.545 | Anderson-Darling Gamma GOF Test | |
| 42 | | 5% A-D Critical Value | 0.719 | Detected data appear Gamma Distributed at 5% Significance | ce Level |
| 43 | | K-S Test Statistic | 0.263 | Kolmogorov-Smirnov Gamma GOF Test | |
| 44 | | 5% K-S Critical Value | 0.295 | Detected data appear Gamma Distributed at 5% Significance | ce Level |
| 45 | | Detected data appear | r Gamma Dis | stributed at 5% Significance Level | |
| 46 | | Note GOF tests | may be unre | liable for small sample sizes | |
| 47 | | | | | |
| 48 | | | Gamma | | |
| 49 | | k hat (MLE) | 3.877 | k star (bias corrected MLE) | 2.506 |
| 50 | | Theta hat (MLE) | 54.42 | Theta star (bias corrected MLE) | 84.17 |
| 51 | | nu hat (MLE) | | nu star (bias corrected) | 40.1 |
| 52 | M | LE Mean (bias corrected) | 211 | MLE Sd (bias corrected) | 133.3 |
| 53 | لـ ۸ | sted Level of Significance | 0.0195 | Approximate Chi Square Value (0.05) Adjusted Chi Square Value | 26.59 |
| 54 | Adjus | sieu Level of Significance | 0.0195 | Aujusted Cni Square Value | 23.04 |
| 55 | | | | | |

| 56 | Α | | В | | | С | | D | | E As: | F suming Ga | | G Distribu | ⊢ ıtion | ł | | l | | | J | 工 | K | | L |
|------------|--------------|------|--------|------|-------|--------|----------|------------------------|----------|-------------------|-----------------------|------------|----------------------|------------|---------------------|-------|---------|-------|----------|----------|------------|-------|---------------|----------------|
| 57 | | | | | | 95% A | pprox | imate (| Gamr | na UCL | 318.1 | | | | | | 9 | 95% | Adju | usted | Gan | nma | UCL | 354.8 |
| 58 | | | | | | | | | | | | | | | | | | | | | | | | |
| 59 | | | | | | | | | | | Lognorm | al GOF | Test | | | | | | | | | | | |
| 60 | <u> </u> | | | | | | | | | Statistic | | | | | | | Vilk Lo | | | | | | | |
| 61 | | | | | | 10% S | | | | al Value | | | | Data a | | _ | | | | _ | | | Level | |
| 62 | <u> </u> | | | | | | | | | Statistic | | | | | | | s Log | | | | | | | |
| 63 | <u> </u> | | | | | 10 |)% Lilli | | | al Value | | 1 . 1 400 | · • | Data a | | | norma | al at | 10% | Sign | itica | nce | Level | |
| 64 | | | | | | | | | | | Lognorma may be ur | | | | | | | | | | | | | |
| 65 | | | | | | | | 1401 | ie GC | ir iesis | illay be ui | ii eiiabie | 5 101 51 | ııaıı saı | iihi e s | SIZES | | | | | | | | |
| 66 | | | | | | | | | | | Lognorn | nal Stat | istics | | | | | | | | | | | |
| 67 68 | | | | | | | Minim | um of | Logg | ed Data | | | | | | | | | Μє | ean of | f loa | ged | Data | 5.217 |
| 69 | | | | | | | | | | ed Data | | | | | | | | | | SD of | _ | _ | | 0.545 |
| 70 | | | | | | | | | | | 1 | | | | | | | | | | | | | |
| 71 | | | | | | | | | | Assı | uming Log | normal | Distrib | oution | | | | | | | | | | |
| 72 | | | | | | | | | 95% | H-UCL | 352.8 | | | | | | 90% | % Ch | neby | shev | (MV | UE) | UCL | 332 |
| 73 | | | | | | 95% | Cheby | /shev (| (MVU | E) UCL | 387.5 | | | | | | 97.5% | % Ch | neby | shev | (MV | UE) | UCL | 464.4 |
| 74 | | | | | | 99% | Cheby | /shev (| (MVU | E) UCL | 615.6 | | | | | | | | | | | | | |
| 75 | | | | | | | | | | | | | | | | | | | | | | | | |
| 76 | | | | | | | | | | • | etric Distrib | | | | | | | | | | | | | |
| 77 | | | | | | | | | Dat | a appea | ar to follow | a Disc | ernible | Distrib | ution | | | | | | | | | |
| 78 | <u> </u> | | | | | | | | | | | | | | | | | | | | | | | |
| 79 | <u> </u> | | | | | | | | = 0./ 0 | | rametric D | istributi | ion Fre | e UCL | 3 | | | | | | | | | |
| 80 | <u> </u> | | | | | 050/ | <u> </u> | | | LT UCL | | | | | | | | 95 | | CA B | | | | 288.1 |
| 81 | <u> </u> | | | | | | | | | ap UCL | | | | | | | 050 | | | % Boo | | • | | 446.6 |
| 82 | <u> </u> | | | | | | | | | ap UCL | | | | | | | | | | tile B | | • | | 281.3 |
| 83 | <u> </u> | | | | | | - | • | | d) UCL | | | | | | | 95% C | | | • | | , | | 400.3 |
| 84 | <u> </u> | | | | 97. | 5% Cr | nebysr | nev(IVIe | ean, S | d) UCL | 482.2 | | | | | | 99% C | Jner | | ev(IVI6 | эап, —— | Sa) | UCL | 643.1 |
| 85 | | | | | | | | | | | Suggeste | 4 UCI | to I lee | , | | | | | | | | | | |
| 86 87 | | | | | | | 9! | 5% Stu | ıdent' | s-t UCL | | u ool | 10 030 | | | | | | | | | | $\overline{}$ | |
| 88 | | | | | | | | | | | | | | | | | | | | | | | | |
| 89 | | Note | e: Sug | gest | ions | regard | ding th | e sele | ction | of a 95% | 6 UCL are | provide | d to he | lp the u | ser to | sele | ct the | mos | st ap | propr | riate | 95% | UCL | |
| 90 | | | _ | _ | | - | _ | | | | , data distr | | | - | | | | | - | | | | | |
| 91 | Н | lowe | er, si | mula | tions | result | ts will | not co | ver al | l Real W | Vorld data | sets; for | additio | onal ins | ight th | ne us | er ma | y wa | ant to | o cons | sult a | a sta | tisticia | an. |
| 92 | | | | | | | | | | | | | | | | | | | | | | | - | |
| 93 | | | | | | | | | | | | | | | | | | | | | | | | |
| 94 | GC5-WRB | 3 | | | | | | | | | | | | | | | | | | | | | | |
| 95 | <u> </u> | | | | | | | | | | | | | | | | | | | | | | | |
| 96 | | | | | | | | _ | 01 | | Genera | al Statis | stics | | | | | | <u> </u> | <u> </u> | <u></u> | | | |
| 97 | <u> </u> | | | | | Total | Numl | per of (| Obsei | vations | 10 | | | | | | Numb | | | | | | | 10 |
| 98 | <u> </u> | | | | | | | | | II I. | | | | | | | Numb | er o | t Mis | sing | Obs | | | 0 |
| 99 | | | | | | | | | | linimum aximum | | | | | | | | | | | | | Mean edian | 117.1 124.5 |
| 100 | | | | | | | | | IVI | aximum SD | | | | | | | | | | Std. E | Erro | | | 124.5 |
| 101 | | | | | | | Cor | officion | nt of \/ | ariation | | | | | | | | | | oiu. E | | Skewi | | -0.629 |
| 102 | | | | | | | | JIIICI C [] | it OI V | anauUII | 0.234 | | | | | | | | | | | -NGWI | 1033 | -0.029 |
| 103 | | | | | | | | | | | Norma | I GOF | Test | | | | | | | | | | | |
| 104 105 | | | | | | S | Shapiro | o Wilk | Test S | Statistic | | | | | | Sha | piro V | Vilk | GOF | F Tes | | | | |
| 105 | | | | | | | - | | | al Value | | | | Data | appe | | ormal | | | | | e Le | vel | |
| 106 | | | | | | | | | | Statistic | | | | | | | lliefor | | | - | | | | |
| 107 | | | | | | 1 | | | | al Value | | | | Data | а арре | | ormal | | | | canc | e Le | vel | |
| 108 | | | | | | | | | | | ar Normal | at 1% \$ | Signific | | | | | • | | | | | - | |
| 110 | | | | | | | | | | | | | | | | | | | | | | | | |
| 110 | | _ | | | | | | | | | | | | | | | | | | | _ | | | |

| 111 | Α | В | С | | D | E A | F ssuming Nor | G mal Distribution | H on | I | | J | K | | L |
|------------|----|-------------|------------|-----------|------------|----------------|------------------|-----------------------|--------------|------------|-----------|------------|----------------------------|--------|---------|
| 112 | | | 95% | 6 Norma | I UCL | | | | 95% | 6 UCLs (| Adjuste | ed for Sk | ewness) | | |
| 113 | | | | 9 | 95% Stud | dent's-t UCL | 137.1 | | | 95% Ad | justed- | CLT UCL | (Chen-199 | 5) | 132.7 |
| 114 | | | | | | | | | | 95% M | odified- | t UCL (Jo | hnson-197 | 8) | 136.7 |
| 115 | | | | | | | - | 1 | | | | | | • | |
| 116 | | | | | | | Gamma | GOF Test | | | | | | | |
| 117 | | | | | A-D T | est Statistic | 0.498 | | Ande | rson-Da | rling G | amma Go | OF Test | | |
| 118 | | | | 5 | % A-D C | ritical Value | 0.725 | Detected of | data appe | ar Gamm | na Distr | ibuted at | 5% Signific | ance | e Level |
| 119 | | | | | K-S T | est Statistic | | | | _ | | | GOF Test | | |
| 120 | | | | | | ritical Value | | | | | | ibuted at | 5% Signific | ance | e Level |
| 121 | | | | | Detected | data appea | ır Gamma Di | stributed at 5% | 6 Significa | ance Lev | ⁄el | | | | |
| 122 | | | | | | | | | | | | | | | |
| 123 | | | | | | | | Statistics | | | | | | | |
| 124 | | | | | | k hat (MLE | | | | | | • | rrected ML | | 7.422 |
| 125 | | | | | | ta hat (MLE | | | | Th | | • | rrected ML | | 15.78 |
| 126 | | | | | | u hat (MLE | | | | | | • | as correcte | ′ | 148.4 |
| 127 | | | | MLE M | lean (bia | s corrected | 117.1 | | | | | • | as correcte | · | 42.98 |
| 128 | | | | | | | | | | Approxi | | | Value (0.0 | | 121.3 |
| 129 | | | A | djusted l | Level of | Significance | 0.0267 | | | | Adju | sted Chi | Square Valu | Je | 117 |
| 130 | | | | | | | | | | | | | | | |
| 131 | | | | | | | | nma Distributio | n | | | | | | |
| 132 | | | 959 | % Appro | ximate G | amma UCL | 143.3 | | | | 95% | Adjusted | Gamma UC | CL | 148.5 |
| 133 | | | | | | | | | | | | | | | |
| 134 | | | | | | | | I GOF Test | | | | | | | |
| 135 | | | | | | est Statistic | | | | piro Wilk | | | | | |
| 136 | | | 109 | | | ritical Value | | Da | | | | | ificance Le | vel | |
| 137 | | | | | | est Statistic | | | | lliefors L | - | | | | |
| 138 | | | | 10% Li | | critical Value | | | | | |)% Signifi | cance Leve | el | |
| 139 | | | | | Data ap | ppear Appro | ximate Logn | ormal at 10% S | Significan | ice Level | | | | | |
| 140 | | | | | | | | 10: 11:11 | | | | | | | |
| 141 | | | | Mini | | | _ | al Statistics | | | | N4 | (1 d D- | | 4 745 |
| 142 | | | | | | ogged Data | | | | | | | f logged Da f logged Da | | 4.715 |
| 143 | | | | Maxii | num or L | Logged Data | 5.088 | | | | | 30 0 | подуец Ба | la | 0.348 |
| 144 | | | | | | ۸۵۵ | uming Logn | ormal Distributi | tion | | | | | | |
| 145 | | | | | | 95% H-UCL | | | 11011 | C | 00% Ch | obyshov | (MVUE) UC | ווי | 157.1 |
| 146 | | | 10 | 5% Chal | | MVUE) UCL | | | | | | - | (MVUE) UC | | 199.5 |
| 147 | | | | | • • | MVUE) UCI | | | | 37. | .5 /0 C11 | ebysnev | (IVIVOL) OC | | 199.5 |
| 148 | | | | J 70 OHCL | bysilev (i | WIVOL) 001 | . 240 | <u> </u> | | | | | | | |
| 149 | | | | | | Nonnaram | etric Distribu | tion Free UCL | Statistics | | | | | | |
| 150 | | | | | | • | | Discernible Di | | | | | | | |
| 151 | | | | | | | | | | | | | | | |
| 152 153 | | | | | | Nonna | arametric Dis | tribution Free I | UCLs | | | | | | |
| 153 | | | | | 95 | % CLT UCI | | | | | 95 | % BCA B | ootstrap UC | CL | 133.9 |
| 155 | | | 9 | 95% Star | | otstrap UCL | | | | | | | otstrap-t UC | | 135.7 |
| 156 | | | | | | otstrap UCL | | <u> </u> | | 9 | 5% Pe | | ootstrap UC | | 133.9 |
| 157 | | | 90% | | | an, Sd) UCL | | <u> </u> | | | | | ean, Sd) UC | | 164.6 |
| 158 | | | | | • | an, Sd) UCL | | | | | | • . | ean, Sd) UC | | 225.5 |
| 159 | | | | | * | | | 1 | | | | • | <u> </u> | | |
| 160 | | | | | | | Suggested | UCL to Use | | | | | | | |
| 161 | | | | 9 | 95% Stud | dent's-t UCL | 137.1 | | | | | | | | |
| 162 | | | | | | | | 1 | | | | | | | |
| 163 | | Note: Sugge | stions reç | garding t | he selec | tion of a 95° | | ovided to help | the user to | o select t | the mos | t appropi | riate 95% U | CL. | |
| 164 | | Recon | nmendatio | ons are b | ased up | on data size | , data distrib | ution, and skev | wness usii | ng results | s from s | simulation | studies. | | |
| 165 | Нс | wever, simu | lations re | sults wil | I not cov | er all Real \ | Norld data se | ts; for additiona | al insight t | the user r | may wa | int to con | sult a statis | ticiar | า. |
| . 55 | | | | | | | | | | | | | | | |

| | Α | В | C | D | E | F | G | Н | | J | K | L |
|-----|---|-----------|--------------|--------------|---------------|--------------|--------------|---------------|--------------|-------------|------------|---|
| 166 | | | | | | | | | | | | |
| 167 | | Note: For | highly negat | ively-skewe | d data, confi | dence limits | (e.g., Chen, | Johnson, Lo | ognormal, ar | ıd Gamma) ı | may not be | |
| 168 | | | reliable. (| Chen's and J | lohnson's m | ethods provi | de adjustme | nts for posit | vely skewed | data sets. | | |
| 169 | | | | | | | | | | | | |

| | A B C | D E | F | G H I J K ensored Full Data Sets | L |
|--------|--------------------------------|---|----------------|--|----------|
| 1 | | OCL Statis | ucs for Office | erisoreu Fuii Data Sets | |
| 3 | User Selected Options | | | | |
| 4 | Date/Time of Computation | ProUCL 5.2 11/18/2024 1 | 10:57:52 AM | | |
| | From File | WorkSheet.xls | | | |
| 5 6 | Full Precision | OFF | | | |
| 7 | Confidence Coefficient | 95% | | | |
| 8 | Number of Bootstrap Operations | 2000 | | | |
| 9 | | | | | |
| 10 | | | | | |
| _ | GC6-WRA | | | | |
| 12 | | | | | |
| 13 | | | General | Statistics | |
| 14 | Total | Number of Observations | 17 | Number of Distinct Observations | 16 |
| 15 | | | | Number of Missing Observations | 0 |
| 16 | | Minimum | 134 | Mean | 243.8 |
| 17 | | Maximum | 504 | Median | 201 |
| 18 | | SD | 101.1 | Std. Error of Mean | 24.53 |
| 19 | | Coefficient of Variation | 0.415 | Skewness | 1.518 |
| 20 | | | | | |
| 21 | | | Normal (| GOF Test | |
| 22 | S | Shapiro Wilk Test Statistic | 0.825 | Shapiro Wilk GOF Test | |
| 23 | 1% S | hapiro Wilk Critical Value | 0.851 | Data Not Normal at 1% Significance Level | |
| 24 | | Lilliefors Test Statistic | 0.221 | Lilliefors GOF Test | |
| 25 | 1 | % Lilliefors Critical Value | 0.241 | Data appear Normal at 1% Significance Level | |
| 26 | | Data appear Appr | roximate No | rmal at 1% Significance Level | |
| 27 | | | | | |
| 28 | | Ass | suming Norr | mal Distribution | |
| 29 | 95% No | ormal UCL | | 95% UCLs (Adjusted for Skewness) | |
| 30 | | 95% Student's-t UCL | 286.6 | 95% Adjusted-CLT UCL (Chen-1995) | 293.8 |
| 31 | | | | 95% Modified-t UCL (Johnson-1978) | 288.1 |
| 32 | | | | | |
| 33 | | | Gamma (| GOF Test | |
| 34 | | A-D Test Statistic | 0.769 | Anderson-Darling Gamma GOF Test | |
| 35 | | 5% A-D Critical Value | 0.74 | Data Not Gamma Distributed at 5% Significance Leve | el |
| 36 | | K-S Test Statistic | 0.183 | Kolmogorov-Smirnov Gamma GOF Test | |
| 37 | | 5% K-S Critical Value | 0.209 | Detected data appear Gamma Distributed at 5% Significand | ce Level |
| 38 | | Detected data follow App | or. Gamma l | Distribution at 5% Significance Level | |
| 39 | | | | | |
| 40 | | | | Statistics | |
| 41 | | k hat (MLE) | 7.643 | k star (bias corrected MLE) | 6.333 |
| 42 | | Theta hat (MLE) | 31.9 | Theta star (bias corrected MLE) | 38.49 |
| 43 | | nu hat (MLE) | 259.8 | nu star (bias corrected) | 215.3 |
| 44 | MI | LE Mean (bias corrected) | 243.8 | MLE Sd (bias corrected) | 96.86 |
| 45 | | | 0.00.10 | Approximate Chi Square Value (0.05) | 182.4 |
| 46 | Adjus | sted Level of Significance | 0.0346 | Adjusted Chi Square Value | 179.2 |
| 47 | | | | Distribution | |
| 48 | 0501 | | | nma Distribution | 202.2 |
| 49 | 95% A | pproximate Gamma UCL | 287.8 | 95% Adjusted Gamma UCL | 292.9 |
| 50 | | | | LCOE Took | |
| 51 | | Namina MULTI O | | I GOF Test | |
| 52 | | Shapiro Wilk Test Statistic | 0.923 | Shapiro Wilk Lognormal GOF Test | |
| 53 | 10% S | hapiro Wilk Critical Value | 0.91 | Data appear Lognormal at 10% Significance Level | |
| 54 | 40 | Lilliefors Test Statistic % Lilliefors Critical Value | 0.166 | Lilliefors Lognormal GOF Test | |
| 55 | 10 | % Lilletors Critical Value | 0.19 | Data appear Lognormal at 10% Significance Level | |

| | A B C D E | F Lognormal s | G H I J K at 10% Significance Level | L |
|---|---|--|--|--|
| 56 57 | Data appear | Lognormare | at 10 % digitification Level | |
| 58 | | Lognorma | Il Statistics | |
| 59 | Minimum of Logged Data | 4.898 | Mean of logged Data | 5.429 |
| 60 | Maximum of Logged Data | 6.223 | SD of logged Data | 0.361 |
| 61 | | | 1 | |
| 62 | | | ormal Distribution | |
| 63 | 95% H-UCL | 289.2 | 90% Chebyshev (MVUE) UCL | 307.2 |
| 64 | 95% Chebyshev (MVUE) UCL | 336.6 | 97.5% Chebyshev (MVUE) UCL | 377.4 |
| 65 | 99% Chebyshev (MVUE) UCL | 457.5 | | |
| 66 | Nonnonomo | ania Diatribu | tion Free UCL Statistics | |
| 67 | | | Discernible Distribution | |
| 68 | Бата арреа | ii to ioliow a | Discernible Distribution | |
| 69 70 | Nonpar | rametric Dis | tribution Free UCLs | |
| 71 | 95% CLT UCL | 284.1 | 95% BCA Bootstrap UCL | 295.1 |
| 72 | 95% Standard Bootstrap UCL | 283.3 | 95% Bootstrap-t UCL | 307.9 |
| 73 | 95% Hall's Bootstrap UCL | 301.6 | 95% Percentile Bootstrap UCL | 285.7 |
| 74 | 90% Chebyshev(Mean, Sd) UCL | 317.3 | 95% Chebyshev(Mean, Sd) UCL | 350.7 |
| 75 | 97.5% Chebyshev(Mean, Sd) UCL | 396.9 | 99% Chebyshev(Mean, Sd) UCL | 487.8 |
| 76 | | | | |
| 77 | | Suggested | UCL to Use | |
| 78 | 95% Student's-t UCL | 286.6 | | |
| 79 | | | | |
| 80 | | | stribution passing only one of the GOF tests, | |
| | | | | |
| 81 | it is suggested to use a UCL bas | вей ироп а и | istribution passing both GOF tests in ProUCL | |
| 82 | | | | |
| 82 83 | Note: Suggestions regarding the selection of a 95% | UCL are pr | ovided to help the user to select the most appropriate 95% UCL. | |
| 82 83 84 | Note: Suggestions regarding the selection of a 95% Recommendations are based upon data size, | UCL are pr | | ın. |
| 82 83 84 85 | Note: Suggestions regarding the selection of a 95% Recommendations are based upon data size, | UCL are pr | ovided to help the user to select the most appropriate 95% UCL. ution, and skewness using results from simulation studies. | ın. |
| 82 83 84 | Note: Suggestions regarding the selection of a 95% Recommendations are based upon data size, | UCL are pr | ovided to help the user to select the most appropriate 95% UCL. ution, and skewness using results from simulation studies. | ın. |
| 82 83 84 85 86 | Note: Suggestions regarding the selection of a 95% Recommendations are based upon data size, | UCL are pr | ovided to help the user to select the most appropriate 95% UCL. ution, and skewness using results from simulation studies. | in. |
| 82 83 84 85 86 87 | Note: Suggestions regarding the selection of a 95% Recommendations are based upon data size, However, simulations results will not cover all Real W | UCL are pr | ovided to help the user to select the most appropriate 95% UCL. ution, and skewness using results from simulation studies. | ın. |
| 82 83 84 85 86 87 88 | Note: Suggestions regarding the selection of a 95% Recommendations are based upon data size, However, simulations results will not cover all Real W | o UCL are pro data distribution data se | ovided to help the user to select the most appropriate 95% UCL. ution, and skewness using results from simulation studies. ts; for additional insight the user may want to consult a statisticia | |
| 82 83 84 85 86 87 88 | Note: Suggestions regarding the selection of a 95% Recommendations are based upon data size, However, simulations results will not cover all Real W | o UCL are pro data distribition data se | ovided to help the user to select the most appropriate 95% UCL. ution, and skewness using results from simulation studies. ts; for additional insight the user may want to consult a statisticia Statistics Number of Distinct Observations | 9 |
| 82 83 84 85 86 87 88 89 | Note: Suggestions regarding the selection of a 95% Recommendations are based upon data size, However, simulations results will not cover all Real W GC6-WTP Total Number of Observations | General | ovided to help the user to select the most appropriate 95% UCL. ution, and skewness using results from simulation studies. ts; for additional insight the user may want to consult a statisticia Statistics Number of Distinct Observations Number of Missing Observations | 9 |
| 82 83 84 85 86 87 88 89 90 91 92 93 | Note: Suggestions regarding the selection of a 95% Recommendations are based upon data size, However, simulations results will not cover all Real W GC6-WTP Total Number of Observations Minimum | General 14 | ovided to help the user to select the most appropriate 95% UCL. ution, and skewness using results from simulation studies. ts; for additional insight the user may want to consult a statisticia Statistics Number of Distinct Observations Number of Missing Observations Mean | 9 0 8.236 |
| 82 83 84 85 86 87 88 89 90 91 92 93 | Note: Suggestions regarding the selection of a 95% Recommendations are based upon data size, However, simulations results will not cover all Real W GC6-WTP Total Number of Observations Minimum Maximum | General 14 1.7 | ovided to help the user to select the most appropriate 95% UCL. ution, and skewness using results from simulation studies. ts; for additional insight the user may want to consult a statisticia Statistics Number of Distinct Observations Number of Missing Observations Mean Median | 9 0 8.236 7 |
| 82 83 84 85 86 87 88 89 90 91 92 93 94 | Note: Suggestions regarding the selection of a 95% Recommendations are based upon data size, However, simulations results will not cover all Real W GC6-WTP Total Number of Observations Minimum Maximum SD | General 14 1.7 16 3.761 | ovided to help the user to select the most appropriate 95% UCL. ution, and skewness using results from simulation studies. ts; for additional insight the user may want to consult a statisticia Statistics Number of Distinct Observations Number of Missing Observations Mean Median Std. Error of Mean | 9 0 8.236 7 1.005 |
| 82 83 84 85 86 87 88 89 90 91 92 93 94 95 | Note: Suggestions regarding the selection of a 95% Recommendations are based upon data size, However, simulations results will not cover all Real W GC6-WTP Total Number of Observations Minimum Maximum | General 14 1.7 | ovided to help the user to select the most appropriate 95% UCL. ution, and skewness using results from simulation studies. ts; for additional insight the user may want to consult a statisticia Statistics Number of Distinct Observations Number of Missing Observations Mean Median | 9 0 8.236 7 |
| 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 | Note: Suggestions regarding the selection of a 95% Recommendations are based upon data size, However, simulations results will not cover all Real W GC6-WTP Total Number of Observations Minimum Maximum SD | General 14 1.7 16 3.761 0.457 | ovided to help the user to select the most appropriate 95% UCL. ution, and skewness using results from simulation studies. ts; for additional insight the user may want to consult a statisticia Statistics Number of Distinct Observations Number of Missing Observations Mean Median Std. Error of Mean | 9 0 8.236 7 1.005 |
| 82 83 84 85 86 87 90 91 92 93 94 95 96 97 | Note: Suggestions regarding the selection of a 95% Recommendations are based upon data size, However, simulations results will not cover all Real W GC6-WTP Total Number of Observations Minimum Maximum SD | General 14 1.7 16 3.761 0.457 | Statistics Number of Distinct Observations Number of Missing Observations Mean Median Std. Error of Mean Skewness | 9 0 8.236 7 1.005 |
| 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 | Note: Suggestions regarding the selection of a 95% Recommendations are based upon data size, However, simulations results will not cover all Real W GC6-WTP Total Number of Observations Minimum Maximum SD Coefficient of Variation | General 14 1.7 16 3.761 0.457 | ovided to help the user to select the most appropriate 95% UCL. ution, and skewness using results from simulation studies. ts; for additional insight the user may want to consult a statisticia Statistics Number of Distinct Observations Number of Missing Observations Mean Median Std. Error of Mean Skewness | 9 0 8.236 7 1.005 |
| 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 | Note: Suggestions regarding the selection of a 95% Recommendations are based upon data size, However, simulations results will not cover all Real W GC6-WTP Total Number of Observations Minimum Maximum SD Coefficient of Variation Shapiro Wilk Test Statistic | General 14 1.7 16 3.761 0.457 Normal C | ovided to help the user to select the most appropriate 95% UCL. ution, and skewness using results from simulation studies. ts; for additional insight the user may want to consult a statisticia Statistics Number of Distinct Observations Number of Missing Observations Mean Median Std. Error of Mean Skewness GOF Test Shapiro Wilk GOF Test | 9 0 8.236 7 1.005 |
| 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 | Note: Suggestions regarding the selection of a 95% Recommendations are based upon data size, However, simulations results will not cover all Real W GC6-WTP Total Number of Observations Minimum Maximum SD Coefficient of Variation Shapiro Wilk Test Statistic 1% Shapiro Wilk Critical Value | General 14 1.7 16 3.761 0.457 Normal (0.825) | ovided to help the user to select the most appropriate 95% UCL. ution, and skewness using results from simulation studies. ts; for additional insight the user may want to consult a statisticia Statistics Number of Distinct Observations Number of Missing Observations Mean Median Std. Error of Mean Skewness GOF Test Shapiro Wilk GOF Test Data appear Normal at 1% Significance Level | 9 0 8.236 7 1.005 |
| 82 83 84 85 86 87 90 91 92 93 94 95 96 97 98 99 100 | Note: Suggestions regarding the selection of a 95% Recommendations are based upon data size, However, simulations results will not cover all Real W GC6-WTP Total Number of Observations Minimum Maximum SD Coefficient of Variation Shapiro Wilk Test Statistic 1% Shapiro Wilk Critical Value Lilliefors Test Statistic 1% Lilliefors Critical Value | General 14 1.7 16 3.761 0.457 Normal C 0.926 0.825 0.272 0.263 | ovided to help the user to select the most appropriate 95% UCL. ution, and skewness using results from simulation studies. ts; for additional insight the user may want to consult a statisticia Statistics Number of Distinct Observations Number of Missing Observations Mean Median Std. Error of Mean Skewness GOF Test Shapiro Wilk GOF Test Data appear Normal at 1% Significance Level Lilliefors GOF Test | 9 0 8.236 7 1.005 |
| 82 83 84 85 86 87 90 91 92 93 94 95 96 97 98 99 100 101 102 | Note: Suggestions regarding the selection of a 95% Recommendations are based upon data size, However, simulations results will not cover all Real W GC6-WTP Total Number of Observations Minimum Maximum SD Coefficient of Variation Shapiro Wilk Test Statistic 1% Shapiro Wilk Critical Value Lilliefors Test Statistic 1% Lilliefors Critical Value Data appear Apple | General 14 1.7 16 3.761 0.457 Normal C 0.926 0.825 0.272 0.263 roximate No | ovided to help the user to select the most appropriate 95% UCL. ution, and skewness using results from simulation studies. ts; for additional insight the user may want to consult a statisticia Statistics Number of Distinct Observations Number of Missing Observations Mean Median Std. Error of Mean Skewness GOF Test Shapiro Wilk GOF Test Data appear Normal at 1% Significance Level Lilliefors GOF Test Data Not Normal at 1% Significance Level rmal at 1% Significance Level | 9 0 8.236 7 1.005 |
| 82 83 84 85 86 87 90 91 92 93 94 95 96 97 98 99 100 101 102 103 | Note: Suggestions regarding the selection of a 95% Recommendations are based upon data size, However, simulations results will not cover all Real W GC6-WTP Total Number of Observations Minimum Maximum SD Coefficient of Variation Shapiro Wilk Test Statistic 1% Shapiro Wilk Critical Value Lilliefors Test Statistic 1% Lilliefors Critical Value Data appear Appr | General 14 1.7 16 3.761 0.457 Normal C 0.926 0.825 0.272 0.263 roximate No | ovided to help the user to select the most appropriate 95% UCL. ution, and skewness using results from simulation studies. ts; for additional insight the user may want to consult a statisticia Statistics Number of Distinct Observations Number of Missing Observations Mean Median Std. Error of Mean Skewness GOF Test Shapiro Wilk GOF Test Data appear Normal at 1% Significance Level Lilliefors GOF Test Data Not Normal at 1% Significance Level rmal at 1% Significance Level | 9 0 8.236 7 1.005 |
| 82 83 84 85 86 87 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 | Note: Suggestions regarding the selection of a 95% Recommendations are based upon data size, However, simulations results will not cover all Real W GC6-WTP Total Number of Observations Minimum Maximum SD Coefficient of Variation Shapiro Wilk Test Statistic 1% Shapiro Wilk Critical Value Lilliefors Test Statistic 1% Lilliefors Critical Value Data appear Appi As: 95% Normal UCL | General 14 1.7 16 3.761 0.457 Normal C 0.926 0.825 0.272 0.263 roximate No | ovided to help the user to select the most appropriate 95% UCL. ution, and skewness using results from simulation studies. ts; for additional insight the user may want to consult a statisticia Statistics Number of Distinct Observations Number of Missing Observations Mean Median Std. Error of Mean Skewness GOF Test Shapiro Wilk GOF Test Data appear Normal at 1% Significance Level Lilliefors GOF Test Data Not Normal at 1% Significance Level rmal at 1% Significance Level mal Distribution 95% UCLs (Adjusted for Skewness) | 9 0 8.236 7 1.005 0.607 |
| 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 | Note: Suggestions regarding the selection of a 95% Recommendations are based upon data size, However, simulations results will not cover all Real W GC6-WTP Total Number of Observations Minimum Maximum SD Coefficient of Variation Shapiro Wilk Test Statistic 1% Shapiro Wilk Critical Value Lilliefors Test Statistic 1% Lilliefors Critical Value Data appear Appr | General 14 1.7 16 3.761 0.457 Normal C 0.926 0.825 0.272 0.263 roximate No | Statistics Number of Distinct Observations Number of Missing Observations Number of Missing Observations Mean Median Std. Error of Mean Skewness Shapiro Wilk GOF Test Data appear Normal at 1% Significance Level Lilliefors GOF Test Data Not Normal at 1% Significance Level rmal at 1% Significance Level mal Distribution 95% UCLs (Adjusted for Skewness) 95% Adjusted-CLT UCL (Chen-1995) | 9 0 8.236 7 1.005 0.607 |
| 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 108 | Note: Suggestions regarding the selection of a 95% Recommendations are based upon data size, However, simulations results will not cover all Real W GC6-WTP Total Number of Observations Minimum Maximum SD Coefficient of Variation Shapiro Wilk Test Statistic 1% Shapiro Wilk Critical Value Lilliefors Test Statistic 1% Lilliefors Critical Value Data appear Appi As: 95% Normal UCL | General 14 1.7 16 3.761 0.457 Normal C 0.926 0.825 0.272 0.263 roximate No | ovided to help the user to select the most appropriate 95% UCL. ution, and skewness using results from simulation studies. ts; for additional insight the user may want to consult a statisticia Statistics Number of Distinct Observations Number of Missing Observations Mean Median Std. Error of Mean Skewness GOF Test Shapiro Wilk GOF Test Data appear Normal at 1% Significance Level Lilliefors GOF Test Data Not Normal at 1% Significance Level rmal at 1% Significance Level mal Distribution 95% UCLs (Adjusted for Skewness) | 9 0 8.236 7 1.005 0.607 |
| 82 83 84 85 86 87 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 | Note: Suggestions regarding the selection of a 95% Recommendations are based upon data size, However, simulations results will not cover all Real W GC6-WTP Total Number of Observations Minimum Maximum SD Coefficient of Variation Shapiro Wilk Test Statistic 1% Shapiro Wilk Critical Value Lilliefors Test Statistic 1% Lilliefors Critical Value Data appear Appr As: 95% Normal UCL | General 14 1.7 16 3.761 0.457 Normal C 0.926 0.825 0.272 0.263 roximate No suming Normal 10.02 | Statistics Number of Distinct Observations Number of Missing Observations Number of Missing Observations Mean Median Std. Error of Mean Skewness Shapiro Wilk GOF Test Data appear Normal at 1% Significance Level Lilliefors GOF Test Data Not Normal at 1% Significance Level rmal at 1% Significance Level mal Distribution 95% UCLs (Adjusted for Skewness) 95% Adjusted-CLT UCL (Chen-1995) | 9 0 8.236 7 1.005 0.607 |

| | Α | В | (| | D | | E | F | G | 1 | Н | 1 | | J | | K | | L | Т |
|------------|---|-------------|-----------|----------|------------|------------|-----------|---------------------------------------|------------------|-------|------------|------------|---------|----------------|----------|------------|---------------|---------|-----------|
| 111 | | | | | A-[| O Test S | Statistic | 0.545 | | | Ander | rson-Dar | rling (| Gamma | GOF | Test | | | 1 |
| 112 | | | | | 5% A-D |) Critica | al Value | 0.739 | Detected | data | a appea | ır Gamm | na Dis | tributed | l at 5% | 6 Signifi | canc | e Level | 1 |
| 113 | | | | | K-9 | S Test S | Statistic | 0.213 | | ŀ | Kolmog | jorov-Sm | nirnov | / Gamm | na GO | F Test | | | 1 |
| 114 | | | | | 5% K-S | S Critica | al Value | 0.23 | Detected | data | a appea | ır Gamm | na Dis | tributed | l at 5% | 6 Signifi | canc | e Level | 1 |
| 115 | | | | | Detect | ed data | appea | r Gamma Di | stributed at 5 | i% Si | ignifica | nce Leve | el | | | | | | |
| 116 | | | | | | | | | | | | | | | | | | | |
| 117 | | | | | | | | Gamma | Statistics | | | | | | | | | | |
| 118 | | | | | | k ha | t (MLE) | 4.496 | | | | | | • | | ected ML | | 3.58 | |
| 119 | | | | | TI | | t (MLE) | | | | | Th | ieta st | tar (bias | s corre | ected ML | -E) | 2.3 | |
| 120 | | | | | | | t (MLE) | | | | | | | | • | correcte | ´ | 100.2 | |
| 121 | | | | MLE | Mean (l | bias coi | rrected) | 8.236 | | | | | | | • | correcte | 1 | 4.353 | |
| 122 | | | | | | | | | | | | Approxir | | | | • | | 78.14 | |
| 123 | | | | Adjuste | d Level | of Signi | ificance | 0.0312 | | | | | Adj | usted C | Chi Sq | uare Va | lue | 75.56 | |
| 124 | | | | | | | | | | | | | | | | | | | |
| 125 | | | | | | | | | nma Distributi | ion | | | | | | | | | |
| 126 | | | g | 15% Apr | roximate | e Gamn | na UCL | 10.56 | | | | | 95% | 6 Adjust | ted Ga | amma U | CL | 10.93 | |
| 127 | | | | | | | | | | | | | | | | | | | |
| 128 | | | | | | | | | I GOF Test | | | | | | | | | | |
| 129 | | | | | apiro Will | | | | | | - | oiro Wilk | _ | | | | | | |
| 130 | | | 1 | 0% Sha | piro Wilk | | | | | Dat | | _ognorma | | | | | el | | |
| 131 | | | | | Lilliefor | | | | | | | liefors Lo | | | | | | | |
| 132 | | | | 10% | Lilliefors | | | | | | | _ognorma | al at 1 | 10% Sig | ınifica | nce Lev | el —— | | |
| 133 | | | | | | Dat | a Not L | ognormal at | 10% Significa | ance | e Level | | | | | | | | |
| 134 | | | | | | | | | | | | | | | | | | | |
| 135 | | | | | | | | | I Statistics | | | | | | | | | | |
| 136 | | | | | nimum c | | | | | | | | | | | ogged Da | | 1.993 | |
| 137 | | | | Ma | ximum c | of Logge | ed Data | 2.773 | | | | | | SI. | D of Io | ogged Da | ata | 0.543 | |
| 138 | | | | | | | | ! | I Distrib | | | | | | | | | | _ |
| 139 | | | | | | 050/ | | | ormal Distribu | noıtı | - | | 200/ C | ما میں مام مان | / \ / | V/II=\ I I | | 10.10 | _ |
| 140 | | | | 050/ 01 | nebyshev | | H-UCL | 11.62 | | | | | | • | , | IVUE) U | | 12.19 | |
| 141 | | | | | nebysnev | | | | | | | 97. | .5% C | nebysn | iev (ivi | IVUE) U | CL | 16.28 | _ |
| 142 | | | | 99 /0 CI | lebysile | v (IVI V O | E) UCL | 20.94 | | | | | | | | | | | - |
| 143 | | | | | | Nor | noroma | otrio Diotribu | tion Free UC | 1 0+ | otiotico | | | | | | | | 4 |
| 144 | | | | | | | • | | Discernible [| | | | | | | | | | 4 |
| 145 | | | | | | Date | a appea | ai to ioliow a | Discernible i | Disti | - IDUIIOII | | | | | | | | - |
| 146 | | | | | | | Nonna | rametric Dis | tribution Free | | | | | | | | | | - |
| 147 | | | | | | 95% CI | LT UCL | | | | | | 9 | 5% BC/ | A Roo | tstrap U | CIT | 9.95 | - |
| 148 | | | | 95% S | tandard l | | | | | | | | | | | strap-t U | | 10.24 | - |
| 149 150 | | | | | % Hall's I | | • | | | | | <u></u> | 5% P | | | tstrap U | | 9.907 | \dashv |
| 151 | | | 90 | | yshev(N | | • | | | | | | | | | n, Sd) U | | 12.62 | \dashv |
| 152 | | | | | yshev(N | | | | | | | | | - | - | n, Sd) U | | 18.24 | \dashv |
| 153 | | | | | , ,,, | | , | ĺ | | | | | | | | - , - | | | \dashv |
| 154 | | | | | | | | Suggested | UCL to Use | | | | | | | | | | \dashv |
| 155 | | | | | 95% S | Student's | s-t UCL | | | | | | | | | | $\overline{}$ | | - |
| 156 | | | | | | | | | | | | | | | | | | | \dashv |
| 157 | | | | When a | data se | t follow | s an apı | proximate dis | stribution pass | sing | only on | e of the | GOF | tests, | | | | | \dashv |
| 158 | | | | | | | | | istribution pas | | | | | | | | | | \dashv |
| 159 | | | | | | | | | F 22 | | - | | | | | | | | \dashv |
| 160 | | Note: Sugge | estions i | egardin | g the sel | lection of | of a 95% | 6 UCL are pr | ovided to help | p the | user to | select tl | he mo | ost appr | ropriat | e 95% l | JCL. | | \dashv |
| 161 | | | | _ | | | | · · · · · · · · · · · · · · · · · · · | ution, and ske | | | | | | | | | | \exists |
| 162 | H | | | | | • | | | ts; for addition | | | | | | | | sticia | n. | \exists |
| 163 | | | | | | | | | | | | | | | | | | | 1 |
| . 55 | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |

| | A B C | D E | F | G H I J K Consorred Full Data Sets | L |
|----------|--------------------------------|------------------------------|---------------|--|---------|
| 1 | | OCL Statis | | erisoreu Fuii Data Sets | |
| 3 | User Selected Options | | | | |
| 4 | Date/Time of Computation | ProUCL 5.2 11/18/2024 1 | 11:03:21 AM | | |
| 5 | From File | WorkSheet.xls | | | |
| 6 | Full Precision | OFF | | | |
| 7 | Confidence Coefficient | 95% | | | |
| 8 | Number of Bootstrap Operations | 2000 | | | |
| 9 | | | | | |
| 10 | | | | | |
| 11 | GC7-WRA | | | | |
| 12 | | | | | |
| 13 | | | | Statistics | |
| 14 | Total | I Number of Observations | 14 | Number of Distinct Observations | 12 |
| 15 | | | | Number of Missing Observations | 0 |
| 16 | | Minimum | 10 | Mean | 19.06 |
| 17 | | Maximum | 31 | Median | 16 |
| 18 | | SD SD | 7.15 | Std. Error of Mean | 1.911 |
| 19 | | Coefficient of Variation | 0.375 | Skewness | 0.547 |
| 20 | | | Name of 6 | 20F Took | |
| 21 | c | Shapiro Wilk Test Statistic | 0.897 | GOF Test Shapiro Wilk GOF Test | |
| 22 | | Shapiro Wilk Critical Value | 0.897 | Data appear Normal at 1% Significance Level | |
| 23 | 1763 | Lilliefors Test Statistic | 0.825 | Lilliefors GOF Test | |
| 24 | 1 | 1% Lilliefors Critical Value | 0.263 | Data appear Normal at 1% Significance Level | |
| 25 26 | | | | : 1% Significance Level | |
| 27 | | | | | |
| 28 | | Ass | suming Non | mal Distribution | |
| 29 | 95% N | ormal UCL | | 95% UCLs (Adjusted for Skewness) | |
| 30 | | 95% Student's-t UCL | 22.44 | 95% Adjusted-CLT UCL (Chen-1995) | 22.5 |
| 31 | | | | 95% Modified-t UCL (Johnson-1978) | 22.49 |
| 32 | | | | | |
| 33 | | | Gamma (| GOF Test | |
| 34 | | A-D Test Statistic | 0.493 | Anderson-Darling Gamma GOF Test | |
| 35 | | 5% A-D Critical Value | 0.736 | Detected data appear Gamma Distributed at 5% Significance | e Level |
| 36 | | K-S Test Statistic | 0.201 | Kolmogorov-Smirnov Gamma GOF Test | |
| 37 | | 5% K-S Critical Value | 0.229 | Detected data appear Gamma Distributed at 5% Significand | e Level |
| 38 | | Detected data appear | Gamma Di | stributed at 5% Significance Level | |
| 39 | | | | Ohabishisa | |
| 40 | | | | Statistics | 6 262 |
| 41 | | k hat (MLE) Theta hat (MLE) | 7.91 2.409 | k star (bias corrected MLE) Theta star (bias corrected MLE) | 3.043 |
| 42 | | nu hat (MLE) | 2.409 | nu star (bias corrected MLE) | 175.3 |
| 43 | NA | ILE Mean (bias corrected) | 19.06 | MLE Sd (bias corrected) | 7.615 |
| 44 | IVI | LE MEAN (DIAS CONTECTEU) | 13.00 | Approximate Chi Square Value (0.05) | 145.7 |
| 45 46 | Adius | sted Level of Significance | 0.0312 | Adjusted Chi Square Value | 142.1 |
| 46 47 | . 10/01 | | | ,25.50 5 5400.5 Value | - |
| 48 | | Ass | suming Garr | nma Distribution | |
| 48 | 95% A | Approximate Gamma UCL | 22.93 | 95% Adjusted Gamma UCL | 23.51 |
| 50 | | | | · | |
| 51 | | | Lognorma | GOF Test | |
| 52 | 5 | Shapiro Wilk Test Statistic | 0.933 | Shapiro Wilk Lognormal GOF Test | |
| 53 | 10% S | Shapiro Wilk Critical Value | 0.895 | Data appear Lognormal at 10% Significance Level | |
| 54 | | Lilliefors Test Statistic | 0.181 | Lilliefors Lognormal GOF Test | |
| 55 | 10 | 0% Lilliefors Critical Value | 0.208 | Data appear Lognormal at 10% Significance Level | |
| | | | | | |

| 56 | Α | | В | | С | | D | Data ap | | F Lognormal | G at 10% Sig | H nificance | Level | I | | J | | K | L |
|---|---------------|-------|---------|--------------|----------------------------------|---|--|--|---|--|--|--|--|--|--|--|------------------------------|---|-----------------------------------|
| 57 | | | | | | | | | | | | | | | | | | | |
| 58 | | | | | | | | | | _ | al Statistics | | | | | | | | |
| 59 | | | | | | | | Logged | | 2.303 | | | | | | Mean o | | | 2.883 |
| 60 | | | | | l | Maxir | num of | Logged | Data | 3.434 | | | | | | SD o | f logge | ed Data | 0.372 |
| 61 | | | | | | | | | | | 15: | | | | | | | | |
| 62 | | | | | | | | 95% H | | | ormal Distri | bution | | 000 | 0/ Ob - | byshev | / N / N / L I | וב) ווכו | 24.83 |
| 63 | | | | | 05% | Choh | vehov | (MVUE) | | 23.44 | | | | | | byshev | ` | , | 31.08 |
| 64 | | | | | | | - | (MVUE) | | 38.22 | | | | 37.3 | 70 CHE | bysnev | (IVI V U | L) UCL | 31.00 |
| 65 66 | | | | | 3370 | 01101 | yonev | (WVOL) | OOL | 00.22 | | | | | | | | | |
| 66 67 | | | | | | | | Nonpa | arame | tric Distrib | ıtion Free U | JCL Statis | tics | | | | | | |
| 68 | | | | | | | | Data a | appea | r to follow a | Discernibl | e Distribu | tion | | | | | | |
| 69 | | | | | | | | | | | | | | | | | | | |
| 70 | | | | | | | | N | onpar | ametric Dis | tribution Fr | ee UCLs | | | | | | | |
| 71 | | | | | | | 9 | 95% CLT | UCL | 22.2 | | | | | 95% | BCA B | ootstr | ap UCL | 22.26 |
| 72 | | | | | 95% | Stan | dard B | Bootstrap | UCL | 22.14 | | | | | | 95% Bo | otstra | p-t UCL | 22.95 |
| 73 | | | | | ç | 95% F | lall's B | Bootstrap | UCL | 22.16 | | | | 959 | % Pero | centile B | ootstr | ap UCL | 22.2 |
| 74 | | | | | | | • | ean, Sd) | | 24.79 | | | | | • | shev(Me | - | ′ | 27.39 |
| 75 | | | | 97 | ′.5% Cl | hebys | hev(M | ean, Sd) | UCL | 30.99 | | | | 99% | Cheby | shev(Me | ean, S | Sd) UCL | 38.07 |
| 76 | | | | | | | | | | | | | | | | | | | |
| 77 | | | | | | | | | | | UCL to Us | е | | | | | | | |
| 78 | | | | | | | 5% St | udent's-t | UCL | 22.44 | | | | | | | | | |
| 79 | | Noto | Cuasa | otiono | | dina t | | ation of | o 0E0/ | LICI oro n | ravidad ta b | ala tha ua | or to | a alaat tha | moot | onnronr | ioto O | E0/ LICI | |
| | | | | | regard | aing ti | ie seie | ection of | a 95% | OCL are p | ovided to h | eip the us | er to : | select the | most | appropr | late 9 | 5% UCL. | |
| 80 | | | Racom | nmand | dations | ara h | acad ı | ınon dət | 9 6170 | data dietrik | ution and | kownoce | ueino | reculte f | rom ci | mulation | etudi | ioc | |
| 81 | Н | | | | | | | - | | | oution, and s | | | | | | | | ın |
| 81 82 | Но | | | | | | | - | | | oution, and sets; for addit | | | | | | | | ın. |
| 81 82 83 | Но | | | | | | | - | | | | | | | | | | | ın. |
| 81 82 83 84 | Ho GC7-WRB | | | | | | | - | | | | | | | | | | | ın. |
| 81 82 83 84 85 | | | | | | | | - | | | | | | | | | | | in. |
| 81 82 83 84 | | | | | | | | - | | orld data se | | | | | | | | | in. |
| 81 82 83 84 85 86 | | | | | s resul | lts will | not co | - | teal W | orld data se | ets; for addit | | | e user ma | ay war | | sult a | statisticia | 6 |
| 81 82 83 84 85 86 87 | | | | | s resul | lts will | not co | over all F | teal W | orld data se | ets; for addit | | | e user ma | ay war | nt to cons | Sult a | statisticia | |
| 81 82 83 84 85 86 87 | | | | | s resul | lts will | not co | Observa | teal W | General 6 7.43 | ets; for addit | | | e user ma | ay war | nt to cons | Sult a : Obser | rvations rvations Mean | 6 0 96.92 |
| 81 82 83 84 85 86 87 88 | | | | | s resul | lts will | not co | Observa | ations mum | General 6 7.43 220 | ets; for addit | | | e user ma | ay war | Distinct | Obser | rvations rvations Mean Median | 6 0 96.92 78.57 |
| 81 82 83 84 85 86 87 88 89 | | | | | s resul | Its will | ber of | Observa Min | ations mum sp | General 6 7.43 220 96.8 | ets; for addit | | | e user ma | ay war | Distinct | Obser Obser | rvations rvations Mean Median of Mean | 6 0 96.92 78.57 39.52 |
| 81 82 83 84 85 86 87 88 89 90 91 92 93 | | | | | s resul | Its will | ber of | Observa | ations mum sp | General 6 7.43 220 | ets; for addit | | | e user ma | ay war | Distinct | Obser Obser | rvations rvations Mean Median | 6 0 96.92 78.57 |
| 81 82 83 84 85 86 87 88 89 90 91 92 93 | | oweve | r, simu | lations | Total | I Num | ber of | Observa Mini Maxi | etions imum SD iation | General 6 7.43 220 96.8 0.999 | Statistics | ional insiç | ht the | Numb | ber of I | Distinct Missing Std. E | Obser Obser | rvations rvations Mean Median of Mean ewness | 6 0 96.92 78.57 39.52 |
| 81 82 83 84 85 86 87 88 89 90 91 92 93 94 | | oweve | r, simu | mple s | Total | I Num | ber of | Observa Mini Maxi nt of Var | intions imum SD iation | General 6 7.43 220 96.8 0.999 | Statistics | remental s | ht the | Numb | ber of l | Distinct Missing Std. E | Obser Obser Error o | rvations rvations Mean Median of Mean ewness | 6 0 96.92 78.57 39.52 |
| 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 | | oweve | r, simu | mple s | Total | Its will | ber of efficience (e.g., | Observa Mini Maxi nt of Var <10), if | etions mum SD iation | General 6 7.43 220 96.8 0.999 are collecte on ISM (ITF | Statistics d using incr | remental s | ht the | Numb Numb | ber of loor of | Distinct Missing Std. E | Obser Obser Sko | rvations rvations Mean Median of Mean ewness | 6 0 96.92 78.57 39.52 |
| 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 | | oweve | r, simu | mple s | Total | I Num Ccc smal | ber of efficie (e.g., C Tec | Observa Mini Maxi nt of Var <10), if th Reg Grecomme | imum SD iation data a | General 6 7.43 220 96.8 0.999 are collecte on ISM (ITF | Statistics d using increase C 2020 and the Chebys | remental s | ample 112) for | Numb Numb ing methor addition | ber of loor of loor of loon of | Distinct Missing Std. E | Obser Obser Sko | rvations rvations Mean Median of Mean ewness | 6 0 96.92 78.57 39.52 |
| 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 | | oweve | r, simu | mple s | Total size is r also tote that | Ccc small | ber of efficient (e.g., C Tectors may be Chelon | Observa Mini Maxi 10), if ch Reg Grecommobyshev l | eal W intions imum SD iation data a iuide cend th | General 6 7.43 220 96.8 0.999 are collecte on ISM (ITF e t-UCL or ften results | Statistics d using incr C 2020 and the Chebys in gross ov | remental sed ITRC 20 shev UCL | ampl for sr | Numb Numb ing methor additionall samu | ber of loodologonal gu | Distinct Missing Std. E | Obser Obser Sko | rvations rvations Mean Median of Mean ewness | 6 0 96.92 78.57 39.52 |
| 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 | GC7-WRB | oweve | r, simu | mple s | Total size is r also tote that | Ccc small | ber of efficient (e.g., C Tectors may be Chelon | Observa Mini Maxi 10), if ch Reg Grecommobyshev l | eal W intions imum SD iation data a iuide cend th | General 6 7.43 220 96.8 0.999 are collecte on ISM (ITF e t-UCL or ften results | Statistics d using increase C 2020 and the Chebys | remental sed ITRC 20 shev UCL | ampl for sr | Numb Numb ing methor additionall samu | ber of loodologonal gu | Distinct Missing Std. E | Obser Obser Sko | rvations rvations Mean Median of Mean ewness | 6 0 96.92 78.57 39.52 |
| 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 | GC7-WRB | oweve | r, simu | mple s | Total size is r also tote that | Ccc small | ber of efficient (e.g., C Tectors may be Chelon | Observa Mini Maxi 10), if ch Reg Grecommobyshev l | eal W intions imum SD iation data a iuide cend th | General 6 7.43 220 96.8 0.999 are collecte on ISM (ITF e t-UCL or ften results hnical Guid | Statistics d using incr C 2020 and the Chebys in gross ov | remental sed ITRC 20 shev UCL | ampl for sr | Numb Numb ing methor additionall samu | ber of loodologonal gu | Distinct Missing Std. E | Obser Obser Sko | rvations rvations Mean Median of Mean ewness | 6 0 96.92 78.57 39.52 |
| 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 | GC7-WRB | oweve | r, simu | mple s | Total size is r also tote that | Cosmal to ITRO | ber of efficient (e.g., C Tector may recommended the Property of the Proper | Observa Mini Maxi 10), if ch Reg Grecommobyshev l | mum SD iation data a fuide cend th | General 6 7.43 220 96.8 0.999 are collecte on ISM (ITF e t-UCL or ften results hnical Guid | Statistics d using increase 2020 and the Chebys in gross over the for a discontinuous control of the control o | remental sed ITRC 20 shev UCL | amplification of the Control of the | Numb Numb ing methor additionall samu | ber of loor of | Distinct Missing Std. E | Obser Obser Sko | rvations rvations Mean Median of Mean ewness | 6 0 96.92 78.57 39.52 |
| 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 | GC7-WRB | oweve | r, simu | mple s | Total size is r also to the that | Its will I Num Co smal to ITF Th fer to | ber of efficience (e.g., C Tectors may be Chelothe Process o Wilk | Observa Mini Maxi 10), if th Reg Grecommobyshev U | ations mum SD iation data a duide cend th JCL of | General 6 7.43 220 96.8 0.999 are collecte on ISM (ITF et-UCL or ften results hnical Guid | Statistics d using increase 2020 and the Chebys in gross over the for a discontinuous control of the control o | remental sed ITRC 20 shev UCL verestimate sussion of | ht the | Numb Numb ing methor additionall samuthe mea | ber of loor of loonal guple size. Wilk G | Distinct Missing Std. Eggy (ISM) Std. Eggy (ISM) Juidance, L. | Obser Obser Sko | rvations rvations Mean Median of Mean ewness | 6 0 96.92 78.57 39.52 |
| 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 101 | GC7-WRB | oweve | r, simu | mple s | Total size is r also to the that | Ccc small to ITRC The fer to | ber of efficient (e.g., C Tectors may not be Chelotthe Proceed to Wilk or Wi | Observa Mini Maxi 10), if th Reg Grecommobyshev Ucu 5. | ations mum SD iation data a fuide cend th JCL of 2 Tec | General 6 7.43 220 96.8 0.999 are collecte on ISM (ITF e t-UCL or ften results hnical Guid | Statistics d using increase 2020 and the Chebys in gross over the for a discontinuous control of the control o | remental sed ITRC 20 shev UCL verestimate sussion of | ht the | Numb Numb ing meth or additionall same the mea | ber of loor of | Distinct Missing Std. Egy (ISM) Juidance, Zees (n < | Obser Obser Sko | rvations rvations Mean Median of Mean ewness | 6 0 96.92 78.57 39.52 |
| 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102 103 | GC7-WRB | oweve | r, simu | mple s | Total size is r also tote that | cc small to ITRC The fer to Shapin Li | ber of efficie (e.g., C Tec may receive the Pr | Observa Mini Maxi 10), if th Reg Grecommobyshev U Test Sta Critical V Test Sta | data a diude conditions. JCL of 2 Teccondistic /alue | General 6 7.43 220 96.8 0.999 are collecte on ISM (ITF e t-UCL or ften results hnical Guid 0.823 0.713 0.301 0.373 | Statistics d using increte C 2020 and the Chebys in gross owe for a disconstitution of the Company of the Comp | remental sed ITRC 20 shev UCL rerestimate sussion of | ht the | Numb Numb ing methor additionall samp the mea | ber of loor of | Distinct Missing Std. E Std. E GOF Tes Gof Signific | Obser Obser Sko) appro | rvations rvations Mean Median of Mean ewness | 6 0 96.92 78.57 39.52 |
| 81 82 83 84 85 86 87 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 | GC7-WRB | oweve | r, simu | mple s | Total size is r also tote that | cc small to ITRC The fer to Shapin Li | ber of efficient (e.g., C Tectors e Chell the Proposition of Wilk D Wilk Diefors liefors | Observa Mini Maxi 10), if the Reg Grecommobyshev Ucullong Test State Critical Value Critical V | ations ations ations ations ation data a atide cond the JCL of 2 Tec atistic /alue atistic /alue appea | General 6 7.43 220 96.8 0.999 are collecte on ISM (ITF et-UCL or ften results hnical Guid 0.823 0.713 0.301 0.373 ar Normal a | Statistics d using incr C 2020 and the Chebys in gross ov le for a disc | remental sed ITRC 20 shev UCL rerestimal cussion of | ample appear | Numb Numb ing methor additionall samp the mea | ber of loor of | Distinct Missing Std. E Std. E GOF Tes Gof Signific | Obser Obser Sko) appro | rvations rvations Mean Median of Mean ewness | 6 0 96.92 78.57 39.52 |
| 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 | GC7-WRB | oweve | r, simu | mple s | Total size is r also tote that | cc small to ITRC The fer to Shapin Li | ber of efficient (e.g., C Tectors e Chell the Proposition of Wilk D Wilk Diefors liefors | Observa Mini Maxi 10), if the Reg Grecommobyshev Ucullong Test State Critical Value Critical V | ations ations ations ations ation data a atide cond the JCL of 2 Tec atistic /alue atistic /alue appea | General 6 7.43 220 96.8 0.999 are collecte on ISM (ITF et-UCL or ften results hnical Guid 0.823 0.713 0.301 0.373 ar Normal a | Statistics d using increte C 2020 and the Chebys in gross owe for a disconstitution of the Company of the Comp | remental sed ITRC 20 shev UCL rerestimal cussion of | ample appear | Numb Numb ing methor additionall samp the mea | ber of loor of | Distinct Missing Std. E Std. E GOF Tes Gof Signific | Obser Obser Sko) appro | rvations rvations Mean Median of Mean ewness | 6 0 96.92 78.57 39.52 |
| 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 | GC7-WRB | oweve | r, simu | mple s | Total size is r also tote that | cc small to ITRC The fer to Shapin Li | ber of efficient (e.g., C Tectors e Chell the Proposition of Wilk D Wilk Diefors liefors | Observa Mini Maxi 10), if the Reg Grecommobyshev Ucullong Test State Critical Value Critical V | mum SD iation data a Guide Cend th JCL of 2 Tec atistic /alue atistic /alue atpea | General 6 7.43 220 96.8 0.999 are collecte on ISM (ITF e t-UCL or ften results hnical Guid Normal 0.823 0.713 0.301 0.373 ar Normal a | Statistics d using increase 2020 and the Chebys in gross over the for a disconstitution of the Chebys in gross over the for a disconstitution of the Chebys in gross over the for a disconstitution of the Chebys in gross over the for a disconstitution of the Chebys in gross over the Chebys in gro | remental sed ITRC 20 shev UCL rerestimate cussion of Data | ample appear | Numb Numb ing methor additionall samp the mea | ber of loor of | Distinct Missing Std. E Std. E GOF Tes Gof Signific | Obser Obser Sko) appro | rvations rvations Mean Median of Mean ewness | 6 0 96.92 78.57 39.52 |
| 81 82 83 84 85 86 87 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 | GC7-WRB | oweve | r, simu | mple s refer | Total size is r also tote that | Its will I Num Cc smal to ITF ITRC Th fer to Shapir Li 1% Lil | ber of efficient (e.g., C Tectors may recommended the Property of Wilker) o Wilker Wi | Observa Mini Maxi 10), if the Reg Grecommobyshev Ucullong Test State Critical Value Critical V | mum SD iation data a Guide Cend th JCL of 2 Tec atistic /alue atistic /alue atpea | General 6 7.43 220 96.8 0.999 are collecte on ISM (ITF e t-UCL or ften results hnical Guid Normal 0.823 0.713 0.301 0.373 ar Normal a | Statistics d using incr C 2020 and the Chebys in gross ov le for a disc | remental sed ITRC 20 shev UCL rerestimal sussion of Data icance Lesmall samution | ample appea | Numb Numb ing methor additionall samp the mea | ber of loor of | Distinct Missing Std. E Std. E gy (ISM) Jidance, L. GOF Tes 6 Signific | Obser Obser Obser Tror c Sko | rvations rvations Mean Median of Mean ewness roach, | 6 0 96.92 78.57 39.52 |

| | Α | В | С | D | E | F | G | Н | l J K | L |
|--|---|-------------|--------------------------------------|--|---|---|----------------------------------|------------|---|----------------|
| 111 | | | | 95% Stude | ent's-t UCL | 176.6 | | | 95% Adjusted-CLT UCL (Chen-1995) | 166.3 |
| 112 | | | | | | | | | 95% Modified-t UCL (Johnson-1978) | 177.2 |
| 113 | | | | | | | | | | |
| 114 | | | | 4 D T | . 0 | | GOF Test | | D. I' O | |
| 115 | | | | | est Statistic | 0.639 0.721 | Datastad | | erson-Darling Gamma GOF Test | and awal |
| 116 | | | | 5% A-D Cri | est Statistic | 0.721 | Detected | | ear Gamma Distributed at 5% Significand gorov-Smirnov Gamma GOF Test | ce Level |
| 117 | | | | 5% K-S Cri | | 0.298 | Detected | | ear Gamma Distributed at 5% Significand | na l aval |
| 118 | | | | | | | stributed at 59 | | | SC ECVCI |
| 119 120 | | | | | | | eliable for sma | | | |
| 121 | | | | | | | | | | |
| 122 | | | | | | Gamma | Statistics | | | |
| 123 | | | | k | hat (MLE) | 0.767 | | | k star (bias corrected MLE) | 0.495 |
| 124 | | | | Theta | hat (MLE) | 126.4 | | | Theta star (bias corrected MLE) | 196 |
| 125 | | | | | hat (MLE) | 9.202 | | | nu star (bias corrected) | 5.935 |
| 126 | | | М | LE Mean (bias | corrected) | 96.92 | | | MLE Sd (bias corrected) | 137.8 |
| 127 | | | | | | | | | Approximate Chi Square Value (0.05) | 1.606 |
| 128 | | | Adjus | sted Level of S | ignificance | 0.0122 | | | Adjusted Chi Square Value | 0.927 |
| 129 | | | | | A == | i O | Dietwik sti | | | |
| 130 | | | 05% Λ | approximate Ga | | 358 | nma Distributio | on ———— | 95% Adjusted Gamma UCL | 620.6 |
| 131 | | | 9576 F | приохіпіате Са | illilla UCL | 336 | | | 33 % Adjusted Gariiria OCL | 020.0 |
| 132 133 | | | | | | Lognorma | I GOF Test | | | |
| 134 | | | S | Shapiro Wilk Te | st Statistic | 0.822 | | Sha | apiro Wilk Lognormal GOF Test | |
| 135 | | | | hapiro Wilk Cri | | 0.826 | | | Lognormal at 10% Significance Level | |
| 136 | | | | Lilliefors Te | st Statistic | 0.273 | | L | illiefors Lognormal GOF Test | |
| 137 | | | 10 | % Lilliefors Cr | tical Value | 0.298 | Г | ata appea | ar Lognormal at 10% Significance Level | |
| 138 | | | | | | | ormal at 10% | | | |
| 139 | | | | Note | GOF tests | may be unre | eliable for sma | all sample | sizes | |
| 140 | | | | | | | | | | |
| 141 | | | | N4: : | | | I Statistics | | M (1 15 1 | 0.700 |
| 142 | | | | Minimum of Lo | | | | | Mean of logged Data SD of logged Data | 3.796 1.551 |
| 143 | | | | waxiiiiuiii oi Lo | gyeu Data | 5.594 | | | 3D of logged Data | 1.551 |
| 144 | | | | | Assı | ımina Loana | ormal Distribu | tion | | |
| 145 146 | | | | 9 | 5% H-UCL | 9925 | | | 90% Chebyshev (MVUE) UCL | 301 |
| 147 | | | 95% | Chebyshev (M | VUE) UCL | 388.2 | | | 97.5% Chebyshev (MVUE) UCL | 509.3 |
| 148 | | | 99% | Chebyshev (M | VUE) UCL | 747.2 | | | | |
| 149 | | | | | | | | | 1 | |
| 150 | | | | | Nonparame | etric Distribu | tion Free UCL | Statistic | s | |
| 151 | | | | l | Data appea | r to follow a | Discernible D | istributio | n | |
| 152 | | | | | | | | | | |
| 153 | | | | <u>+</u> | - | | tribution Free | UCLs | 0-2/-0-2 | 450.0 |
| | | | 050 | | CLT UCL | 161.9 | | | 95% BCA Bootstrap UCL | 159.3 |
| 154 | | | | Standard Boo | tstrap UCL | 155.9 | | | 95% Bootstrap-t UCL 95% Percentile Bootstrap UCL | 175.7 159.9 |
| 154 155 | | | | | totro - LIOI | 122 | | | | 1288 |
| 154 155 156 | | | g | 95% Hall's Boo | | 132 | | | • | |
| 154 155 156 157 | | | 90% Ch | 95% Hall's Boo nebyshev(Mear | n, Sd) UCL | 215.5 | | | 95% Chebyshev(Mean, Sd) UCL | 269.2 |
| 154 155 156 157 158 | | | 90% Ch | 95% Hall's Boo | n, Sd) UCL | | | | • | |
| 154 155 156 157 158 159 | | | 90% Ch | 95% Hall's Boo nebyshev(Mear | n, Sd) UCL | 215.5 343.7 | UCL to Use | | 95% Chebyshev(Mean, Sd) UCL | 269.2 |
| 154 155 156 157 158 159 160 | | | 90% Ch | 95% Hall's Boo nebyshev(Mear | n, Sd) UCL n, Sd) UCL | 215.5 343.7 | UCL to Use | | 95% Chebyshev(Mean, Sd) UCL | 269.2 |
| 154 155 156 157 158 159 160 161 | | | 90% Ch | 95% Hall's Boo nebyshev(Mear nebyshev(Mear | n, Sd) UCL n, Sd) UCL | 215.5 343.7 Suggested | UCL to Use | | 95% Chebyshev(Mean, Sd) UCL | 269.2 |
| 154 155 156 157 158 159 160 161 162 | | Note: Sugge | 90% Cr 97.5% Cr | 95% Hall's Boo nebyshev(Mear nebyshev(Mear 95% Stude | n, Sd) UCL n, Sd) UCL ent's-t UCL | 215.5 343.7 Suggested 176.6 | | the user t | 95% Chebyshev(Mean, Sd) UCL | 269.2 490.1 |
| 154 155 156 157 158 159 160 161 162 163 | | | 90% Ch 97.5% Ch | 95% Hall's Boo nebyshev(Mean nebyshev(Mean 95% Stude | n, Sd) UCL n, Sd) UCL ent's-t UCL | 215.5 343.7 Suggested 176.6 | ovided to help | | 95% Chebyshev(Mean, Sd) UCL 99% Chebyshev(Mean, Sd) UCL | 269.2 490.1 |
| 154 155 156 157 158 159 160 161 162 | | Recon | 90% Ch 97.5% Ch estions regard | 95% Hall's Boo nebyshev(Mean nebyshev(Mean 95% Stude ding the selecti are based upo | n, Sd) UCL n, Sd) UCL ent's-t UCL on of a 95% n data size | 215.5 343.7 Suggested 176.6 UCL are production, data distribution | ovided to help ution, and ske | wness usi | 95% Chebyshev(Mean, Sd) UCL 99% Chebyshev(Mean, Sd) UCL to select the most appropriate 95% UCL. | 269.2 |

A B C D E F G H I J K L

| 1 | A B C D E | F | G H I J K L |
|----------|---|--------------------|--|
| 2 | OGE Status | uco ioi one | censored i dii bata cets |
| 3 | User Selected Options | LAF. 40 D | |
| 5 | Date/Time of Computation ProUCL 5.2 11/19/2024 4 From File ProUCL Input.xls | +.45:42 PM | |
| 6 | Full Precision OFF | | |
| 7 | Confidence Coefficient 95% | | |
| 9 | Number of Bootstrap Operations 2000 | | |
| 10 | | | |
| 11 12 | GF-WRA | | |
| 13 | | General | Il Statistics |
| 14 | Total Number of Observations | 26 | Number of Distinct Observations 22 |
| 15 16 | Minimum | 170 | Number of Missing Observations 0 Mean 305.6 |
| 17 | Maximum | 491 | Median 287.5 |
| 18 19 | SD | 78.73 | Std. Error of Mean 15.44 |
| 20 | Coefficient of Variation | 0.258 | Skewness 0.634 |
| 21 | | Normal | GOF Test |
| 22 | Shapiro Wilk Test Statistic | 0.96 | Shapiro Wilk GOF Test |
| 23 24 | 1% Shapiro Wilk Critical Value Lilliefors Test Statistic | 0.891 0.132 | Data appear Normal at 1% Significance Level Lilliefors GOF Test |
| 25 | 1% Lilliefors Critical Value | 0.199 | Data appear Normal at 1% Significance Level |
| 26 27 | Data appea | ar Normal a | at 1% Significance Level |
| 28 | Ass | sumina Nor | rmal Distribution |
| 29 | 95% Normal UCL | | 95% UCLs (Adjusted for Skewness) |
| 30 31 | 95% Student's-t UCL | 332 | 95% Adjusted-CLT UCL (Chen-1995) 333.1 95% Modified-t UCL (Johnson-1978) 332.3 |
| 32 | | | |
| 33 34 | * D.T. (0 | | GOF Test |
| 35 | A-D Test Statistic 5% A-D Critical Value | 0.234 0.744 | Anderson-Darling Gamma GOF Test Detected data appear Gamma Distributed at 5% Significance Level |
| 36 | K-S Test Statistic | 0.109 | Kolmogorov-Smirnov Gamma GOF Test |
| 37 38 | 5% K-S Critical Value | 0.171 | Detected data appear Gamma Distributed at 5% Significance Level Distributed at 5% Significance Level |
| 39 | регестей аата арреаг | adminia Di | visuributed at 576 SigniffCalice Level |
| 40 | | | a Statistics |
| 41 42 | k hat (MLE) Theta hat (MLE) | 16.13 18.95 | k star (bias corrected MLE) 14.29 Theta star (bias corrected MLE) 21.39 |
| 43 | nu hat (MLE) | | nu star (bias corrected) 743.1 |
| 44 45 | MLE Mean (bias corrected) | 305.6 | MLE Sd (bias corrected) 80.84 |
| 46 | Adjusted Level of Significance | 0.0398 | Approximate Chi Square Value (0.05) 680.9 Adjusted Chi Square Value 676.9 |
| 47 | | | |
| 48 49 | Ass 95% Approximate Gamma UCL | | mma Distribution 95% Adjusted Gamma UCL 335.5 |
| 50 | 93% Approximate Gamina OCL | 333.0 | 95 % Aujusteu Gaillilla OCL 555.5 |
| 51 | | | al GOF Test |
| 52 53 | Shapiro Wilk Test Statistic 10% Shapiro Wilk Critical Value | 0.984 0.933 | Shapiro Wilk Lognormal GOF Test Data appear Lognormal at 10% Significance Level |
| 54 | Lilliefors Test Statistic | 0.0925 | Lilliefors Lognormal GOF Test |
| 55 56 | 10% Lilliefors Critical Value | 0.156 | Data appear Lognormal at 10% Significance Level |
| 57 | Data appear i | Lognormal | at 10% Significance Level |
| 58 | | | nal Statistics |
| 59 60 | Minimum of Logged Data Maximum of Logged Data | 5.136 6.196 | Mean of logged Data 5.691 SD of logged Data 0.256 |
| 61 | | | |
| 62 63 | | | normal Distribution |
| 64 | 95% H-UCL 95% Chebyshev (MVUE) UCL | 335.3 373.2 | 90% Chebyshev (MVUE) UCL 352.1 97.5% Chebyshev (MVUE) UCL 402.4 |
| 65 | 99% Chebyshev (MVUE) UCL | 459.8 | 7.15.15 0.1007,0.1107 (11.17 0.17 0.01 1.17 0.17 |
| 66 67 | Nonorama | tric Dietrib | ution Free UCL Statistics |
| 68 | | | a Discernible Distribution |
| 69 70 | | | strikution Free LICLs |
| 71 | Nonpar 95% CLT UCL | ametric Dis 331 | stribution Free UCLs 95% BCA Bootstrap UCL 331.3 |
| 72 | 95% Standard Bootstrap UCL | 330.3 | 95% Bootstrap-t UCL 334.4 |
| 73 74 | 95% Hall's Bootstrap UCL | 333.8 | 95% Percentile Bootstrap UCL 330 |
| 75 | 90% Chebyshev(Mean, Sd) UCL 97.5% Chebyshev(Mean, Sd) UCL | 351.9 402 | 95% Chebyshev(Mean, Sd) UCL 372.9 99% Chebyshev(Mean, Sd) UCL 459.2 |
| 76 | | | |
| 77 78 | 95% Student's-t UCL | Suggested 332 | d UCL to Use |
| 79 | 95% Student S-f UCL | 33Z | |
| 80 | | | provided to help the user to select the most appropriate 95% UCL. |
| 81 82 | | | bution, and skewness using results from simulation studies. ets; for additional insight the user may want to consult a statistician. |
| JŁ | However, Simulations results will not cover all Real W | onu uala Se | eta, for additional marght the user may want to consult a statistician. |

| | Α | В | С | | D | Е | - | F | G | | Н | | | | J | ŀ | (| L |
|------------|--------|-------------|-------------|------------------|---------------------------------|-----------------------------|----------------|--------------------------------|----------------------------------|-----------------|------------------|-----------|-----------|-----------|--------------------------|---------------|-----------|----------------|
| 83 84 | | | | | | | | | | | | | | | | | | |
| | GF-WRB | | | | | | | | | | | | | | | | | |
| 86 | | | | | | | | | | | | | | | | | | |
| 87 88 | | | Tc | atal Nu | mber of (| Obcony | ations | General 7 | Statistics | | | | Numb | or of | Distinct (| Oheon | ations | 7 |
| 89 | | | 10 | <u>ilai ivui</u> | ilibei oi c | Juseiva | 2110115 | / | | | | | | | Missing (| | | 0 |
| 90 | | | | | | | imum | 28.7 | | | | | | | | | Mean | 84.81 |
| 91 92 | | | | | | Maxi | imum SD | 141 42.32 | | | | | | | Std F | M Error of | edian | 79.36 16 |
| 93 | | | | C | oefficien | nt of Var | | 0.499 | | | | | | | Olu. L | | vness | 0.402 |
| 94 95 | | | | | | 40) '(| | | | | | | | | (1014) | | | |
| 96 | | Note: Sa | | | | | | re collected on ISM (ITR | | | | | | | | | acn, | |
| 97 | | ŀ | | nat ITR | C may re | ecomm | end th | e t-UCL or t | he Cheby | shev | UCL for | sma | ıll samp | ole siz | | | | |
| 98 99 | | | | | | | | ften results hnical Guid | | | | | | | 1 | | | |
| 100 | | | | telel to | o uie Pic | <u> </u> | .2 160 | illical Guiu | e ioi a uis | Cussic | on or un | e Cili | ebysne | v UC | <u></u> | | | |
| 101 | | | | | | | | | GOF Test | | | | | | | | | |
| 102 103 | | | 1% | | iro Wilk iro Wilk (| | | 0.907 0.73 | | | Data ani | | | | GOF Tes Signific | | evel | |
| 104 | | | | | _illiefors | | | 0.189 | | | Jata ap | | Lilliefor | | | Janee L | CVCI | |
| 105 | | | | 1% L | illiefors (| | | 0.35 | 10/ 0: : | | | | Normal | at 1% | 6 Signific | cance L | evel | |
| 106 107 | | | | | Not | <u>uata</u> le GOF | appea tests | ar Normal at may be unre | <u>: 1% Signi</u> eliable for | ricano small | e Leve samnle | ı Size | es. | | | | | |
| 108 | | | | | 1100 | .5 401 | | | | | | . 5.20 | | | | | | |
| 109 110 | | | OF0' | Name | al lioi | | Ass | suming Nor | mal Distrib | ution | | 0/ 11/ | N c /A - | li i et e | d for Ole | D14/P # = = = | ` | |
| 111 | | | <u> </u> | | <u>al UCL</u> 95% Stu | udent's-t | t UCL | 115.9 | | | 95 | | | | d for Ske LT UCL | | | 113.7 |
| 112 | | | | | | | | <u> </u> | | | | | | | UCL (Jo | | | 116.3 |
| 113 114 | | | | | | | | Gammo | GOF Test | | | | | | | | | |
| 115 | | | | | A-D | Test Sta | atistic | 0.298 | | | And | ersor | n-Darlin | ıg Ga | mma GC | OF Test | | |
| 116 | | | | Ę | 5% A-D (| | | 0.71 | Detec | ted da | ata appe | ear G | amma | Distril | outed at | 5% Sigi | nificano | e Level |
| 117 118 | | | | | <u>K-S</u> 5% K-S (| Test Sta | | 0.186 0.313 | Detec | ted d: | | | | | iamma (outed at | | | lava l a |
| 119 | | | | | | | | Gamma Di | | | | | | Distrii | Juica at | J 70 Olgi | illicario | ic Ecver |
| 120 121 | | | | | Not | <u>ie GOF</u> | tests | may be unre | eliable for | <u>small</u> | sample | size | s | | | | | |
| 122 | | | | | | | | Gamma | Statistics | | | | | | | | | |
| 123 | | | | | | k hat (| | 4.281 | | | | | | | (bias co | | | 2.541 |
| 124 125 | | | | | | eta hat (| | 19.81 59.93 | | | | | Theta | | (bias co ı star (bi | | | 33.37 |
| 126 | | | | MLE N | Mean (bia | <u>nu hat (</u> as corre | | 84.81 | | | | | | | E Sd (bi | | | 35.58 53.2 |
| 127 | | | | | • | | | | | | | App | oroxima | te Ch | i Square | Value | (0.05) | 22.93 |
| 128 129 | | | Ad | ljusted | Level of | Signific | cance | 0.0158 | | | | | | Adjus | ted Chi S | Square | Value | 19.92 |
| 130 | | | | | | | | suming Gan | ma Distril | bution |) | | | | | | | |
| 131 132 | | | 95% | 6 Appro | oximate (| <u>Gamma</u> | ı UCL | 131.6 | | | | | 9 | 95% A | djusted | Gamma | UCL | 151.5 |
| 133 | | | | | | | | Lognorma | I GOF Tes | | | | | | | | | |
| 134 | | | | | iro Wilk | | | 0.928 | . 461 160 | | | | | | mal GO | | | |
| 135 136 | | | 10% | | iro Wilk (| | | 0.838 | | <u>Da</u> | | | | | 0% Sign | | Level | |
| 137 | | | | | <u>illiefors</u> illiefors (| | | 0.182 0.28 | | Da | | | | | <u>al GOF</u> 0% Sign | | Level | |
| 138 | | | | | | Data ap | ppear | Lognormal a | | nifica | nce Le | vel | | | | | | |
| 139 140 | | | | | Not | <u>ie GOF</u> | tests I | may be unre | eliable for | <u>small</u> | sample | size | s | | | | | |
| 141 | | | | | | | | Lognorma | l Statistics | S | | | | | | | | |
| 142 143 | | | | | imum of | | | 3.357 | | | | | | | Mean of | | | 4.319 |
| 144 | | | | waxi | imum of | <u>Logged</u> | Data | 4.949 | | | | | | | SD 01 | f logged | ı Data | 0.557 |
| 145 | | | | | | | | ıming Logno | rmal Dist | ributic | n | | | | | | | |
| 146 147 | | | 05 | 0/ Cb - | hych | 95% H | | 157.7 | | | | | | | byshev | | | 140 |
| 148 | | | | | ebyshev (ebyshev (| | | 164.6 265.9 | | | | | 97.5% | ₀ ∪ne | ebyshev | (IVI V UE | JUCL | 198.7 |
| 149 | | | | | ., | | | | | | | | | | | | | |
| 150 151 | | | | | | | | tric Distribu r to follow a | | | | | | | | | | |
| 152 | | | | | | aia 8 | apped | i to ioliow a | ייסרוווום איריים. | וה הופ | •แามนแบ | 11 | | | | | | |
| 153 | | | | | - | | | ametric Dis | tribution F | ree U | CLs | | _ | 051 | , DC : - | | 110: | 110.5 |
| 154 155 | | | Ot | 5% Sta | 95 Indard Bo | 5% CLT | | 111.1 109.4 | | | | | | | <u>6 BCA B</u> 95% Bo | | | 112.5 130.3 |
| 156 | | | | 95% | Hall's Bo | ootstrap | UCL | 140.9 | | | | | | 6 Pero | centile B | ootstrap | UCL | 109.9 |
| 157 158 | | | | | shev(Me | | | 132.8 | | | | | | | shev(Me | | | 154.5 |
| 159 | | | 97.5% | uneby | shev(Me | ean, Sd) | UCL | 184.7 | | | | | 99% (| neby | shev(Me | ean, Sd | UCL | 244 |
| 160 | | | | | | | | Suggested | UCL to Us | se | | | | | | | | |
| 161 162 | | | | | 95% Stu | ıdent's-t | t UCL | 115.9 | | | | | | | | | | |
| 163 | | Note: Sugge | estions rea | arding | the selec | ction of | a 95% | UCL are pr | ovided to h | nelp th | ne user | to se | lect the | most | appropr | iate 959 | % UCL. | |
| 164 | | | | | | | | data distrib | | | | | | | | | | |

| 405 | Α | В | С | D | E | F | G | Н | Į | J | K | L |
|---------------------------------|--------|-------------|-----------------|--------------------|-----------------------------------|-----------------------|-----------------|-------------------|-----------------|----------------------------|------------------------------|----------------|
| 165 166 | | wever, simu | lations results | s will not co | over all Real W | orld data se | ts; for additio | nal insight the | e user may v | vant to cons | ult a statisticia | an. |
| 167 | | | | | | | | | | | | |
| | GF-WRC | | | | | | | | | | | |
| 169 | | | | | | | | | | | | |
| 170 | | | | | | General | Statistics | | | | | |
| 171 | | | Total | Number of | Observations | 17 | | | | | Observations | 17 |
| 172 173 | | | | | | 44 | | | Number | of Missing C | Observations | 0 |
| 174 | | | | | Minimum Maximum | 41 1340 | | | | | Mean Median | 143.1 75 |
| 175 | | | | | SD | 309.1 | | | | Std F | rror of Mean | 74.96 |
| 176 | | | | Coefficier | nt of Variation | 2.16 | | | | Old. L | Skewness | 4.094 |
| 177 | | | | | | | | | | | | |
| 178 | | | | | | | GOF Test | | | | | |
| 179 180 | | | | | Test Statistic | 0.318 | | | | k GOF Test | | |
| 181 | | | 1% Sr | | Critical Value Test Statistic | 0.851 0.494 | | Data Not | Lilliefors | % Significar | ice Level | |
| 182 | | | 19 | | Critical Value | 0.434 | | Data Not | | % Significar | | |
| 183 | | | • | 70 Elliototo | | | % Significar | | - Torrinar at 1 | 70 Olgimiodi | 100 20101 | |
| 184 | | | | | | | | | | | | |
| 185 | | | | | As: | <u>suming Nor</u> | mal Distributi | | | | | |
| 186 187 | | | 95% No | ormal UCL | | 074 | | | | sted for Ske | | 246 |
| 188 | | | | 95% 50 | udent's-t UCL | 274 | | | | | (Chen-1995) hnson-1978) | 346 286.4 |
| 189 | | | | | | | | | 33 /6 IVIOUIIIE | u-1 OCL (301 | 1115011-1970) | 200.4 |
| 190 | | | | - | | Gamma | GOF Test | | | | | |
| 191 | | | | | Test Statistic | 3.592 | | | | Gamma GO | | |
| 192 | | | | | Critical Value | 0.768 | Da | ata Not Gamm | na Distribute | ed at 5% Sig | nificance Lev | el |
| 193 194 | | | | | Test Statistic | 0.426 | - | | | v Gamma G | | |
| 195 | | | | | Critical Value Oata Not Gamr | 0.215 | | | | at 5% Sig | nificance Lev | el |
| 196 | | | | | ata NOL Gailli | | eu at 5 /6 Sig | IIIIICAIICE LEV | <u>CI</u> | | | |
| 197 | | | | | | Gamma | Statistics | | | | | |
| 198 | | | | | k hat (MLE) | 0.958 | | | ks | tar (bias cor | rrected MLE) | 0.828 |
| 199 | | | | | eta hat (MLE) | 149.4 | | | Theta s | | rrected MLE) | 172.8 |
| 200 201 | | | | | nu hat (MLE) | 32.57 | | | | | as corrected) | 28.15 |
| 202 | | | ML | <u>-E Mean (bi</u> | ias corrected) | 143.1 | | Λ | | | as corrected) | 157.3 17.05 |
| 203 | | | Δdius | ted Level o | f Significance | 0.0346 | | A | | | Value (0.05) Square Value | 16.14 |
| 204 | | | Aujus | ieu Levei o | i Signilicance | 0.0340 | | | Au | justeu Cili S | quale value | 10.14 |
| 205 | | | | | Ass | suming Gam | nma Distribut | tion | | | | |
| 206 | | | 95% Ap | pproximate | Gamma UCL | 236.4 | | | 95% | % Adjusted C | Gamma UCL | 249.6 |
| 207 208 | | | | | | | | | | | | |
| 208 | | | CI | hanira Wille | Toot Ctotiotic | Lognorma 0.623 | I GOF Test | Chani | no Mille I om | normal COE | Toot | |
| 210 | | | | | Test Statistic Critical Value | 0.623 | | | | normal GOF 10% Signific | | |
| 211 | | | 10 70 01 | | Test Statistic | 0.309 | | | | rmal GOF T | | |
| 212 | | | 109 | | Critical Value | 0.19 | | | | 10% Signific | | |
| 213 | | | | | Data Not Lo | ognormal at | 10% Signific | ance Level | | | | |
| 214 215 216 | | | | | | | | | | | | |
| 215 | | | | Minimum of | Logged Date | | I Statistics | | | Moon of | Jaggad Data | 4 250 |
| 217 | | | | | Logged Data Logged Data | 3.714 7.2 | | | | | logged Data logged Data | 4.358 0.791 |
| 218 | | | iv | laximum or | Logged Data | 7.2 | | | | <u> </u> | logged Data | 0.731 |
| 219 | | | | | Assı | ıming Logno | rmal Distribu | ution | | | | |
| 220 | | | | | 95% H-UCL | 170 | | | | | MVUE) UCL | 168.9 |
| 221 | | | | | (MVUE) UCL | 198.1 | | | 97.5% (| <u>Chebyshev (</u> | MVUE) UCL | 238.7 |
| 222 223 | | | 99% (| <u>Inebyshev</u> | (MVUE) UCL | 318.4 | | | | | | |
| 224 | | | | | Nonnarame | tric Dietribu | tion Free UC | 1 Statistics | | | | |
| 225 | | | | | | | iscernible D | | | | | |
| 225 226 227 | | | | | | | | | | | | |
| 227 | | | | | | | tribution Free | e UCLs | | | | |
| 228 229 | | | 0501 | | 5% CLT UCL | 266.4 | | | | | ootstrap UCL | 369.2 |
| 230 | | | | | ootstrap UCL ootstrap UCL | 260.2 994.7 | | | OEO/ F | | otstrap-t UCL | |
| 221 | | | | | ean, Sd) UCL | 368 | | | | | ootstrap UCL an, Sd) UCL | 291.5 469.9 |
| 232 | | | | | ean, Sd) UCL | 611.2 | | | | | an, Sd) UCL | 888.9 |
| 233 | | | | | , , , , , , , , , | | | | | | | |
| 234 | | | | | | | UCL to Use | | | | | |
| 232 233 234 235 236 | | | | 95% St | udent's-t UCL | 274 | | | | | | |
| 236 | | Th | louisted LIC | 0.000 5 | d on see: | iono that the | doto ware - | vallacted != - | randam ar | d upbiocod : | monros | |
| 238 | | i ne ca | iicuiated UCL | | ed on assumpt ase verify the d | | | | | ı undiased î | наннег. | |
| 238 239 240 | | | | | were collected | | | | | | | |
| 240 | | | | | hen contact a | | | | | | | |
| 241 | | | | | | | | | | | | |
| 242 | ı | Note: Sugge | stions regardi | ing the sele | ection of a 95% | UCL are pr | ovided to hel | p the user to s | select the m | ost appropri | ate 95% UCL |] |
| 243 244 | 11- | Recon | mendations a | are based u | ipon data size, | , data distrib | ution, and ske | ewness using | results fron | 1 simulation | studies. | |
| 244 245 | HO | wever, simu | iauons result | 5 WIII HOT CO | over all Real W | ronu data se | is, ior additio | ııaı ırısıgnt the | user may v | varii io cons | uit a statisticia | JII. |
| 246 | | | | | | | | | | | | |
| | | | | | | | | | | | | |

| | A B C D E | | F | G | Н | | J | K | L |
|------------|--|----------------|------------------|-------------------------------|----------------|---------------|----------------------------|---------------------------------|----------------|
| 247 248 | GF-WRC-Rev | | | | | | | | |
| 249 | | | General | Statistics | | | | | |
| 250 | Total Number of Observatio | | 16 | | | | | Observations | 16 |
| 251 252 | Minimu | ım 4 | 41 | | | Numbe | r of Missing (| Observations Mean | 0 68.31 |
| 253 | Maximu | | 02 | | | | | Median | 71 |
| 254 255 | | | 20.42 | | | | Std. E | rror of Mean | 5.106 |
| 256 | Coefficient of Variation | on | 0.299 | | | | | Skewness | 0.154 |
| 257 258 | | | Normal (| GOF Test | | | | | |
| 258 259 | | | 0.928 | | D-4 | | ilk GOF Test | | |
| 260 | 1% Shapiro Wilk Critical Valu Lilliefors Test Statis | | 0.844 | | рата арре | | at 1% Signific GOF Test | ance Levei | |
| 261 | 1% Lilliefors Critical Val | ue | 0.248 | | | | at 1% Signific | ance Level | |
| 262 263 | Data ap | pear N | lormal at | t 1% Significa | ance Level | | | | |
| 264 | | Assum | ning Norr | mal Distributi | on | | | | |
| 265 | 95% Normal UCL | | | | 95% | | usted for Ske | | |
| 266 267 | 95% Student's-t UC | | 77.26 | | | | | (Chen-1995) hnson-1978) | 76.92 77.3 |
| 268 | | | | | | 33 70 WOUTH | CG-1 OOL (00 | 11113011-1370) | 77.0 |
| 269 270 | 4.D.T. +0.15 | | | GOF Test | | | 0 00 | \F.T. | |
| 270 | A-D Test Statis 5% A-D Critical Vali | | 0.475 0.739 | Detected | | | I Gamma GC |)F Test 5% Significan | ce I evel |
| 272 | K-S Test Statis | | 0.163 | Detected | | | ov Gamma G | | JC LCVCI |
| 273 274 | 5% K-S Critical Value | ue | 0.215 | Detected | data appea | r Gamma D | istributed at | 5% Significan | ce Level |
| 275 | Detected data appoint | ear Ga | amma Dis | stributed at 5 | % Significa | nce Level | | | |
| 276 | | | | Statistics | | | | | |
| 277 278 | k hat (ML | | 11.58 | | | | | rrected MLE) | 9.446 |
| 279 | Theta hat (ML nu hat (ML | | 5.902 370.4 | | | <u>i neta</u> | star (bias co | as corrected) | 7.232 302.3 |
| 280 | MLE Mean (bias correcte | | 68.31 | | | | MLE Sd (bia | as corrected) | 22.23 |
| 281 | Adjusted Loyal of Cignifican | | 0.0335 | | | | | Value (0.05) | 263 258.8 |
| 282 283 | Adjusted Level of Significan | ce (| 0.0335 | | | A | ajustea Chi S | Square Value | 258.8 |
| 284 | | | | ma Distributi | ion | | | | |
| 285 286 | 95% Approximate Gamma UC | <u>CL 7</u> | 78.51 | | | 95 | Marked 6 | Gamma UCL | 79.78 |
| 287 | | Lc | ognormal | I GOF Test | | | | | |
| 288 289 | Shapiro Wilk Test Statis | | 0.924 | | | | gnormal GOI | | |
| 289 | 10% Shapiro Wilk Critical Valı Lilliefors Test Statis | | 0.906 0.171 | | | | at 10% Signi ormal GOF | ificance Level | |
| 291 | 10% Lilliefors Critical Value | ue | 0.196 | | Data appear | Lognormal | | ficance Level | |
| 292 293 | Data appe | ar Log | <u>ınormal a</u> | at 10% Signif | icance Leve | el | | | |
| 294 295 | | L | .ognorma | I Statistics | | | | | |
| 295 | Minimum of Logged Da | | 3.714 | | | | | logged Data | 4.18 |
| 296 297 | Maximum of Logged Da | ata | 4.625 | | | | SD of | logged Data | 0.309 |
| 298 | | | ng Logno | rmal Distribu | ıtion | | | | |
| 299 300 | 95% H-U(| CL T | 79.7 | | | | | (MVUE) UCL | 84.45 |
| 301 | 95% Chebyshev (MVUE) U0 99% Chebyshev (MVUE) U0 | | 91.73 21.7 | | | 97.5% | Chebysnev | (MVUE) UCL | 101.8 |
| 302 | | | | | | | | l | |
| 303 304 | | | | tion Free UC Discernible I | | | | | |
| 305 | Дата ард | <u>jear to</u> | TOIIOW a | Discernible | Distribution | | | | |
| 306 | | | | tribution Free | UCLs | | A- 0/ | | |
| 307 308 | 95% CLT U0 95% Standard Bootstrap U0 | | 76.71 76.57 | | | | | ootstrap UCL otstrap-t UCL | 76.94 77.7 |
| 309 310 | 95% Standard Bootstrap UC 95% Hall's Bootstrap UC | | 76.62 | | | 95% | Percentile Bo | | 76.56 |
| 310 311 | | CL 8 | 83.63 | | | 95% CI | hebyshev(Me | ean, Sd) UCL | 90.57 |
| 312 | 97.5% Chebyshev(Mean, Sd) U(| <u>ا ات</u> | 00.2 | | | 99% CI | nebyshev(Me | an, Sd) UCL | 119.1 |
| 313 | | | ggested | UCL to Use | | | | | |
| 314 315 | 95% Student's-t U0 | CL 7 | 77.26 | | | | | | |
| 316 | Note: Suggestions regarding the selection of a 9 |)5% UC | CL are pr | ovided to helr | the user to | select the r | nost appropri | iate 95% UCI | |
| 317 | Recommendations are based upon data si | ize, dat | ıta distribu | ution, and ske | ewness usin | g results fro | m simulation | studies. | |
| 318 319 | However, simulations results will not cover all Rea | I World | data set | ts; for addition | nal insight th | ne user may | want to cons | sult a statisticia | an. |
| 320 | | | | | | | | | |
| 321 | GF-WRD | | | | | | | | |
| 322 323 | | | General | Statistics | | | | | |
| 324 | Total Number of Observation | | 7 | Julionico | | Numbe | er of Distinct (| Observations | 7 |
| 325 326 | | \perp | 45.70 | | | Numbe | r of Missing (| Observations | 0 |
| 327 | Minimu Maximu | | 45.79 80 | | | | | Mean Median | 64.52 66.6 |
| 328 | | | 10.85 | | | | Std. E | rror of Mean | 4.101 |
| | | | | | | | | | |

| | Α | В | | С | | D | | E | F | | G | | Н | | I | | J | | K | L |
|------------|----|------------|----------|---------|----------------|-----------|-------------|-----------------------|------------|-------|--|--------------|----------|---------|-----------|---------|-----------------------|-----------|-----------------|----------------|
| 329 | | | | | С | oefficie | ent of V | /ariation | 0.168 | 8 | | | | | | | | Ske | ewness | -0.481 |
| 330 331 | | Note: C | omplo | olao lo | | ul (o. a. | ~10\ | if data | oro colloc | ato d | uoina ineres | mont | al aa | malia | a moth | adala | av (ISM | l\ oppr | | |
| 332 | | Note: 5 | | | | | | | | | using increi | | | | | | | | oacn, | |
| 333 | | | | | | | | | | | he Chebysh | | | | | | | | | |
| 334 | | | | | | | | | | | n gross ove | | | | | | | | | |
| 335 | | | | Re | <u>efer to</u> | o the P | roUCL | . 5.2 Ted | chnical G | uide | for a discu | <u>ssion</u> | of th | he Ch | ebyshe | v UC | L. | | | |
| 336 337 | | | | | | | | | Marra | -1.0 | OF Tool | | | | | | | | | |
| 338 | | | | | Shan | iro Will | (Test | Statistic | | | OF Test | | | SI | aniro \ | Wilk C | OF Tes | et . | | |
| 339 | | | | | | | | al Value | | , | | Da | ita ar | | | | 6 Signifi | | Level | |
| 340 | | | | | Ĺ | illiefors | s Test | Statistic | 0.153 | 3 | | | | | Lilliefo | rs GO | F Test | | | |
| 341 | | | | | <u>1% L</u> | illiefors | | al Value | | | | | | | Norma | l at 19 | 6 Signifi | cance | Level | |
| 342 343 | | | | | | N | | | | | 1% Signification 1% Signification 1% 1% Signification 1% 1% 1% 1% 1% 1% 1% 1% 1% 1% 1% 1% 1% | | | | ·• | | | | | |
| 344 | | | | | | INC | ole GC | JF IESIS | may be u | ııııe | ilable for Sir | idii Sa | ampi | e size | 5 | | | | | |
| 345 | | | | | | | | As | suming N | Norn | nal Distribut | ion | | | | | | | | |
| 346 | | | | 95% N | | al UCL | | | | | | | 95 | | | | d for Sk | | | |
| 347 348 | | | | | | 95% S | tudent | 's-t UCL | 72.49 |) | | | | | | | CLT UCL | | | 70.46 |
| 349 | | | | | | | | | | | | | | 95 | % IVIOU | illea-t | UCL (J | onnsor | 1-19/8) | 72.36 |
| 350 | | | | | | | | | Gamn | na (| GOF Test | | | | | | | | | |
| 351 | | | | | | A-D |) Test | Statistic | | | | | And | derso | n-Darlii | ng Ga | mma G | OF Te | st | |
| 352 | | | | | | | | al Value | | | Detected | | | | | | | | | ce Level |
| 353 354 | | | | | | | | Statistic al Value | | | Detected | | | | | | Samma (| | | oo Lovel |
| 355 | | | | | | | | | | | Detected at 5 | | | | | | บนเ ย น สโ | . J % SI | griiican | e revei |
| 356 | | | | | | | | | | | liable for sm | | | | | | | | | |
| 357 | | | | | | | | | | | | | | | | | | | | |
| 358 359 | | | | | | | 1. 1 | / N AL T \ | | | Statistics | | | | | I | /l-! | | | 20.10 |
| 360 | | | | | | Tı | | at (MLE) at (MLE) | | | | | | | | | (bias co | | | 22.12 2.917 |
| 361 | | | | | | | | at (MLE) | | • | | | | | 11161 | | u star (b | | | 309.6 |
| 362 | | | | N | VLE I | Mean (b | | rrected) | 64.52 | 2 | | | | | | ML | E Sd (b | ias cor | rected) | 13.72 |
| 363 | | | | | | | | | | | | | | App | | | i Square | | | 269.9 |
| 364 365 | | | | Adju | <u>usted</u> | Level | of Sign | ificance | 0.015 | 8 | | | | | | Adjus | ted Chi | Square | <u> Value</u> | 258.6 |
| 366 | | | | | | | | Δο | sumina G | am | ma Distribut | tion | | | | | | | | |
| 367 | | | | 95% / | Appro | oximate | Gamı | ma UCL | | | | | | | (| 95% A | Adjusted | Gamn | na UCL | 77.25 |
| 368 | | | | | | | | | | • | | | | | | | | | | |
| 369 370 | | | | | 01 | | - . | O | | | GOF Test | | - | | \A.C.I. I | | 100 | | | |
| 371 | | | | | | | | Statistic al Value | | _ | | Data | | | | | rmal GO | | t ce Level | |
| 372 | | | | 10 /0 C | | | | Statistic | | | | Data | | | | | al GOF | | <u>'e revei</u> | |
| 373 | | | | 1 | | | Critica | al Value | 0.28 | | | Data | appe | ear Lo | | | 0% Sigr | | e Level | |
| 374 375 | | | | | | | | | | | t 10% Signi | | | | | | | | | |
| 376 | | | | | | No | ote GC | OF tests | may be u | ınre | liable for sm | nall sa | ampl | e size | S | | | | | |
| 377 | | | | | | | | | Lognor | rmal | Statistics | | | | | | | | | |
| 378 | | | | | Mini | imum o | f Logg | ed Data | | | - Otationoo | | | | | | Mean o | of logge | ed Data | 4.154 |
| 379 | | | | | Maxi | imum o | f Logg | ed Data | 4.382 | 2 | | | | | | | SD o | of logge | ed Data | 0.178 |
| 380 381 | | | | | | | | A | | | maal Diatella | | | | | | | | | |
| 382 | | | | | | | 95% | H-UCL | | | rmal Distrib | ution | | | 900 | % Che | ebyshev | /M\/LI | E) IICI | 77.58 |
| 383 | | | | 95% | 6 Che | byshev | | JE) UCL | 83.49 | | | | | | | | ebyshev | | | 91.68 |
| 384 | | | | | | | | JE) UCL | | | | | | | | | | | | |
| 385 386 | | | | | | | L 1. | | anda Dist | ٠ الد | ion Fact US | | _a! - *! | | | | | | | |
| 387 | | | | | | | | | | | ion Free UC Discernible | | | | | | | | | |
| 388 | | | | | | | Jai | appec | 101101 | ., a | | <u></u> | uul | J.1 | | | | | | |
| 389 | | | | | | | | | | | ribution Fre | e UC | Ls | | | | | | | |
| 390 | | | | 0=0 | V 0: | | | LT UCL | | | | | | | | | 6 BCA B | | | 70.28 |
| 391 392 | | | | | | | | rap UCL | | | | | | | OEO | | 95% Bo | | | 71.84 70.67 |
| 393 | | | (| | | | | rap UCL Sd) UCL | | | | | | | | | centile B /shev(M | | | 82.39 |
| 394 | | | | | | | | Sd) UCL | | | | | | | | | /shev(M | | | 105.3 |
| 395 | | | • | | | · · | | | | | | | | • | | | | | | |
| 396 397 | | | | | | 050/ 0 | | I- + ! ! O' | | | UCL to Use | | | | | | | | — т | |
| 397 | | | | | | 95% S | tudent | 's-t UCL | 72.49 | , | | | | | | | | | | |
| 399 | 1 | Note: Suan | estions | s regar | rdina | the sel | ection | of a 95% | 6 UCL are | e pro | ovided to hel | p the | user | r to se | lect the | most | appron | riate 9! | 5% UCI | |
| 400 | | Reco | mmenc | dations | s are | based | upon d | lata size | , data dis | tribu | ition, and sk | ewne | ss u | sing re | esults f | rom si | imulatio | n studi | es. | |
| 401 | Ho | | | | | | | | | | s; for additio | | | | | | | | | an. |
| 402 403 | | Nata : F | su bledd | | _4! ' | دام برا | الجامور | | dans - " | - la | /o.a. Oh | 1-1- | | 1 | I | and 4 | `` | \ | | |
| 403 | | Note: Fo | | | | | | | | | (e.g., Chen, de adjustme | | | | | | | , may r | IOT DE | |
| 405 | | | 161 | avi6. | <u> </u> | ni o aiil | <u> </u> | JUI & III | ourous pi | OVIC | aajusiiil e | 1160 10 | , pu | OILV CI | JACW | ou ud | .ය ೨೮಄. | | | |
| | | | | | | | | | | | | | | | | | | | | |

| 3 User Selected Options 4 Dates Time of Compatation ProduCL Set 2122/2024 9:16:19 PM 5 From Fill ProduCL Input xis 7 Confidence Coefficient Ship 7 Coefficient Ship 7 Coefficient Ship 7 Coefficient Ship 7 Coefficient Ship 8 Coefficient Ship 8 Coefficient Ship 8 Coefficient Ship 9 Coeffi | 1 | Α | В | С | D | E LIOL Otati | F | G H I J K L |
|--|----------|---------------|---------------|----------------|-----------------|--------------------|----------------|---|
| Duse/Time of Composition ProUCEL Epot 4:8 | | | | | | UCL Statis | Stics for Unc | ensored Fuli Data Sets |
| Front File ProUCI, InputAls | | D- | | | | 10/0/0001.0 | .10:10 DM | |
| Full Precision (OFF Number of Bosterrap Operations 2000 10 11 11 12 13 14 15 15 16 16 17 18 18 18 19 19 19 19 10 10 10 10 10 10 | | Dai | te/Time of Co | | | | : 16: 19 PM | |
| Minimum Size Mini | | | | II Precision | OFF | | | |
| Common Statistics Total Number of Deservations 7 Number of Desired Observations 7 Number of Missing Observations 7 7 Number of Missing Observations 7 Number of Missing Obse | | Number | | | | | | |
| Text | 9 | Trainbor C | л воогопар | Орогацопо | 12000 | | | |
| Total Number of Observations 7 | | I MM-TI Δ | | | | | | |
| Total Number of Observations | 12 | CIAIIAI- I CV | | | | | | |
| Number of Missian Observations O | | | | Total | Number of O | hoonyotiono | | |
| Maximum 18894 | 15 | | | TOLAI | Number of O | <u>DSELVATIONS</u> | / | |
| Section Conficient of Variation O.321 | | | | | | | | |
| Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach, refer also to ITRC 7 sch Rag Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance. The Chebryshev UCL other results in gross overestimates of the meen. The Chebryshev UCL other results in gross overestimates of the meen. The Chebryshev UCL Sc Technical Guide for a Sciencesion of the Chebryshev UCL. The Chebryshev UCL Sc Technical Guide for a Sciencesion of the Chebryshev UCL. The Chebryshev UCL Sc Technical Guide for a Sciencesion of the Chebryshev UCL. Normal GOF Test Shapiro Wilk Test Statistic 0,73 | 18 | | | | | | | |
| Note: Sample size is small (e.g., <10). If data are collected using incremental sampling methodology (SM) approach, refer state to ITRC Tech Reg Guide on ISM (TRC 2020) and ITRC 2012 for additional guidance, state of ITRC 100 for the Chebyshev UCL for small sample sizes (n < 7). The Chebyshev UCL for small sample sizes (n < 7). The Chebyshev UCL for small sample sizes (n < 7). The Chebyshev UCL for small sample sizes (n < 7). The Chebyshev UCL for small sample sizes (n < 7). The Chebyshev UCL for small sample sizes (n < 7). The Chebyshev UCL for small sample sizes (n < 7). The Chebyshev UCL for small sample sizes (n < 7). The Chebyshev UCL for small sample sizes (n < 7). The Chebyshev UCL for small sample sizes (n < 7). The Chebyshev UCL for small sample sizes (n < 7). The Chebyshev UCL for small sample sizes (n < 7) and spaces for small sample sizes (n < 7). The Chebyshev UCL small sample sizes (n < 7). The Chebyshev UCL small sample sizes (n < 7). The Chebyshev UCL small sample sizes (n < 7). The Chebyshev UCL small sample sizes (n < 7). The Chebyshev UCL small sample sizes (n < 7). The Chebyshev UCL small sample sizes (n < 7). The Chebyshev UCL small sample sizes (n < 7). The Chebyshev UCL small sample sizes (n < 7). The Chebyshev UCL small sample sizes (n < 7). The Chebyshev UCL small sample sizes (n < 7). The Chebyshev UCL small sample sizes (n < 7). The Chebyshev UCL small sample sizes (n < 7). The Chebyshev UCL small sample sizes (n < 7). The Chebyshev UCL small sample sizes (n < 7). The Chebyshev UCL small sample sizes (n < 7). The Chebyshev UCL small sample sizes (n < 7). The Chebyshev UCL small sample sizes (n < 7). The Chebyshev UCL small sample sizes (n < 7). The Chebyshev UCL small sample sizes (n < 7). The Chebyshev UCL small sample sizes (n < 7). The Chebyshev UCL small sample sizes (n < 7). The Chebyshev UCL small sample sizes (n < 7). The Chebyshev UCL small sample sizes (n < 7). The Chebyshev UCL small sample sizes (n < 7). The Chebyshev UCL small sample sizes (n < 7). The Chebyshev UCL smal | 19 | | | | Coefficient | of Variation | 0.631 | |
| Teffer also to ITRC Tech Reo Guide on ISM (TIRC 2020 and ITRC 2012) for additional guidence, but note that ITRC may recommend the LUCL of the Chebyshev UCL for semila sample sizes (n < 7). | | | Note: Sar | mple size is : | small (e.g. < | 10), if data a | are collected | using incremental sampling methodology (ISM) approach |
| The Chebyshev UCL often results in gross overestimates of the mean. | 22 | | | refer also to | o ITRC Tech | Reg Guide | on ISM (ITR | C 2020 and ITRC 2012) for additional guidance, |
| Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL | 23 | | b | out note that | | | | |
| Shapiro Wilk Test Steinstic | 25 | | | Ref | | | | |
| Shapiro Wilk Test Statistic 0.942 Shapiro Wilk GOF Test | | | | | | | | • |
| 1% Shapiro Wilk Critical Value 0.73 | 28 | | | S | hapiro Wilk T | est Statistic | 0.942 | |
| 1% Lillefors Critical Value 0.35 | 29 | | | | hapiro Wilk Cı | ritical Value | 0.73 | Data appear Normal at 1% Significance Level |
| Second Color | | | | 1 | | | | |
| | 32 | | | | | Data appe | ar Normal at | 1% Significance Level |
| Second S | | | | | Note | GOF tests | may be unre | liable for small sample sizes |
| | 35 | | | | | As | suming Nor | nal Distribution |
| | | | | 95% No | | 1 | 0000 | |
| Gamma GOF Test | 38 | | | | 95% Stud | ient's-t UCL | 8099 | |
| A.D Test Statistic | | | | | | | | |
| S% A-D Critical Value | | | | | A-D T | est Statistic | | |
| Significance Sign | 42 | | | | | | | Detected data appear Gamma Distributed at 5% Significance Level |
| Detected data appear Gamma Distributed at 5% Significance Level | | | | | | | | |
| A | 45 | | | | Detected | data appea | r Gamma Di | stributed at 5% Significance Level |
| Camma Statistics Camma Stati | 46 | | | | Note | GOF tests | may be unre | liable for small sample sizes |
| Reserve | 48 | | | | | | Gamma | Statistics |
| Number | | | | | | | 2.259 | k star (bias corrected MLE) 1.386 |
| MLE Mean (bias corrected) 5535 MLE Sd (bias corrected) 4701 | | | | | | | | |
| Adjusted Level of Significance 0.0158 | 52 | | | MI | | | | MLE Sd (bias corrected) 4701 |
| Assuming Gamma Distribution 95% Adjusted Gamma UCL 10313 95% Adjusted Gamma UCL 12637 95% Approximate Gamma UCL 10313 95% Adjusted Gamma UCL 12637 | 53 54 | | | \ diuc | stad Laval of C | Significance | 0.0150 | |
| Data appear Lognormal Statistics | 55 | | | Aajus | teu Level of S | эідіннсапсе | 0.0158 | Aujusteu Oni Square value 8.499 |
| Lognormal GOF Test | 56 57 | | | 050/ * | | | | |
| Shapiro Wilk Test Statistic 0.891 Shapiro Wilk Lognormal GOF Test | 58 | | | 95% A | pproximate G | iarrima UCL | 10313 | 95% Adjusted Gamma UCL 1263/ |
| 10% Shapiro Wilk Critical Value 0.838 Data appear Lognormal at 10% Significance Level | | | | _ | | | | |
| Color | | | | | | | | |
| Data appear Lognormal at 10% Significance Level | 62 | | | | Lilliefors To | est Statistic | 0.233 | Lilliefors Lognormal GOF Test |
| Note GOF tests may be unreliable for small sample sizes | | | | 10 | | | | |
| Lognormal Statistics 68 Minimum of Logged Data 6.732 Mean of logged Data 8.381 69 Maximum of Logged Data 9.295 SD of logged Data 0.845 70 71 Assuming Lognormal Distribution 72 95% H-UCL 19275 90% Chebyshev (MVUE) UCL 11515 73 95% Chebyshev (MVUE) UCL 14075 97.5% Chebyshev (MVUE) UCL 17629 74 99% Chebyshev (MVUE) UCL 24608 Nonparametric Distribution Free UCL Statistics 75 0 Nonparametric Distribution Free UCL Statistics 78 Nonparametric Distribution Free UCLs 80 95% CLT UCL 7706 95% BCA Bootstrap UCL 7886 81 95% Standard Bootstrap UCL 7580 95% Bootstrap-t UCL 9484 | 65 | | | | | | | |
| 68 Minimum of Logged Data 6.732 Mean of logged Data 8.381 69 Maximum of Logged Data 9.295 SD of logged Data 0.845 70 71 Assuming Lognormal Distribution 72 95% H-UCL 19275 90% Chebyshev (MVUE) UCL 11515 73 95% Chebyshev (MVUE) UCL 14075 97.5% Chebyshev (MVUE) UCL 17629 74 99% Chebyshev (MVUE) UCL 24608 Nonparametric Distribution Free UCL Statistics 76 Nonparametric Distribution Free UCL Statistics 77 Data appear to follow a Discernible Distribution 78 Nonparametric Distribution Free UCLs 80 95% BCA Bootstrap UCL 7886 81 95% Standard Bootstrap UCL 7580 95% Bootstrap-t UCL 9484 | | | | | | | | |
| Maximum of Logged Data 9.295 SD of logged Data 0.845 | 68 | | | | Minimum of I | ogged Data | | |
| Assuming Lognormal Distribution 95% H-UCL 19275 90% Chebyshev (MVUE) UCL 11515 97.5% Chebyshev (MVUE) UCL 14075 97.5% Chebyshev (MVUE) UCL 17629 99% Chebyshev (MVUE) UCL 24608 97.5% Chebyshev (MVUE) UCL 17629 99% Chebyshev (MVUE) UCL 24608 99% Chebyshev (MVUE) UCL 17629 99% Chebyshev (MVUE) UCL | 69 | | | | | | | |
| 72 95% H-UCL 19275 90% Chebyshev (MVUE) UCL 11515 73 95% Chebyshev (MVUE) UCL 14075 97.5% Chebyshev (MVUE) UCL 17629 74 99% Chebyshev (MVUE) UCL 24608 75 76 Nonparametric Distribution Free UCL Statistics 77 Data appear to follow a Discernible Distribution 78 Nonparametric Distribution Free UCLs 80 95% BCA Bootstrap UCL 7886 80 95% Standard Bootstrap UCL 7580 95% Bootstrap-t UCL 9484 | | | | | | Δορ | umina I cana | rmal Distribution |
| 74 99% Chebyshev (MVUE) UCL 24608 75 Nonparametric Distribution Free UCL Statistics 77 Data appear to follow a Discernible Distribution 78 Nonparametric Distribution Free UCLs 80 Nonparametric Distribution Free UCLs 80 95% CLT UCL 7706 95% BCA Bootstrap UCL 7886 81 95% Standard Bootstrap UCL 7580 95% Bootstrap-t UCL 9484 | 72 | | | | | 95% H-UCL | 19275 | 90% Chebyshev (MVUE) UCL 11515 |
| 75 Nonparametric Distribution Free UCL Statistics 77 Data appear to follow a Discernible Distribution 78 Nonparametric Distribution Free UCLs 80 Nonparametric Distribution Free UCLs 80 95% CLT UCL 7706 95% BCA Bootstrap UCL 7886 81 95% Standard Bootstrap UCL 7580 95% Bootstrap-t UCL 9484 | 73 74 | | | | | | | 97.5% Chebyshev (MVUE) UCL 17629 |
| Data appear to follow a Discernible Distribution 78 Nonparametric Distribution Free UCLs 80 95% CLT UCL 7706 95% BCA Bootstrap UCL 7886 81 95% Standard Bootstrap UCL 7580 95% Bootstrap-t UCL 9484 | 75 | | | | onenyanev (N | vi v OL) UCL | <u> </u> | |
| 78 79 Nonparametric Distribution Free UCLs 80 95% CLT UCL 7706 95% BCA Bootstrap UCL 7886 81 95% Standard Bootstrap UCL 7580 95% Bootstrap-t UCL 9484 | | | | | | | | |
| 79 Nonparametric Distribution Free UCLs 80 95% CLT UCL 7706 95% BCA Bootstrap UCL 7886 81 95% Standard Bootstrap UCL 7580 95% Bootstrap-t UCL 9484 | 78 | | | | | uata appea | ar to tollow a | DISCERNIDIE DISTRIBUTION |
| 81 95% Standard Bootstrap UCL 7580 95% Bootstrap-t UCL 9484 | 79 | | | | | | | |
| | | | | Q5% | | | | |
| | | | | | | | | |

| | A B C D E | F | G H I J K | L |
|------------|--|----------------|--|---------------------|
| 83 | 90% Chebyshev(Mean, Sd) UCL | - | 95% Chebyshev(Mean, Sd) UCL | 11288 |
| 84 | 97.5% Chebyshev(Mean, Sd) UCL | | 99% Chebyshev(Mean, Sd) UCL | |
| 85 | | | | |
| 86 87 | 95% Student's-t UCL | | UCL to Use | |
| 88 | 95% Students-t OCL | 0099 | | |
| 89 | Note: Suggestions regarding the selection of a 95% | 6 UCL are pr | ovided to help the user to select the most appropriate 95% UCL. | |
| 90 | Recommendations are based upon data size | , data distrib | ution, and skewness using results from simulation studies. | |
| 91 | However, simulations results will not cover all Real W | /orld data se | ts; for additional insight the user may want to consult a statisticia | ın. |
| 92 93 | | | | |
| 94 | LMM-WRA | | | |
| 95 | | | | |
| 96 | | | Statistics | |
| 97 98 | Total Number of Observations | 13 | Number of Distinct Observations Number of Missing Observations | 13 0 |
| 99 | Minimum | 93.12 | Mean | 1284 |
| 100 | Maximum | | Median | 544 |
| 101 | SD | | Std. Error of Mean | 393 |
| 102 | Coefficient of Variation | 1.104 | Skewness | 1.218 |
| 103 104 | | Normal (| GOF Test | |
| 105 | Shapiro Wilk Test Statistic | 0.801 | Shapiro Wilk GOF Test | |
| 106 | 1% Shapiro Wilk Critical Value | | Data Not Normal at 1% Significance Level | |
| 107 | Lilliefors Test Statistic | 0.307 | Lilliefors GOF Test | |
| 108 109 | 1% Lilliefors Critical Value | | Data Not Normal at 1% Significance Level | |
| 110 | Data Not | i inormal at 1 | % Significance Level | |
| 111 | As | sumina Nori | mal Distribution | |
| 112 | 95% Normal UCL | | 95% UCLs (Adjusted for Skewness) | |
| 113 | 95% Student's-t UCL | 1985 | 95% Adjusted-CLT UCL (Chen-1995) | |
| 114 115 | | | 95% Modified-t UCL (Johnson-1978) | 2007 |
| 116 | | Gamma | GOF Test | |
| 117 | A-D Test Statistic | | Anderson-Darling Gamma GOF Test | |
| 118 | 5% A-D Critical Value | | Detected data appear Gamma Distributed at 5% Significand | e Level |
| 119 120 | K-S Test Statistic | | Kolmogorov-Smirnov Gamma GOF Test | |
| 121 | 5% K-S Critical Value | | Detected data appear Gamma Distributed at 5% Significand stributed at 5% Significance Level | e Levei |
| 122 | Dototou data appou | - Gamma Di | Sansatou at 0 % Signinoanio Esvoi | |
| 123 | | | Statistics | |
| 124 125 | k hat (MLE) | | k star (bias corrected MLE) | 0.71 |
| 126 | Theta hat (MLE) nu hat (MLE) | | Theta star (bias corrected MLE) nu star (bias corrected) | 1808 18.47 |
| 127 | MLE Mean (bias corrected) | | MLE Sd (bias corrected) | 1524 |
| 128 | | | Approximate Chi Square Value (0.05) | 9.731 |
| 129 | Adjusted Level of Significance | 0.0301 | Adjusted Chi Square Value | 8.84 |
| 130 131 | | oumina Com | ma Diawih wian | |
| 132 | 95% Approximate Gamma UCL | | ma Distribution 95% Adjusted Gamma UCL | 2683 |
| 133 | 30% Approximate damina 66E | 2407 | 33 % Adjusted Canima GOE | 2005 |
| 134 | | | GOF Test | |
| 135 136 | Shapiro Wilk Test Statistic | | Shapiro Wilk Lognormal GOF Test | |
| 137 | 10% Shapiro Wilk Critical Value Lilliefors Test Statistic | 0.889 0.197 | Data appear Lognormal at 10% Significance Level Lilliefors Lognormal GOF Test | |
| 138 | 10% Lilliefors Critical Value | | Data appear Lognormal at 10% Significance Level | |
| 139 | | | at 10% Significance Level | |
| 140 141 | | 1 | I Chadiatica | |
| 141 | Minimum of Logged Data | | I Statistics Mean of logged Data | 6.471 |
| 143 | Maximum of Logged Data | | SD of logged Data | 1.295 |
| 144 | | | | |
| 145 | | | ormal Distribution | 2050 |
| 146 147 | 95% H-UCL 95% Chebyshev (MVUE) UCL | | 90% Chebyshev (MVUE) UCL 97.5% Chebyshev (MVUE) UCL | <u>2952</u> 4685 |
| 148 | 95% Chebyshev (MVUE) UCL | | 97.3% Chebysnev (WVUE) UCL | 4000 |
| 149 | | | | |
| 150 | | | tion Free UCL Statistics | |
| 151 152 | Data appea | r to follow a | Discernible Distribution | |
| 153 | Nonna | rametric Die | tribution Free UCLs | |
| 154 | 95% CLT UCL | | 95% BCA Bootstrap UCL | 2047 |
| 155 | 95% Standard Bootstrap UCL | | 95% Bootstrap-t UCL | 2319 |
| 156 157 | 95% Hall's Bootstrap UCL | | | 1939 |
| 158 | 90% Chebyshev(Mean, Sd) UCL 97.5% Chebyshev(Mean, Sd) UCL | | 95% Chebyshev(Mean, Sd) UCL 99% Chebyshev(Mean, Sd) UCL | |
| 159 | or.on onedyshev(mean, ou) oue | | 55% Ghobyshov(Modif, Od) GOE | - 100 |
| 160 | | | UCL to Use | |
| 161 162 | 95% Adjusted Gamma UCL | 2683 | | |
| 163 | The calculated LICLs are based on assume | tions that the | e data were collected in a random and unbiased manner. | |
| 164 | | | e data were collected in a random and unbiased manner. | |
| | | | | |

| 165 | A B C D E | F | G | Н | | J | K | L |
|-------------|---|-------------------|------------------------------------|-------------|--------------|-----------------------------|----------------|---------------|
| 165 166 | If the data were collected then contact a | | | | | 3, | | |
| 167 | | | | | | | | |
| 168 169 | Note: Suggestions regarding the selection of a 95% Recommendations are based upon data size, | | | | | | | |
| 170 | However, simulations results will not cover all Real W | | | | | | | an. |
| 171 172 | | | | | | | | |
| | LMM-WRB | | | | | | | |
| 174 175 | | | 0 | | | | | |
| 176 | Total Number of Observations | General 6 | Statistics | | Numbe | r of Distinct C | Observations | 6 |
| 177 | | | | | | r of Missing C | Observations | 0 |
| 178 179 | Minimum Maximum | 142.8 8150 | | | | | Mean Median | 1885 854.5 |
| 180 | SD | 3093 | | | | Std. E | rror of Mean | 1263 |
| 181 182 | Coefficient of Variation | 1.64 | | | | | Skewness | 2.366 |
| 183 | Note: Sample size is small (e.g., <10), if data a | are collected | using increme | ental samp | ling method | dology (ISM) | approach, | |
| 184 185 | refer also to ITRC Tech Reg Guide of | on ISM (ITR | C 2020 and IT | RC 2012) 1 | for addition | al guidance, | | |
| 186 | but note that ITRC may recommend th The Chebyshev UCL o | | | | | e sizes (n < / | ′). | |
| 187 | Refer to the ProUCL 5.2 Tec | hnical Guide | e for a discuss | ion of the | Chebyshev | UCL. | | |
| 188 189 | | Normal (| GOF Test | | | | | |
| 190 | Shapiro Wilk Test Statistic | 0.61 | 201 100t | | | ilk GOF Test | | |
| 191 192 | 1% Shapiro Wilk Critical Value | 0.713 | | Data No | | 1% Significar | nce Level | |
| 193 | Lilliefors Test Statistic 1% Lilliefors Critical Value | 0.435 0.373 | | Data No | | GOF Test 1% Significar | nce Level | |
| 194 195 | | Normal at 1 | % Significanc | | | | | |
| 195 | As | suming Norr | mal Distribution | n | | | | |
| 197 | 95% Normal UCL | ounning reon | Tidi Diotribatio | 95% | UCLs (Adju | sted for Ske | wness) | |
| 198 199 | 95% Student's-t UCL | 4429 | | , | | ed-CLT UCL ed-t UCL (Jo | | |
| 200 | | | | | 95 % MOUIII | eu-i OCL (30 | 11115011-1970) | 4033 |
| 201 | . 5.7 | | GOF Test | | | | | |
| 202 203 | A-D Test Statistic 5% A-D Critical Value | 0.57 0.725 | Detected (| | | Gamma GO istributed at 5 | | ce I evel |
| 204 | K-S Test Statistic | 0.329 | | Kolmog | orov-Smirn | ov Gamma G | OF Test | |
| 205 206 | 5% K-S Critical Value Detected data appear | | | | | istributed at 5 | 5% Significan | ce Level |
| 207 | Note GOF tests | | | | | | | |
| 208 209 | | Commo | Statistics | | | | | |
| 210 | k hat (MLE) | | Statistics | | k | star (bias cor | rected MLE) | 0.449 |
| 211 | Theta hat (MLE) | | | | Theta | star (bias cor | | |
| 212 213 | nu hat (MLE) MLE Mean (bias corrected) | 8.099 1885 | | | | | as corrected) | 5.383 2815 |
| 214 | | | | , | | Chi Square | Value (0.05) | 1.333 |
| 215 216 | Adjusted Level of Significance | 0.0122 | | | A | djusted Chi S | quare Value | 0.739 |
| 217 | | | ma Distributio | n | | | | |
| 218 219 | 95% Approximate Gamma UCL | 7612 | | | 95 | % Adjusted (| Gamma UCL | 13728 |
| 220 | | Lognormal | GOF Test | | | | | |
| 221 222 | Shapiro Wilk Test Statistic | 0.925 | | | | gnormal GOF | | |
| 223 | 10% Shapiro Wilk Critical Value Lilliefors Test Statistic | 0.826 0.236 | <u> </u> | | | at 10% Signi ormal GOF T | | |
| 224 | 10% Lilliefors Critical Value | 0.298 | | ata appear | Lognormal | at 10% Signi | | |
| 225 226 | Data appear Note GOF tests | | at 10% Signific eliable for sma | | | | | |
| 227 | 11000 | | | | | | | |
| 228 229 | Minimum of Logged Data | Lognorma 4.961 | I Statistics | | | Moon of | logged Data | 6.642 |
| 230 | Maximum of Logged Data Maximum of Logged Data | 9.006 | | | | | logged Data | 1.423 |
| 231 232 | A | ımine Lees | rmal Distribute | lon | · · | | | |
| 233 | ASSU 95% H-UCL | | ormal Distributi | IUII | 90% | Chebyshev (| MVUE) UCL | 4359 |
| 234 | 95% Chebyshev (MVUE) UCL | 5590 | | | | Chebyshev (| | 7298 |
| 235 236 | 99% Chebyshev (MVUE) UCL | 10654 | <u> </u> | | | | | |
| 237 | | | tion Free UCL | | | | | |
| 238 239 | Data appea | r to follow a | Discernible D | istribution | | | | |
| 240 | Nonpar | rametric Dist | tribution Free | UCLs | | | | |
| 241 | 95% CLT UCL | 3962 | | | | 95% BCA Bo | | 4620 |
| 242 243 | 95% Standard Bootstrap UCL 95% Hall's Bootstrap UCL | | | | 95% | 95% Boo Percentile Bo | otstrap-t UCL | 14725 4282 |
| 244 | 90% Chebyshev(Mean, Sd) UCL | 5673 | | | 95% CI | nebyshev(Me | an, Sd) UCL | 7389 |
| 245 246 | 97.5% Chebyshev(Mean, Sd) UCL | 9770 | | | 99% CI | nebyshev(Me | an, Sd) UCL | 14447 |
| ∠4 0 | | | | | | | | |

| | Α | В | С | D | E | F | G | Н | I | J | K | L |
|-----|---|--------------|----------------|----------------|---------------|----------------|------------------|----------------|----------------|--------------|-----------------|------|
| 247 | | | | | | Suggested | UCL to Use | | | | | |
| 248 | | | Recommend | ation cannot | be provided | | | | | | | |
| 249 | | | | | | | | | | | | |
| 250 | | The ca | Iculated UCI | s are based | on assump | tions that the | e data were d | collected in a | a random and | d unbiased r | nanner. | |
| 251 | | | | Pleas | e verify the | data were co | ollected from | random loca | ations. | | | |
| 252 | | | | If the data w | ere collecte | d using judgi | mental or oth | er non-rand | om methods | , | | |
| 253 | | | | the | en contact a | statistician | to correctly c | alculate UC | Ls. | | | |
| 254 | | | | | | | | | | | | |
| 255 | 1 | Note: Sugges | stions regard | ing the selec | tion of a 95% | 6 UCL are pr | ovided to hel | p the user to | select the m | ost appropri | ate 95% UC | L. |
| 256 | | Recom | mendations | are based up | on data size | , data distrib | ution, and sk | ewness usin | g results fron | n simulation | studies. | |
| 257 | | wever, simul | lations result | s will not cov | er all Real V | Vorld data se | ts; for addition | nal insight th | ne user may v | want to cons | ult a statistic | ian. |
| 258 | | | | | | | | | | | | |

| | A B C | D E | F | G H I J J ensored Full Data Sets | K | L |
|----------|--------------------------------|--|----------------|--|------------------|---|
| 1 | | UCL Statis | SUCS IOI ONG | erisoreu Fuli Data Sets | | |
| 3 | User Selected Options | | | | | |
| 4 | Date/Time of Computation | ProUCL 5.2 11/18/2024 | 12:17:31 PM | | | |
| 5 | From File | WorkSheet.xls | | | | |
| 6 | Full Precision | OFF | | | | |
| 7 | Confidence Coefficient | 95% | | | | |
| 8 | Number of Bootstrap Operations | 2000 | | | | |
| 9 | | .1 | | | | |
| 10 | | | | | | |
| 11 | SH-WRA | | | | | |
| 12 | | | | | | |
| 13 | | | | Statistics | | |
| 14 | Total | I Number of Observations | 10 | Number of Distinct Obser | | 7 |
| 15 | <u> </u> | N. A | 0 | Number of Missing Obser | | 0 |
| 16 | | Minimum | 9 | | Mean | 20.56 |
| 17 | | Maximum SD | 81.8 | | Median | 13 6.883 |
| 18 | | Coefficient of Variation | 21.76 1.059 | Std. Error o | t Mean ewness | 3.033 |
| 19 | | Coemcient of variation | 1.059 | SKE | wiless | J.UJJ |
| 20 | | | Normal (| GOF Test | | |
| 21 22 | 5 | Shapiro Wilk Test Statistic | | Shapiro Wilk GOF Test | | |
| 23 | | Shapiro Wilk Critical Value | | Data Not Normal at 1% Significance Le | evel | |
| 24 | | Lilliefors Test Statistic | 0.392 | Lilliefors GOF Test | | |
| 25 | 1 | 1% Lilliefors Critical Value | 0.304 | Data Not Normal at 1% Significance Le | evel | |
| 26 | | Data Not | t Normal at 1 | % Significance Level | | |
| 27 | | | | | | |
| 28 | | As | suming Nor | nal Distribution | | |
| 29 | 95% No | ormal UCL | | 95% UCLs (Adjusted for Skewnes | s) | |
| 30 | | 95% Student's-t UCL | 33.18 | 95% Adjusted-CLT UCL (Cher | - 1 | 38.93 |
| 31 | | | | 95% Modified-t UCL (Johnson | n-1978) | 34.28 |
| 32 | | | | | | |
| 33 | | | | GOF Test | | |
| 34 | | A-D Test Statistic | | Anderson-Darling Gamma GOF Tes | | |
| 35 | | 5% A-D Critical Value | | Data Not Gamma Distributed at 5% Significa | | ! |
| 36 | <u> </u> | K-S Test Statistic 5% K-S Critical Value | 0.323 0.27 | Kolmogorov-Smirnov Gamma GOF T Data Not Gamma Distributed at 5% Significa | | <u></u> |
| 37 | | | | ed at 5% Significance Level | lice Leve | л ———————————————————————————————————— |
| 38 | | Data Not Gaill | IIIa Distribut | at 5 % Significance Level | | |
| 39 | | | Gamma | Statistics | | |
| 40 41 | | k hat (MLE) | 2.174 | k star (bias correcte | d MLE) | 1.588 |
| 41 | | Theta hat (MLE) | 9.459 | Theta star (bias correcte | | 12.95 |
| 43 | | nu hat (MLE) | 43.47 | nu star (bias cor | , | 31.76 |
| 44 | M | LE Mean (bias corrected) | 20.56 | MLE Sd (bias cor | - 1 | 16.31 |
| 45 | | <u> </u> | 1 | Approximate Chi Square Value | (0.05) | 19.88 |
| 46 | Adjus | sted Level of Significance | 0.0267 | Adjusted Chi Square | e Value | 18.27 |
| 47 | | | 1 | | I_ | |
| 48 | | As | suming Gam | ma Distribution | | |
| 49 | 95% A | Approximate Gamma UCL | 32.84 | 95% Adjusted Gamm | na UCL | 35.75 |
| 50 | | | | | | |
| 51 | | | | GOF Test | | |
| 52 | | Shapiro Wilk Test Statistic | 0.705 | Shapiro Wilk Lognormal GOF Test | | |
| 53 | 10% S | Shapiro Wilk Critical Value | | Data Not Lognormal at 10% Significance | Level | |
| 54 | | Lilliefors Test Statistic | 0.271 | Lilliefors Lognormal GOF Test | 1 2 | |
| 55 | 10 | 0% Lilliefors Critical Value | 0.241 | Data Not Lognormal at 10% Significance | Level | |

| | A B C D E | F ognormal at | G H I J K 1 10% Significance Level | L |
|---|--|--|--|-------------------------------|
| 56 57 | | ognoma ac | Total Giginii Ganica Lavoi | |
| 58 | | Lognorma | l Statistics | |
| 59 | Minimum of Logged Data | 2.197 | Mean of logged Data | 2.776 |
| 60 | Maximum of Logged Data | 4.404 | SD of logged Data | 0.615 |
| 61 | | | | |
| 62 | Assu | ıming Logno | ormal Distribution | |
| 63 | 95% H-UCL | 31.69 | 90% Chebyshev (MVUE) UCL | 30.36 |
| 64 | 95% Chebyshev (MVUE) UCL | 35.51 | 97.5% Chebyshev (MVUE) UCL | 42.65 |
| 65 | 99% Chebyshev (MVUE) UCL | 56.69 | | |
| 66 | Namanana | tulo Dietulbu | tion Fron LICI Chatistics | |
| 67 | | | tion Free UCL Statistics Discernible Distribution | |
| 68 | Data do II | ot lollow a L | viscernible Distribution | |
| 69 70 | Nonpa | rametric Dis | tribution Free UCLs | |
| 70 71 | 95% CLT UCL | 31.88 | 95% BCA Bootstrap UCL | 40.52 |
| 72 | 95% Standard Bootstrap UCL | 31.29 | 95% Bootstrap-t UCL | 102.5 |
| 73 | 95% Hall's Bootstrap UCL | 86.63 | 95% Percentile Bootstrap UCL | 33.82 |
| 74 | 90% Chebyshev(Mean, Sd) UCL | 41.21 | 95% Chebyshev(Mean, Sd) UCL | 50.56 |
| 75 | 97.5% Chebyshev(Mean, Sd) UCL | 63.54 | 99% Chebyshev(Mean, Sd) UCL | 89.04 |
| 76 | | | · | |
| 77 | | Suggested | UCL to Use | |
| 78 | 95% Student's-t UCL | 33.18 | | |
| 79 | | | | |
| 80 | - | | e data were collected in a random and unbiased manner. | |
| 81 | - | | ollected from random locations. | |
| 82 | II III III III III III III III III III | | | |
| ~~ | | | mental or other non-random methods, | |
| 83 | | | to correctly calculate UCLs. | |
| 84 | then contact a | statistician | to correctly calculate UCLs. | |
| 84 85 | then contact a Note: Suggestions regarding the selection of a 95% | statistician | | |
| 84 85 86 | Note: Suggestions regarding the selection of a 95% Recommendations are based upon data size | statistician UCL are production, data distrib | to correctly calculate UCLs. ovided to help the user to select the most appropriate 95% UCL. | n. |
| 84 85 | Note: Suggestions regarding the selection of a 95% Recommendations are based upon data size | statistician UCL are production, data distrib | ovided to help the user to select the most appropriate 95% UCL. ution, and skewness using results from simulation studies. | n. |
| 84 85 86 87 | Note: Suggestions regarding the selection of a 95% Recommendations are based upon data size | statistician UCL are production, data distrib | ovided to help the user to select the most appropriate 95% UCL. ution, and skewness using results from simulation studies. | n. |
| 84 85 86 87 88 89 | Note: Suggestions regarding the selection of a 95% Recommendations are based upon data size | statistician UCL are production, data distrib | ovided to help the user to select the most appropriate 95% UCL. ution, and skewness using results from simulation studies. | ın. |
| 84 85 86 87 88 | Note: Suggestions regarding the selection of a 95% Recommendations are based upon data size However, simulations results will not cover all Real W | Statistician UCL are pr data distrib orld data se | ovided to help the user to select the most appropriate 95% UCL. ution, and skewness using results from simulation studies. ts; for additional insight the user may want to consult a statisticia | n. |
| 84 85 86 87 88 89 | Note: Suggestions regarding the selection of a 95% Recommendations are based upon data size However, simulations results will not cover all Real W SH-WRB | Statistician O UCL are proposed to the propos | ovided to help the user to select the most appropriate 95% UCL. ution, and skewness using results from simulation studies. ts; for additional insight the user may want to consult a statisticial statistics. | |
| 84 85 86 87 88 89 90 91 92 93 | Note: Suggestions regarding the selection of a 95% Recommendations are based upon data size However, simulations results will not cover all Real W | Statistician UCL are pr data distrib orld data se | ovided to help the user to select the most appropriate 95% UCL. ution, and skewness using results from simulation studies. ts; for additional insight the user may want to consult a statisticial Statistics Number of Distinct Observations | 9 |
| 84 85 86 87 88 89 90 91 92 93 94 | Note: Suggestions regarding the selection of a 95% Recommendations are based upon data size However, simulations results will not cover all Real W SH-WRB Total Number of Observations | Statistician UCL are proposed data distribution data se | co correctly calculate UCLs. ovided to help the user to select the most appropriate 95% UCL. ution, and skewness using results from simulation studies. ts; for additional insight the user may want to consult a statisticial Statistics Number of Distinct Observations Number of Missing Observations | 9 |
| 84 85 86 87 88 90 91 92 93 94 95 | Note: Suggestions regarding the selection of a 95% Recommendations are based upon data size However, simulations results will not cover all Real W SH-WRB Total Number of Observations Minimum | Statistician 5 UCL are properties of the proper | co correctly calculate UCLs. ovided to help the user to select the most appropriate 95% UCL. ution, and skewness using results from simulation studies. ts; for additional insight the user may want to consult a statisticial Statistics Number of Distinct Observations Number of Missing Observations Mean | 9 0 47.87 |
| 84 85 86 87 88 89 90 91 92 93 94 95 96 | Note: Suggestions regarding the selection of a 95% Recommendations are based upon data size However, simulations results will not cover all Real W SH-WRB Total Number of Observations Minimum Maximum | General 9 19 80.8 | co correctly calculate UCLs. ovided to help the user to select the most appropriate 95% UCL. ution, and skewness using results from simulation studies. ts; for additional insight the user may want to consult a statisticial Statistics Number of Distinct Observations Number of Missing Observations Mean Median | 9 |
| 84 85 86 87 88 89 90 91 92 93 94 95 96 | Note: Suggestions regarding the selection of a 95% Recommendations are based upon data size However, simulations results will not cover all Real W SH-WRB Total Number of Observations Minimum | Statistician 5 UCL are properties of the proper | co correctly calculate UCLs. ovided to help the user to select the most appropriate 95% UCL. ution, and skewness using results from simulation studies. ts; for additional insight the user may want to consult a statisticial Statistics Number of Distinct Observations Number of Missing Observations Mean | 9 0 47.87 59 |
| 84 85 86 87 88 89 90 91 92 93 94 95 96 97 | Note: Suggestions regarding the selection of a 95% Recommendations are based upon data size However, simulations results will not cover all Real W SH-WRB Total Number of Observations Minimum Maximum SD | General 9 19 80.8 23.13 | co correctly calculate UCLs. In covided to help the user to select the most appropriate 95% UCL. In the select the most appropriate 95% UCL. It is the select the most appropriat | 9 0 47.87 59 7.71 |
| 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 | Note: Suggestions regarding the selection of a 95% Recommendations are based upon data size However, simulations results will not cover all Real W SH-WRB Total Number of Observations Minimum Maximum SD Coefficient of Variation | General 9 19 80.8 23.13 0.483 | co correctly calculate UCLs. In covided to help the user to select the most appropriate 95% UCL. In the select the most appropriate 95% UCL. It is the select the most appropriat | 9 0 47.87 59 7.71 |
| 84 85 86 87 88 89 90 91 92 93 94 95 96 97 | Note: Suggestions regarding the selection of a 95% Recommendations are based upon data size However, simulations results will not cover all Real W SH-WRB Total Number of Observations Minimum Maximum SD Coefficient of Variation Note: Sample size is small (e.g., <10), if data a | General 9 19 80.8 23.13 0.483 | co correctly calculate UCLs. ovided to help the user to select the most appropriate 95% UCL. ution, and skewness using results from simulation studies. ts; for additional insight the user may want to consult a statisticial Statistics Number of Distinct Observations Number of Missing Observations Mean Median Std. Error of Mean Skewness | 9 0 47.87 59 7.71 |
| 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 | Note: Suggestions regarding the selection of a 95% Recommendations are based upon data size However, simulations results will not cover all Real W SH-WRB Total Number of Observations Minimum Maximum SD Coefficient of Variation Note: Sample size is small (e.g., <10), if data a refer also to ITRC Tech Reg Guide of the size is small (e.g., <10). | General 9 19 80.8 23.13 0.483 are collected on ISM (ITR | co correctly calculate UCLs. In covided to help the user to select the most appropriate 95% UCL. In cution, and skewness using results from simulation studies. Its; for additional insight the user may want to consult a statisticial statistics. Statistics | 9 0 47.87 59 7.71 |
| 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 | Note: Suggestions regarding the selection of a 95% Recommendations are based upon data size However, simulations results will not cover all Real W SH-WRB Total Number of Observations Minimum Maximum SD Coefficient of Variation Note: Sample size is small (e.g., <10), if data a refer also to ITRC Tech Reg Guide of but note that ITRC may recommend the The Chebyshev UCL of the size is small (e.g., <10). | General 9 19 80.8 23.13 0.483 are collected on ISM (ITR | co correctly calculate UCLs. ovided to help the user to select the most appropriate 95% UCL. ution, and skewness using results from simulation studies. ts; for additional insight the user may want to consult a statisticial Statistics Number of Distinct Observations Number of Missing Observations Mean Median Std. Error of Mean Skewness I using incremental sampling methodology (ISM) approach, C 2020 and ITRC 2012) for additional guidance, the Chebyshev UCL for small sample sizes (n < 7). in gross overestimates of the mean. | 9 0 47.87 59 7.71 |
| 84 85 86 87 88 90 91 92 93 94 95 96 97 98 99 100 101 | Note: Suggestions regarding the selection of a 95% Recommendations are based upon data size However, simulations results will not cover all Real W SH-WRB Total Number of Observations Minimum Maximum SD Coefficient of Variation Note: Sample size is small (e.g., <10), if data a refer also to ITRC Tech Reg Guide of but note that ITRC may recommend the The Chebyshev UCL of the same of th | General 9 19 80.8 23.13 0.483 are collected on ISM (ITR | co correctly calculate UCLs. ovided to help the user to select the most appropriate 95% UCL. ution, and skewness using results from simulation studies. ts; for additional insight the user may want to consult a statisticial Statistics Number of Distinct Observations Number of Missing Observations Mean Median Std. Error of Mean Skewness I using incremental sampling methodology (ISM) approach, C 2020 and ITRC 2012) for additional guidance, the Chebyshev UCL for small sample sizes (n < 7). | 9 0 47.87 59 7.71 |
| 84 85 86 87 88 89 91 92 93 94 95 96 97 98 99 100 101 102 103 | Note: Suggestions regarding the selection of a 95% Recommendations are based upon data size However, simulations results will not cover all Real W SH-WRB Total Number of Observations Minimum Maximum SD Coefficient of Variation Note: Sample size is small (e.g., <10), if data a refer also to ITRC Tech Reg Guide but note that ITRC may recommend the The Chebyshev UCL of Refer to the ProUCL 5.2 Tech | General 9 19 80.8 23.13 0.483 are collected on ISM (ITR | statistics Statistics Number of Distinct Observations Number of Missing Observations Mean Median Std. Error of Mean Skewness I using incremental sampling methodology (ISM) approach, C 2020 and ITRC 2012) for additional guidance, the Chebyshev UCL for small sample sizes (n < 7). in gross overestimates of the mean. e for a discussion of the Chebyshev UCL. | 9 0 47.87 59 7.71 |
| 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 | Note: Suggestions regarding the selection of a 95% Recommendations are based upon data size However, simulations results will not cover all Real W SH-WRB Total Number of Observations Minimum Maximum SD Coefficient of Variation Note: Sample size is small (e.g., <10), if data a refer also to ITRC Tech Reg Guide but note that ITRC may recommend the The Chebyshev UCL of Refer to the ProUCL 5.2 Tech | General 9 19 80.8 23.13 0.483 are collected on ISM (ITR let t-UCL or fiten results chnical Guid | co correctly calculate UCLs. In ovided to help the user to select the most appropriate 95% UCL. In ovided to help the user to select the most appropriate 95% UCL. In ovided to help the user to select the most appropriate 95% UCL. In ovided to help the user may want to consult a statistic as the statistic and the sta | 9 0 47.87 59 7.71 |
| 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 | Note: Suggestions regarding the selection of a 95% Recommendations are based upon data size However, simulations results will not cover all Real W SH-WRB Total Number of Observations Minimum Maximum SD Coefficient of Variation Note: Sample size is small (e.g., <10), if data a refer also to ITRC Tech Reg Guide but note that ITRC may recommend the The Chebyshev UCL of Refer to the ProUCL 5.2 Tech | General 9 19 80.8 23.13 0.483 are collected on ISM (ITR let-UCL or fiten results chnical Guid | co correctly calculate UCLs. In covided to help the user to select the most appropriate 95% UCL. In cution, and skewness using results from simulation studies. Its; for additional insight the user may want to consult a statisticial statistics. Statistics | 9 0 47.87 59 7.71 |
| 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 108 | Note: Suggestions regarding the selection of a 95% Recommendations are based upon data size However, simulations results will not cover all Real W SH-WRB Total Number of Observations Minimum Maximum SD Coefficient of Variation Note: Sample size is small (e.g., <10), if data a refer also to ITRC Tech Reg Guide a but note that ITRC may recommend the The Chebyshev UCL or Refer to the ProUCL 5.2 Tech Shapiro Wilk Test Statistic Shapiro Wilk Test Statistic 1% Shapiro Wilk Critical Value | General 9 19 80.8 23.13 0.483 are collected on ISM (ITR let t-UCL or state) thinical Guide Normal (0.872 0.764 | co correctly calculate UCLs. Dovided to help the user to select the most appropriate 95% UCL. Sution, and skewness using results from simulation studies. Its; for additional insight the user may want to consult a statisticial statistics. Statistics Number of Distinct Observations Number of Missing Observations Mean Median Std. Error of Mean Skewness Skewness Lusing incremental sampling methodology (ISM) approach, C 2020 and ITRC 2012) for additional guidance, the Chebyshev UCL for small sample sizes (n < 7). In gross overestimates of the mean. The for a discussion of the Chebyshev UCL. SOF Test Shapiro Wilk GOF Test Data appear Normal at 1% Significance Level | 9 0 47.87 59 7.71 |
| 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 | Note: Suggestions regarding the selection of a 95% Recommendations are based upon data size However, simulations results will not cover all Real W SH-WRB Total Number of Observations Minimum Maximum SD Coefficient of Variation Note: Sample size is small (e.g., <10), if data a refer also to ITRC Tech Reg Guide but note that ITRC may recommend the The Chebyshev UCL of Refer to the ProUCL 5.2 Tech Shapiro Wilk Test Statistic Shapiro Wilk Test Statistic 1% Shapiro Wilk Critical Value Lilliefors Test Statistic | General 9 19 80.8 23.13 0.483 are collected on ISM (ITR let-UCL or fiten results chnical Guid | co correctly calculate UCLs. In covided to help the user to select the most appropriate 95% UCL. In cution, and skewness using results from simulation studies. Its; for additional insight the user may want to consult a statisticial statistics. Statistics | 9 0 47.87 59 7.71 |

| 111 | A B C D E Data appea | F ar Normal at | G H I J K 1% Significance Level | L |
|------------|---------------------------------|-------------------|---|----------|
| 112 | | | liable for small sample sizes | |
| 113 | | | · | |
| 114 | Ass | suming Norr | nal Distribution | |
| 115 | 95% Normal UCL | | 95% UCLs (Adjusted for Skewness) | |
| 116 | 95% Student's-t UCL | 62.2 | 95% Adjusted-CLT UCL (Chen-1995) | 60.38 |
| 117 | | | 95% Modified-t UCL (Johnson-1978) | 62.18 |
| 118 | | | | |
| 119 | | Gamma (| OF Test | |
| 120 | A-D Test Statistic | 0.692 | Anderson-Darling Gamma GOF Test | |
| 121 | 5% A-D Critical Value | 0.725 | Detected data appear Gamma Distributed at 5% Significance L | Level |
| 122 | K-S Test Statistic | 0.283 | Kolmogorov-Smirnov Gamma GOF Test | |
| 123 | 5% K-S Critical Value | 0.28 | Data Not Gamma Distributed at 5% Significance Level | |
| 124 | Detected data follow App | pr. Gamma I | Distribution at 5% Significance Level | |
| 125 | Note GOF tests r | may be unre | liable for small sample sizes | |
| 126 | | | | |
| 127 | | Gamma | Statistics | |
| 128 | k hat (MLE) | 4.192 | , | 2.869 |
| 129 | Theta hat (MLE) | 11.42 | ` ' | 16.68 |
| 130 | nu hat (MLE) | 75.46 | ` ' | 51.64 |
| 131 | MLE Mean (bias corrected) | 47.87 | | 28.26 |
| 132 | | | | 36.14 |
| 133 | Adjusted Level of Significance | 0.0231 | Adjusted Chi Square Value | 33.42 |
| 134 | | | | |
| 135 | | | ma Distribution | |
| 136 | 95% Approximate Gamma UCL | 68.4 | 95% Adjusted Gamma UCL | 73.96 |
| 137 | | | | |
| 138 | 0 | Lognormal | | |
| 139 | Shapiro Wilk Test Statistic | 0.86 | Shapiro Wilk Lognormal GOF Test | |
| 140 | 10% Shapiro Wilk Critical Value | 0.859 | Data appear Lognormal at 10% Significance Level | |
| 141 | Lilliefors Test Statistic | 0.283 | Lilliefors Lognormal GOF Test | |
| 142 | 10% Lilliefors Critical Value | 0.252 | Data Not Lognormal at 10% Significance Level | |
| 143 | | | ormal at 10% Significance Level | |
| 144 | Note GOF tests i | may be unre | liable for small sample sizes | |
| 145 | | Lognorma | Chatistica | |
| 146 | Minimum of Logged Data | 2.944 | | 3.744 |
| 147 | Maximum of Logged Data | 4.392 | | 0.551 |
| 148 | waxiiiuiii oi Logged Data | 7.002 | SD of logged Data | 0.001 |
| 149 | Δοσι | ımina l oano | rmal Distribution | |
| 150 | 95% H-UCL | 77.28 | | 75.34 |
| 151 | 95% Chebyshev (MVUE) UCL | 87.58 | | 04.6 |
| 152 | 99% Chebyshev (MVUE) UCL | 138 | 23.03.2 22330.03 (132.) 302 | |
| 153 | 33 % 335/3.107 (1117 3.2.) | | | |
| 154 155 | Nonparame | tric Distribut | tion Free UCL Statistics | |
| 156 | • | | Discernible Distribution | |
| 157 | | | | |
| 157 | Nonpar | ametric Dist | ribution Free UCLs | |
| 159 | 95% CLT UCL | 60.55 | | 59.56 |
| 160 | 95% Standard Bootstrap UCL | 59.82 | · | 61.46 |
| 161 | 95% Hall's Bootstrap UCL | 58.43 | • | 59.87 |
| 162 | 90% Chebyshev(Mean, Sd) UCL | 71 | · | 81.47 |
| 163 | 97.5% Chebyshev(Mean, Sd) UCL | 96.01 | | 24.6 |
| 164 | | | | |
| 165 | | Suggested | UCL to Use | |
| 100 | | | | <u> </u> |

| | A B | | D E | F | G | Н | I | J | K | L |
|------------|---------------|----------------------|--|---------------|-------------------|--------------|--------------|-----------------|-------------------|--------|
| 166 | | 95 | 5% Student's-t UCL | 62.2 | | | | | | |
| 167 | N | | | 1101 | | | 1 | | . 050/ 1101 | |
| 168 | | | e selection of a 95% | • | • | | | | | |
| 169 | | | nsed upon data size, not cover all Real W | | <u> </u> | | | | | |
| 170 | However, Simu | | not cover all Real vi | ond data se | is, for additiona | I Insigni ii | ie usei may | want to cons | uit a statisticia | JII. |
| 171 | Note: For | r highly negatively- | skewed data, confid | lence limite | (e.g. Chen Io | hneon I | ognormal a | nd Gamma) | may not he | |
| 172 | 11010.101 | | s and Johnson's me | | | | _ | · · · | | |
| 173 174 | | Tollable: Gliell | | oulous provi | ao aajaoanona | - TOT POOR | voly okoliou | data ooto. | | |
| 175 | | | | | | | | | | |
| 176 | SH-WRC | | | | | | | | | |
| 177 | | | | | | | | | | |
| 178 | | | | General | Statistics | | | | | |
| 179 | | Total Numb | per of Observations | 9 | | | Numbe | r of Distinct (| Observations | 5 |
| 180 | | - | | | | | Number | of Missing (| Observations | 0 |
| 181 | | | Minimum | 12 | | | | | Mean | 17.16 |
| 182 | | | Maximum | 21 | | | | | Median | 16 |
| 183 | | | SD | 3.784 | | | | Std. E | rror of Mean | 1.261 |
| 184 | | Coe | efficient of Variation | 0.221 | | | | | Skewness | 0.0146 |
| 185 | | | | | | | | | | |
| 186 | Note: Sar | | (e.g., <10), if data a | | | | | | approach, | |
| 187 | <u></u> | | C Tech Reg Guide o | • | | • | | • | | |
| 188 | | | may recommend th | | | | · | e sizes (n < 7 | 7). | |
| 189 | | | Chebyshev UCL on the ProUCL 5.2 Tec | | | | | LICI | | |
| 190 | | | ne Prouct 5.2 red | ninical Guide | e ior a discussi | On or the | Chebyshev | UCL. | | |
| 191 | | | | Normal (| GOF Test | | | | | |
| 192 | | Shapiro | Wilk Test Statistic | 0.801 | 1001 | | Shapiro Wi | lk GOF Test | <u> </u> | |
| 193 194 | | • | Wilk Critical Value | 0.764 | | Data appe | - | t 1% Signific | | |
| 195 | | | iefors Test Statistic | 0.29 | | | | GOF Test | | |
| 196 | | 1% Lilli | efors Critical Value | 0.316 | | Data appe | ar Normal a | t 1% Signific | ance Level | |
| 197 | | | Data appea | ar Normal at | 1% Significan | ce Level | | | | |
| 198 | | | Note GOF tests | may be unre | liable for small | sample s | sizes | | - | |
| 199 | | | | | | | | | | |
| 200 | | | | suming Norr | mal Distribution | | | | | |
| 201 | | 95% Normal | | | | | ` - | sted for Ske | • | |
| 202 | | 95 | 5% Student's-t UCL | 19.5 | | | | | (Chen-1995) | 19.24 |
| 203 | | | | | | | 95% Modific | ed-t UCL (Jo | hnson-1978) | 19.5 |
| 204 | | | | Cam 1 | COE Took | | | | | |
| 205 | | | A-D Test Statistic | 0.866 | GOF Test | Andor | eon-Darlina | Gamma GC |)F Teet | |
| 206 | | 50 / | A-D Test Statistic A-D Critical Value | 0.721 | Data | | | | nificance Lev | el |
| 207 | | | K-S Test Statistic | 0.301 | Data | | | ov Gamma G | <u> </u> | - |
| 208 209 | | 5% | 6 K-S Critical Value | 0.279 | Data | | | | nificance Lev | el |
| 210 | | | Data Not Gamr | | | | | | | |
| 211 | | | | | | | | | | |
| 212 | | | | Gamma | Statistics | | | | | |
| 213 | | | k hat (MLE) | 22.67 | | | k: | star (bias co | rrected MLE) | 15.19 |
| 214 | | | Theta hat (MLE) | 0.757 | | | Theta | star (bias co | rrected MLE) | 1.13 |
| 215 | | | nu hat (MLE) | 408 | | | | • | as corrected) | 273.4 |
| 216 | | MLE Me | an (bias corrected) | 17.16 | | | | • | as corrected) | 4.402 |
| 217 | | | | | | | | • | Value (0.05) | 236.1 |
| 218 | | Adjusted Le | evel of Significance | 0.0231 | | | Ad | djusted Chi S | Square Value | 228.7 |
| 219 | | | | | | | | | | |
| 220 | | | Ass | suming Gam | ma Distributior | 1 | | | | |

| | Α | В | | С | D | E | F | G | Н | | J | K | L |
|-----|---|-------------|----------|--------------------|----------------|----------------|----------------|-----------------|----------------|------------|----------------|--------------------|-------|
| 221 | | | | 95% A _l | pproximate (| Gamma UCL | 19.87 | | | 9 | 95% Adjusted | Gamma UCL | 20.5 |
| 222 | | | | | | | | | | | | | |
| 223 | | | | | | | | I GOF Test | | | | | |
| 224 | | | | | • | Test Statistic | | | • | | ognormal GO | | |
| 225 | | | | 10% Sł | | Critical Value | | | | • | at 10% Signifi | | |
| 226 | | | | | | Test Statistic | | | | - | normal GOF | | |
| 227 | | | | 10 | % Lilliefors C | Critical Value | | | | ognormal . | at 10% Signifi | cance Level | |
| 228 | | | | | | Data Not L | ognormal at | 10% Signific | cance Level | | | | |
| 229 | | | | | | | | | | | | | |
| 230 | | | | | | | | I Statistics | | | | | |
| 231 | | | | | | Logged Data | | | | | | f logged Data | 2.82 |
| 232 | | | | N | laximum of l | Logged Data | 3.045 | | | | SD o | f logged Data | 0.225 |
| 233 | | | | | | | | | | | | | |
| 234 | | | | | | | uming Logno | ormal Distrib | ution | | | | |
| 235 | | | | | | 95% H-UCL | 20.07 | | | | % Chebyshev | ` ' | 21.03 |
| 236 | | | | | | MVUE) UCL | 22.79 | | | 97.5% | % Chebyshev | (MVUE) UCL | 25.22 |
| 237 | | | | 99% (| Chebyshev (| MVUE) UCL | 30.01 | | | | | | |
| 238 | | | | | | | | | | | | | |
| 239 | | | | | | • | etric Distribu | | | | | | |
| 240 | | | | | | Data appea | ar to follow a | Discernible | Distribution | | | | |
| 241 | | | | | | | | | | | | | |
| 242 | | | | | | - | rametric Dist | tribution Fre | e UCLs | | | | |
| 243 | | | | | | 5% CLT UCL | 19.23 | | | | | ootstrap UCL | 19.11 |
| 244 | | | | | | otstrap UCL | 19.12 | | | | | otstrap-t UCL | 19.36 |
| 245 | | | | | | otstrap UCL | 18.74 | | | | 6 Percentile B | • | 19.11 |
| 246 | | | | | • | an, Sd) UCL | 20.94 | | | | Chebyshev(Me | | 22.65 |
| 247 | | | 97 | 7.5% Ch | ebyshev(Me | an, Sd) UCL | 25.03 | | | 99% (| Chebyshev(Me | ean, Sd) UCL | 29.71 |
| 248 | | | | | | | | | | | | | |
| 249 | | | | | | | Suggested | UCL to Use | | | | | |
| 250 | | | | | 95% Stu | dent's-t UCL | 19.5 | | | | | | |
| 251 | | | | | | | | | | | | | |
| 252 | | | - | • | _ | | • | | • | | | riate 95% UCL | |
| 253 | | | | | | | | | | | rom simulatior | | |
| 254 | H | owever, sin | mulatior | ns result | s will not cov | er all Real W | /orld data set | ts; for additio | nal insight th | ne user ma | y want to con- | sult a statisticia | an. |
| 255 | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |

| | A B C | D E | F | G H | l J | K | L |
|----------|--------------------------------|--|----------------|-----------------------------|---------------------------------------|-----------------------------------|----------|
| 1 | | UCL Statis | Stics for Unce | ensored Full Data Sets | | | |
| 2 | User Selected Options | , | | | | | |
| 3 | Date/Time of Computation | ProUCL 5.2 11/18/2024 | 12·24·51 PM | | | | |
| 4 | From File | WorkSheet.xls | 12.24.011 W | | | | |
| 5 | Full Precision | OFF | | | | | |
| 6 7 | Confidence Coefficient | 95% | | | | | |
| 8 | Number of Bootstrap Operations | 2000 | | | | | |
| 9 | | | | | | | |
| 10 | | | | | | | |
| | TL-WRA | | | | | | |
| 12 | | | | | | | |
| 13 | | | General | Statistics | | | |
| 14 | Total | Number of Observations | 8 | | Number of Distin | | 8 |
| 15 | | | | | Number of Missin | ng Observations | 0 |
| 16 | | Minimum | 175.2 | | | Mean | 282.2 |
| 17 | | Maximum | 454 | | | Median | 250.2 |
| 18 | | SD | 112.8 | | Sto | d. Error of Mean | 39.87 |
| 19 | | Coefficient of Variation | 0.4 | | | Skewness | 0.426 |
| 20 | Maka O-mula atau ta | email (e.g. 40) 18 4-2-1 | no oalla -4- 1 | using incremental accord | ing mothedal// | M) oppress-L | |
| 21 | = | small (e.g., <10), if data a to ITRC Tech Reg Guide o | | - | | | |
| 22 | | ITRC may recommend th | • | • | _ | | |
| 23 | Dut note that | = | | in gross overestimates of | · · · · · · · · · · · · · · · · · · · | < / ₁ / ₁ . | |
| 24 | Rei | fer to the ProUCL 5.2 Tec | | | | | |
| 25 26 | | | | | | | |
| 27 | | | Normal C | GOF Test | | | |
| 28 | S | Shapiro Wilk Test Statistic | 0.843 | : | Shapiro Wilk GOF T | est | |
| 29 | 1% S | hapiro Wilk Critical Value | 0.749 | Data appea | ar Normal at 1% Sign | ificance Level | |
| 30 | | Lilliefors Test Statistic | 0.284 | | Lilliefors GOF Tes | st | |
| 31 | 1 | % Lilliefors Critical Value | 0.333 | Data appea | ar Normal at 1% Sign | ificance Level | |
| 32 | | | | 1% Significance Level | | | |
| 33 | | Note GOF tests | may be unre | liable for small sample si | zes | | |
| 34 | | | | | | | |
| 35 | | | suming Norr | mal Distribution | | | |
| 36 | 95% N | ormal UCL | 057.7 | | UCLs (Adjusted for S | • | 0540 |
| 37 | | 95% Student's-t UCL | 357.7 | | 5% Adjusted-CLT UC | , | 354.2 |
| 38 | | | | | 95% Modified-t UCL (| (301118011-1978) | 358.7 |
| 39 | | | Gamma (| GOF Test | | | |
| 40 | | A-D Test Statistic | 0.693 | | son-Darling Gamma | GOF Test | |
| 41 42 | | 5% A-D Critical Value | 0.717 | Detected data appear | = | | ce Level |
| 42 | | K-S Test Statistic | 0.296 | | prov-Smirnov Gamma | | |
| 44 | | 5% K-S Critical Value | 0.295 | | na Distributed at 5% | | el |
| 45 | | | | Distribution at 5% Signific | | = | |
| 46 | | | | liable for small sample si | | | |
| 47 | | | | | | | |
| 48 | | | Gamma | Statistics | | | |
| 49 | | k hat (MLE) | 7.275 | | k star (bias | corrected MLE) | 4.63 |
| 50 | | Theta hat (MLE) | 38.79 | | Theta star (bias | ŕ | 60.94 |
| 51 | | nu hat (MLE) | | | | (bias corrected) | 74.08 |
| 52 | M | LE Mean (bias corrected) | 282.2 | | | (bias corrected) | 131.1 |
| 53 | | | 0.01== | Α | Approximate Chi Squa | | 55.26 |
| 54 | | sted Level of Significance | 0.0195 | | Adjusted Ch | hi Square Value | 51.17 |
| 55 | | | | | | | |

| Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach, refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance, but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7). The Chebyshev UCL often results in gross overestimates of the mean. Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL. Normal GOF Test | | Α | | В | | С | | D | E | | F | G | والمراا | Н | | ı | | , | j | | K | 工 | L |
|--|----------|--|-------|---------|--------|---------|----------|----------|----------|---------|-------------|-----------------|---------|-------------|-------|----------|----------|--------|---------|-------|---------|---------|--------|
| | | | | | | 05% / | \\ nnrov | imata (| Gamma | | | | ibuuc | <u></u> | | | 05% | Λdiu | etod (| Gar | ma H | | 408 E |
| Stropping Wilk Teel Statistic 18.83 Shapino Wilk Lognormal COF Teet 10% Shapino Wilk Cell Statistic 18.85 Data Not Lognormal at 10% Significance Level 10% Illisifients Critical Value 0.25 Data Not Lognormal at 10% Significance Level 18.85 Data Not Lognormal at 10% | | | | | | 93 /0 F | Approx | iiiate (| Jaiiiiia | UCL | 376.3 | | | | | | 95 /0 | Auju | Sieu | Jan | IIIa U | UL | 400.5 |
| Shapiro Wilk Test Statistic 0.833 | \vdash | | | | | | | | | | Lognorma | l GOF Te | est | | | | | | | | | | |
| 19% Shapiro Wilk Critical Value 0.851 | | | | | | | Shapiro | o Wilk | Test Sta | atistic | <u> </u> | | | Sha | apiro | Wilk I | Loan | orma | I GOF | F Te | est | | |
| Lillidors Tost Statistic 2.78 | | | | | | | • | | | | | | | | - | | | | | | | el | |
| 10% Lilliefors Critical Value 0.265 Data Not Lognormal at 10% Significance Level | - | | | | | | | | | | | | | | | | | | | | | | |
| Data Not Lognormal at 10% Significance Level | \vdash | | | | | 10 | | | | | | | | | | | _ | | | | | el | |
| | | | | | | | | | Data I | Not Lo | ognormal a | 10% Sigi | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | |
| Maximum of Logged Data 5.168 | - | | | | | | | | | | Lognorma | rmal Statistics | | | | | | | | | | | |
| Maximum of Logged Date 6.118 SD of logged Date 0.4 | - | | | | | | Minim | um of | Logged | Data | 5.166 | | | | | | | Мє | an of | log | ged Da | ata | 5.572 |
| The Content of C | \vdash | | | | | | Maxim | um of | Logged | Data | 6.118 | | | | | | | , | SD of | log | ged Da | ata | 0.4 |
| 77 | | | | | | | | | | | | | | | | | | | | | | | |
| | 70 | | | | | | | | | Assı | ıming Logn | ormal Dis | tribut | ion | | | | | | | | | |
| | 71 | | | | | | | | 95% H- | -UCL | 397.3 | | | | | 90 | % C | hebys | shev (| (MV | UE) U | CL | 402.6 |
| 73 | | | | | | 95% | Cheb | yshev (| MVUE) | UCL | 457.2 | | | | | 97.5 | % C | hebys | shev (| (MV | UE) U | CL | 533 |
| Nonparametric Distribution Free UCL Statistics Data appear to follow a Discernible Distribution Pree UCL | | | | | | 99% | Cheb | yshev (| (MVUE) | UCL | 681.9 | | | | | | | | | | | | |
| Data appear to follow a Discemible Distribution | 74 | | | | | | | | | | | | | | | | | | | | | | |
| Nonparametric Distribution Free UCLs | 75 | | | | | | | | - | | | | | | | | | | | | | | |
| Nonparametric Distribution Free UCLs 347.8 95% BCA Bootstrap UCL 347.8 35% BCA Bootstrap UCL 347.6 347.8 35% BCA Bootstrap UCL 347.6 347.8 35% BCA Bootstrap UCL 347.6 | 76 | Data appear to follow a Discernible Distribution | | | | | | | | | | | | | | | | | | | | | |
| 95% Standard Bootstrap UCL 347.8 95% BCA Bootstrap UCL 351.1 95% Bootstrap UCL 372.1 344.5 95% Bootstrap UCL 372.1 344.5 95% Bootstrap UCL 372.1 351.6 95% Halfs Bootstrap UCL 345.6 95% Percentile Bootstrap UCL 345.6 35.6 95% Percentile Bootstrap UCL 345.6 35.6 95% Percentile Bootstrap UCL 345.6 35.6 95% Percentile Bootstrap UCL 35.6 35.6 95% Percentile Bootstrap UCL 35.6 35.6 95% Chebyshev(Mean, Sd) UCL 465 35.2 99% Chebyshev(Mean, Sd) UCL 456 35.2 99% Chebyshev(Mean, Sd) UCL 465 99% Chebyshev(Mean, Sd) | 77 | | | | | | | | | | | | | | | | | | | | | | |
| Standard Bootstrap UCL 344.5 95% Bootstrap-t UCL 372.1 | 78 | | | | | | | | | | | tribution | Free | UCLs | | | | | | | | | |
| 1 | 79 | | | | | | | | | | | | | | | | | | | | | | |
| 20 90% Chebyshev(Mean, Sd) UCL 401.8 95% Chebyshev(Mean, Sd) UCL 456 | 80 | | | | | | | | | | | | | | | | | | | | • | | |
| State Suggested UCL to Use Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL Suggestions regarding the selection of a 95% UCL are provided to help the user used upon data statistic in However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistic in Suggestion Suggest | 81 | | | | | | | | • | | | | | | | | | | | | | | |
| Suggested UCL to Use Suggested UCL to Use | 82 | | | | | | - | | | | | | | | | | | - | - | | | | |
| 85 Suggested UCL to Use 86 95% Student's-t UCL 357.7 | 83 | | | | 9 | 7.5% C | hebysł | nev(Me | an, Sd) | UCL | 531.2 | | | | | 99% | Che | byshe | ev(Me | an, | Sd) U | CL | 678.9 |
| 86 95% Student's-t UCL 357.7 88 Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. 89 Recommendations are based upon data size, data distribution, and skewness using results from simulation studies. 90 However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician. 91 However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician. 91 Page 10 Page 1 | \vdash | | | | | | | | | | 0 | 1101 1 1 | | | | | | | | | | | |
| Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. Recommendations are based upon data size, data distribution, and skewness using results from simulation studies. However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician. However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician. For additional insight the user may want to consult a statistician. General Statistics General Statistics Total Number of Distinct Observations of Number of Distinct Observations of Number of Missing Observations of Number of Distinct Observations of Number of Missing Observations of Number of Missing Observations of Number of Numb | 85 | | | | | | 0 | F0/ C+ | | LICI | | UCL to C | Jse | | | | | | | | | | |
| Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. Recommendations are based upon data size, data distribution, and skewness using results from simulation studies. However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician. TL-WRB TL-WRB General Statistics General Statistics Total Number of Observations 7 Number of Distinct Observations 7 Number of Missing Observations 0 Minimum 35.7 Number of Missing Observations 0 Maximum 194 Median 137.3 Mean 122.5 Maximum 194 Median 137.3 Coefficient of Variation 0.473 Skewness -0.322 Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach, refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance, but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7). Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL. | _ | | | | | | 9: | 5% Stu | uents-t | UCL | 357.7 | | | | | | | | | | | \perp | |
| Recommendations are based upon data size, data distribution, and skewness using results from simulation studies. However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician. General Statistics General Statistics Total Number of Observations 7 Number of Distinct Observations 7 Number of Missing Observations 0 Number of Missing Observations 10 Number of Numbe | _ | | Note: | Suga | estion | s renar | ding th | م دمامہ | ction of | a 95% | LICL are n | ovided to | heln | the user t | to se | lect the | e mo | et an | nronri | iate | 95% I | ICI | |
| However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician. 91 However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician. 92 Page 193 TL-WRB 94 Page 195 Page | \vdash | | | | | | | | | | | | | | | | | | | | | | |
| 192 | | | | | | | | | | | | | | | | | | | | | | sticia | n. |
| 92 | | | | ., | | | | | | | | , | | | | | <u>,</u> | | | | | | |
| 93 TL-WRB 94 95 General Statistics 96 Total Number of Observations 7 Number of Distinct Observations 7 Number of Missing Observations 0 98 Minimum 35.7 Number of Missing Observations 0 98 Maximum 194 Median 137.3 100 SD 57.99 Std. Error of Mean 21.92 101 Coefficient of Variation 0.473 Skewness -0.322 102 103 Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach, refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance, 105 but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7). 106 The Chebyshev UCL often results in gross overestimates of the mean. 107 Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL. 108 Normal GOF Test 109 Normal | | | | | | | | | | | | | | | | | | | | | | | |
| 94 95 General Statistics 96 Total Number of Observations 7 Number of Distinct Observations 7 Number of Missing Observations 0 98 Minimum 35.7 Mean 122.5 99 Maximum 194 Median 137.3 100 SD 57.99 Std. Error of Mean 21.92 101 Coefficient of Variation 0.473 Skewness -0.322 102 103 Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach, 104 refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance, 105 but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7). 106 The Chebyshev UCL often results in gross overestimates of the mean. 107 Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL. 108 Normal GOF Test 108 Normal GOF Test 109 Normal GOF | | TL-WRB | | | | | | | | | | | | | | | | | | | | | |
| 95 General Statistics 96 Total Number of Observations 7 Number of Distinct Observations 7 97 Number of Missing Observations 0 98 Minimum 35.7 Mean 122.5 99 Maximum 194 Median 137.3 100 SD 57.99 Std. Error of Mean 21.92 101 Coefficient of Variation 0.473 Skewness -0.322 102 Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach, 104 refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance, 105 but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7). 106 The Chebyshev UCL often results in gross overestimates of the mean. 107 Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL. 108 109 Normal GOF Test | 33 | | | | | | | | | | | | | | | | | | | | | | |
| Total Number of Observations 7 Number of Distinct Observations 7 Number of Missing Observations 0 Minimum 35.7 Mean 122.5 Maximum 194 Median 137.3 Coefficient of Variation 0.473 Std. Error of Mean 21.92 Coefficient of Variation 0.473 Skewness -0.322 Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach, refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance, but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7). The Chebyshev UCL often results in gross overestimates of the mean. Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL. | | | | | | | | | | | General | Statistics | 3 | | | | | | | | | | |
| Number of Missing Observations 0 | | | | | | Tota | l Numl | ber of C | Observa | tions | 7 | | | | | Num | ber o | of Dis | tinct (| Obse | ervatio | ns | 7 |
| Minimum 35.7 Mean 122.5 Maximum 194 Median 137.3 Modian | | | | | | | | | | | | | | | | Num | ber c | of Mis | sing (| Obse | ervatio | ns | 0 |
| Maximum 194 Median 137.3 | | | | | | | | | Mini | mum | 35.7 | | | | | | | | | | Me | an | 122.5 |
| SD 57.99 Std. Error of Mean 21.92 | | | | | | | | | Maxi | mum | 194 | | | | | | | | | | Medi | an | 137.3 |
| Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach, refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance, but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7). The Chebyshev UCL often results in gross overestimates of the mean. Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL. Normal GOF Test | - | | | | | | | | | SD | 57.99 | | | | | | | | Std. E | Error | of Me | an | 21.92 |
| Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach, refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance, but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7). The Chebyshev UCL often results in gross overestimates of the mean. Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL. Normal GOF Test | 101 | Coefficient of Va | | | | | | | | | 0.473 | | | | | | | | | S | kewne | ss | -0.322 |
| refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance, but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7). The Chebyshev UCL often results in gross overestimates of the mean. Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL. Normal GOF Test | 102 | | | | | | | | | | | | | | | | | | | | | | |
| but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7). The Chebyshev UCL often results in gross overestimates of the mean. Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL. Normal GOF Test | 103 | | No | ote: Sa | | | | | | | | | | | - | | | | | | roach | l, | |
| The Chebyshev UCL often results in gross overestimates of the mean. Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL. Normal GOF Test | 104 | V T | | | | | | | | | | | | | | | | | | | | | |
| 107 Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL. 108 109 Normal GOF Test | 105 | | | | | | | | | | | | | | | | | | | | | | |
| 108 109 Normal GOF Test | 106 | <u> </u> | | | | | | | | | | | | | | | | | | | | | |
| Normal GOF Test | 107 | | | | | Re | fer to | the Pro | JUCL 5. | 2 Tec | hnical Guid | e for a dis | scuss | sion of the | e Ch | ebysh | ev U | CL. | | | | | |
| OL : WILL T. 101 C. I. O. | 108 | | | | | | | | | | | | | | | | | | | | | | |
| Shapiro Wilk Test Statistic 0.952 Shapiro Wilk GOF Test | 109 | | | | | | | | | | | GOF Test | t | | | | | | | | | | |
| | 110 | | | | | | Shapiro | o Wilk | Test Sta | itistic | 0.952 | <u></u> | | | SI | napiro | Wilk | GOF | Test | t | | | |

| | A B C D E | F | G H I J K L |
|------------|---|----------------|--|
| 111 | 1% Shapiro Wilk Critical Value | | Data appear Normal at 1% Significance Level |
| 112 | Lilliefors Test Statistic | | Lilliefors GOF Test |
| 113 | 1% Lilliefors Critical Value | | Data appear Normal at 1% Significance Level |
| 114 | • • | | t 1% Significance Level |
| 115 | Note GOF tests | may be unre | eliable for small sample sizes |
| 116 | Δο | suming Non | mal Distribution |
| 117 | 95% Normal UCL | | 95% UCLs (Adjusted for Skewness) |
| 118 119 | 95% Student's-t UCL | 165.1 | 95% Adjusted-CLT UCL (Chen-1995) 155.7 |
| 120 | | | 95% Modified-t UCL (Johnson-1978) 164.6 |
| 121 | | 1 | |
| 122 | | Gamma (| GOF Test |
| 123 | A-D Test Statistic | 0.329 | Anderson-Darling Gamma GOF Test |
| 124 | 5% A-D Critical Value | 0.71 | Detected data appear Gamma Distributed at 5% Significance Level |
| 125 | K-S Test Statistic | | Kolmogorov-Smirnov Gamma GOF Test |
| 126 | 5% K-S Critical Value | | Detected data appear Gamma Distributed at 5% Significance Level |
| 127 | | | stributed at 5% Significance Level |
| 128 | Note GOF tests | may be unre | eliable for small sample sizes |
| 129 | | | Chablishing |
| 130 | k bot /MLF) | | Statistics k star (bias corrected MLE) 2.373 |
| 131 | k hat (MLE) Theta hat (MLE) | | k star (bias corrected MLE) 2.373 Theta star (bias corrected MLE) 51.61 |
| 132 | nu hat (MLE) | | nu star (bias corrected) 33.22 |
| 133 | MLE Mean (bias corrected) | | MLE Sd (bias corrected) 79.5 |
| 134 135 | (5:65 55:155:53) | | Approximate Chi Square Value (0.05) 21.04 |
| 136 | Adjusted Level of Significance | 0.0158 | Adjusted Chi Square Value 18.18 |
| 137 | , , | | · · · · · · · · · · · · · · · · · · · |
| 138 | As | suming Garr | nma Distribution |
| 139 | 95% Approximate Gamma UCL | 193.4 | 95% Adjusted Gamma UCL 223.8 |
| 140 | | <u>I</u> | |
| 141 | | Lognorma | I GOF Test |
| 142 | Shapiro Wilk Test Statistic | | Shapiro Wilk Lognormal GOF Test |
| 143 | 10% Shapiro Wilk Critical Value | | Data appear Lognormal at 10% Significance Level |
| 144 | Lilliefors Test Statistic | | Lilliefors Lognormal GOF Test |
| 145 | 10% Lilliefors Critical Value | | Data appear Lognormal at 10% Significance Level |
| 146 | • • | | at 10% Significance Level |
| 147 | Note GOP tests | may be unre | eliable for small sample sizes |
| 148 | | Lognorma | al Statistics |
| 149 | Minimum of Logged Data | | Mean of logged Data 4.677 |
| 150 151 | Maximum of Logged Data | | SD of logged Data 0.602 |
| 152 | | | |
| 153 | Assı | uming Logno | ormal Distribution |
| 154 | 95% H-UCL | 248.7 | 90% Chebyshev (MVUE) UCL 211.1 |
| 155 | 95% Chebyshev (MVUE) UCL | 250 | 97.5% Chebyshev (MVUE) UCL 304 |
| 156 | 99% Chebyshev (MVUE) UCL | 410.2 | |
| 157 | | | |
| 158 | - | | tion Free UCL Statistics |
| 159 | Data appea | ir to follow a | Discernible Distribution |
| 160 | | | No. 1 to East 1101 to |
| 161 | <u> </u> | | tribution Free UCLs |
| 162 | 95% CLT UCL | 158.5 | 95% BCA Bootstrap UCL 154.9 95% Bootstrap-t UCL 162.7 |
| 163 | 95% Standard Bootstrap UCL 95% Hall's Bootstrap UCL | | 95% Bootstrap-t UCL 162.7 95% Percentile Bootstrap UCL 155.6 |
| 164 | 95% Hall's Bootstrap UCL 90% Chebyshev(Mean, Sd) UCL | | 95% Percentile Bootstrap UCL 155.6 95% Chebyshev(Mean, Sd) UCL 218 |
| 165 | 30 % Chebyshev(iviean, 30) OCL | 100.2 | 33 /0 Chebyshev (Wedt), 30) UCL 210 |

| | Α | | В | С | | D | E | F | | G | | Н | | J | K | L | | | |
|------------|--|------|-----------|--------------|----------|------------|----------------|--------------|----------|-----------|----------|----------|-------------|---------------------|---------------|----------|--|--|--|
| 166 | | | | 97.5% | Cheby | shev(Mea | an, Sd) UCL | 259.3 | | | | | 99% C | chebyshev(Mean, | Sd) UCL | 340.5 | | | |
| 167 | | | | | | | | | | | | | | | | | | | |
| 168 | | | | | | | | Suggested | J UCL t | to Use | | | | | | | | | |
| 169 | | | | | | 95% Stud | dent's-t UCL | 165.1 | | | | | | | | | | | |
| 170 | | | | | | | | | | | | | | | 050/ 1101 | | | | |
| 171 | | Not | | _ | - | | | • | | | • | | | most appropriate | | | | | |
| 172 | | I | | | | | | | | | | | | om simulation stud | | | | | |
| 173 | ļ | 10we | ver, simu | liations res | Suits Wi | not cov | er all Real v | voria data s | ets; for | additio | nai in | signt tr | ne user may | want to consult a | 1 Statisticia | an. | | | |
| 174 | | | loto: For | . biably po | gotivol | | d data sanf | idonoo limit | - / | Chan | lohn | oon L | ognormal o | and Gamma) may | , not bo | | | | |
| 175 | | | NOIE. FOI | | | - | | nethods prov | | | | | _ | | not be | | | | |
| 176 | | | | Tellable | 5. Cile | - S and 5 | 011130113111 | eulous prov | nue auj | Justine | 1113 101 | i posit | vely skewe | u uata sets. | | | | | |
| 177 | | | | | | | | | | | | | | | | | | | |
| 178 | TL-WRC | — | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| 180 | | | | | | | | Genera | l Statis | tics | | | | | | | | | |
| 181 | | | | Tc | tal Nur | nber of C | bservations | | T | | | | Numbe | er of Distinct Obse | ervations | 8 | | | |
| 182 183 | | | | | | | | - | + | | | | | er of Missing Obse | | 0 | | | |
| 183 | | | | | | | Minimum | n 99 | + | | | | | | Mean | 165.2 | | | |
| 185 | | | | | | | Maximum | n 205 | | | | | | | Median | 156 | | | |
| 186 | | | | | | | SD | 36.84 | + | | | | | Std. Error | of Mean | 12.28 | | | |
| 187 | | | | | C | oefficient | t of Variation | 0.223 | + | | | | | S | kewness | -0.428 | | | |
| 188 | | | | | | | | _1 | | | | | | | | | | | |
| 189 | Note: Occupie the install (see add) if data are callested union in constant and the data of (IOM) constant | | | | | | | | | | | | | | | | | | |
| 190 | refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance, | | | | | | | | | | | | | | | | | | |
| 191 | hat a last ITDO and a last ITD | | | | | | | | | | | | | | | | | | |
| 192 | The Obstant will Obstant with the words of the words | | | | | | | | | | | | | | | | | | |
| 193 | | | | F | Refer to | the Pro | UCL 5.2 Te | chnical Guid | de for a | ı discu | ssion | of the | Chebyshev | UCL. | | | | | |
| 194 | | | | | | | | | | | | | | | | | | | |
| 195 | | | | | | | | Normal | GOF T | est | | | | | | | | | |
| 196 | | | | | | | Test Statistic | | | | | | | /ilk GOF Test | | | | | |
| 197 | | | | 1% | | | Critical Value | | | | Dat | ta appe | | at 1% Significance | e Level | | | | |
| 198 | | | | | | | Test Statistic | | | | | | | s GOF Test | | | | | |
| 199 | | | | | 1% Li | lliefors C | Critical Value | | 100 | | | | ear Normal | at 1% Significance | e Level | | | | |
| 200 | | | | | | | | ear Normal a | | - | | | | | | | | | |
| 201 | | | | | | Note | GOF tests | may be uni | reliable | tor sn | nali sa | imple s | sizes | | | | | | |
| 202 | | | | | | | | ssuming No | mal D | iotrib. d | | | | | | | | | |
| 203 | | | | 05% | Norma | ALIICI | | Summy No | | Sulbut | .1011 | 05% | LICLe (Adi | usted for Skewne | | | | | |
| 204 | | | | | | | dent's-t UCL | 188.1 | + | | | | , , | ted-CLT UCL (Che | | 183.5 | | | |
| 205 | | | | | | | | | +- | | | | • | fied-t UCL (Johns | ′ | 187.8 | | | |
| 206 | | | | | | | | 1 | | | | | 30.0 MOUII | | | | | | |
| 207 208 | | | | | | | | Gamma | GOF 1 | Test | | | | | | | | | |
| 208 | | | | | | A-D T | Test Statistic | | Τ. | | | Ander | rson-Darlin | g Gamma GOF T | est | | | | |
| 210 | | | | | - 5 | | Critical Value | | D | etecte | | | | Distributed at 5% S | | ce Level | | | |
| 211 | | | | | | | Test Statistic | | + | | | | | ov Gamma GOF | | | | | |
| 212 | | | | | Ę | % K-S C | Critical Value | | D | etecte | | | | Distributed at 5% S | | ce Level | | | |
| 213 | | | | | | Detected | data appea | ar Gamma D |)istribu | ted at ! | 5% Si | gnifica | nce Level | | | | | | |
| 214 | | | | | | Note | GOF tests | may be uni | reliable | for sn | nall sa | ample : | sizes | | | | | | |
| 215 | | | | | | - | | | | | - | | | | | | | | |
| 216 | | | | | | - | | Gamma | Statis | tics | | | | | | | | | |
| 217 | | | | | | | k hat (MLE) | 20.57 | | | | | k | star (bias correct | ed MLE) | 13.79 | | | |
| 218 | | | | | | Thet | ta hat (MLE) | 8.034 | | | | | Theta | star (bias correct | ed MLE) | 11.99 | | | |
| 219 | | | | | | n | nu hat (MLE) | 370.2 | 1 | | | | | nu star (bias co | orrected) | 248.1 | | | |
| 220 | | | | | MLE N | lean (bia | s corrected) |) 165.2 | 1 | | | | | MLE Sd (bias co | orrected) | 44.5 | | | |
| | | | | | | | | | | | | | | | | | | | |

| 221 | | | | | | | | | | - | | 212.7 | | | |
|-----|---|---------------------------------|-----------------|----------------|----------------|----------------|-----------------|-----------------|-----------------|-----------------|------------------|-------|--|--|--|
| 222 | | | Adjus | sted Level of | Significance | 0.0231 | | | Ad | ljusted Chi Sq | μare Value | 205.7 | | | |
| 223 | | | | | | | | | | | | | | | |
| 224 | | | | | | suming Gam | nma Distribut | tion | | | | | | | |
| 225 | | | 95% A | pproximate (| Gamma UCL | 192.8 | | | 959 | % Adjusted G | amma UCL | 199.3 | | | |
| 226 | | | | | | | | | | | | | | | |
| 227 | | | | | | | I GOF Test | | | | | | | | |
| 228 | | | | • | Test Statistic | | | ·- | | normal GOF | | | | | |
| 229 | | | 10% S | | Critical Value | | | | | at 10% Signific | | | | | |
| 230 | | | | | Test Statistic | | | | _ | ormal GOF Te | | | | | |
| 231 | | | 10 | | Critical Value | | | | | at 10% Signific | cance Level | | | | |
| 232 | | | | | Data appear | | | | | | | | | | |
| 233 | | | | Not | te GOF tests | may be unre | liable for sm | nall sample s | sizes | | | | | | |
| 234 | | | | | | | | | | | | | | | |
| 235 | | | | | | | I Statistics | | | | | | | | |
| 236 | | | | | Logged Data | | | | | | ogged Data | 5.083 | | | |
| 237 | | | N | Maximum of | Logged Data | 5.323 | | | | SD of lo | ogged Data | 0.242 | | | |
| 238 | Accomplised to an arms of Distribution | | | | | | | | | | | | | | |
| 239 | | Assuming Lognormal Distribution | | | | | | | | | | | | | |
| 240 | 95% H-UCL 196.1 90% Chebyshev (MVUE) UCL 205.6 | | | | | | | | | | | | | | |
| 241 | 95% Chebyshev (MVUE) UCL 223.8 97.5% Chebyshev (MVUE) UCL 249 | | | | | | | | | | | | | | |
| 242 | | | 99% | Chebyshev | (MVUE) UCL | 298.6 | | | | | | | | | |
| 243 | | | | | | | | | | | | | | | |
| 244 | | | | | Nonparame | etric Distribu | tion Free UC | CL Statistics | | | | | | | |
| 245 | | | | | Data appea | r to follow a | Discernible | Distribution | | | | | | | |
| 246 | | | | | | | | | | | | | | | |
| 247 | | | | | Nonpa | rametric Dis | tribution Fre | e UCLs | | | | | | | |
| 248 | | | | 9! | 5% CLT UCL | | | | (| 95% BCA Boo | - | 181.8 | | | |
| 249 | | | | | ootstrap UCL | | | | | | strap-t UCL | 187.5 | | | |
| 250 | | | 9 | 5% Hall's Bo | ootstrap UCL | 182.7 | | | 95% F | Percentile Boo | otstrap UCL | 183.3 | | | |
| 251 | | | 90% Ch | ebyshev(Me | ean, Sd) UCL | 202.1 | | | 95% Ch | ebyshev(Mea | ın, Sd) UCL | 218.8 | | | |
| 252 | | | 97.5% Ch | nebyshev(Me | ean, Sd) UCL | 241.9 | | | 99% Ch | ebyshev(Mea | ın, Sd) UCL | 287.4 | | | |
| 253 | | | | | | | | | | | | | | | |
| 254 | | | | | | Suggested | UCL to Use | | | | | | | | |
| 255 | | | | 95% Stu | udent's-t UCL | 188.1 | | | | | | | | | |
| 256 | | | | | | | | | | | | | | | |
| 257 | | | | | | | | | | ost appropria | | | | | |
| 258 | | Recom | nmendations | are based u | pon data size | , data distrib | ution, and sk | ewness usin | ng results from | n simulation s | tudies. | | | | |
| 259 | Ho | wever, simu | ılations result | ts will not co | ver all Real W | /orld data se | ts; for additio | onal insight th | he user may v | want to consu | ılt a statistici | an. | | | |
| 260 | | | | | | | | | | | | | | | |
| 261 | | Note: For | | | | | | | | nd Gamma) m | nay not be | | | | |
| 262 | | | reliable. | Chen's and | Johnson's m | ethods provi | de adjustme | nts for posit | vely skewed | data sets. | | | | | |
| 263 | | | | | | | | | | | | | | | |
| | | | | - | | | | | | | | | | | |

| | A B C D E | F | G H I J K L |
|----------|--|----------------|---|
| 2 | UCL Statis | stics for Unc | ensored Full Data Sets |
| 3 | User Selected Options Date/Time of Computation ProUCL 5.2 12/2/2024 9 | .10.04 DM | |
| 5 | From File ProUCL 1.2 12/2/2024 9 | : 19:04 PM | |
| 6 7 | Full Precision OFF Confidence Coefficient 95% | | |
| 8 | Number of Bootstrap Operations 2000 | | |
| 9 | | | |
| 11 | UMM-TLA | | |
| 12 13 | | General | Statistics |
| 14 | Total Number of Observations | 6 | Number of Distinct Observations 6 |
| 15 16 | Minimum | 376.9 | Number of Missing Observations 0 Mean 4501 |
| 17 | Maximum | 10200 | Median 3246 |
| 18 19 | SD Coefficient of Variation | | Std. Error of Mean 1482 Skewness 0.81 |
| 20 | | | |
| 21 | | | l using incremental sampling methodology (ISM) approach, C 2020 and ITRC 2012) for additional guidance, |
| 23 | but note that ITRC may recommend the | ne t-UCL or t | he Chebyshev UCL for small sample sizes (n < 7). |
| 24 25 | | | in gross overestimates of the mean. e for a discussion of the Chebyshev UCL. |
| 26 | | | • |
| 27 28 | Shapiro Wilk Test Statistic | | GOF Test Shapiro Wilk GOF Test |
| 29 30 | 1% Shapiro Wilk Critical Value | 0.713 | Data appear Normal at 1% Significance Level |
| 31 | Lilliefors Test Statistic 1% Lilliefors Critical Value | | Lilliefors GOF Test Data appear Normal at 1% Significance Level |
| 32 33 | Data appe | ar Normal at | 1% Significance Level |
| 34 | Note GOF tests | may be unre | eliable for small sample sizes |
| 35 36 | | suming Nor | mal Distribution |
| 37 | 95% Normal UCL 95% Student's-t UCL | 7487 | 95% UCLs (Adjusted for Skewness) 95% Adjusted-CLT UCL (Chen-1995) 7462 |
| 38 39 | | | 95% Modified-t UCL (Johnson-1978) 7569 |
| 40 | | Gamma | GOF Test |
| 41 42 | A-D Test Statistic 5% A-D Critical Value | 0.304 0.709 | Anderson-Darling Gamma GOF Test |
| 43 | K-S Test Statistic | | Detected data appear Gamma Distributed at 5% Significance Level Kolmogorov-Smirnov Gamma GOF Test |
| 44 45 | 5% K-S Critical Value | | Detected data appear Gamma Distributed at 5% Significance Level stributed at 5% Significance Level |
| 46 | | | eliable for small sample sizes |
| 47 48 | | Gamma | Statistics |
| 49 | k hat (MLE) | 1.384 | k star (bias corrected MLE) 0.803 |
| 50 51 | Theta hat (MLE) nu hat (MLE) | | Theta star (bias corrected MLE) 5606 nu star (bias corrected) 9.635 |
| 52 | MLE Mean (bias corrected) | | MLE Sd (bias corrected) 5024 |
| 53 54 | Adjusted Level of Significance | 0.0122 | Approximate Chi Square Value (0.05) 3.715 Adjusted Chi Square Value 2.515 |
| 55 | | • | |
| 56 57 | As: 95% Approximate Gamma UCL | | ma Distribution 95% Adjusted Gamma UCL 17244 |
| 58 | 50% Approximate dumina GC | | |
| 59 60 | Shapiro Wilk Test Statistic | | GOF Test Shapiro Wilk Lognormal GOF Test |
| 61 | 10% Shapiro Wilk Critical Value | 0.826 | Data appear Lognormal at 10% Significance Level |
| 62 63 | Lilliefors Test Statistic 10% Lilliefors Critical Value | | Lilliefors Lognormal GOF Test Data appear Lognormal at 10% Significance Level |
| 64 65 | Data appear | Lognormal a | at 10% Significance Level |
| 66 | Note GOF tests | may be unre | eliable for small sample sizes |
| 67 68 | 10. | | Statistics |
| 69 | Minimum of Logged Data Maximum of Logged Data | | Mean of logged Data 8.009 SD of logged Data 1.157 |
| 70 71 | | | |
| 72 | Assi 95% H-UCL | | prmal Distribution 90% Chebyshev (MVUE) UCL 12034 |
| 73 74 | 95% Chebyshev (MVUE) UCL | 15194 | 97.5% Chebyshev (MVUE) UCL 19579 |
| 75 | 99% Chebyshev (MVUE) UCL | Z8194 | |
| 76 77 | | | tion Free UCL Statistics |
| 78 | Data appea | ai lo tollow a | Discernible Distribution |
| 79 80 | | | tribution Free UCLs |
| 81 | 95% CLT UCL 95% Standard Bootstrap UCL | 6734 | 95% BCA Bootstrap UCL 6958 95% Bootstrap-t UCL 11005 |
| 82 | 95% Hall's Bootstrap UCL | | 95% Percentile Bootstrap UCL 6852 |

| | A B C D E | F | G H I J K | L |
|------------|--|-----------------|--|----------------|
| 83 | 90% Chebyshev(Mean, Sd) UCL | , | 95% Chebyshev(Mean, Sd) UCL | 10961 |
| 84 | 97.5% Chebyshev(Mean, Sd) UCL | | 99% Chebyshev(Mean, Sd) UCL | |
| 85 | | | | |
| 86 87 | 95% Student's-t UCL | | UCL to Use | |
| 88 | 95% Students-t OCL | 7407 | | |
| 89 | Note: Suggestions regarding the selection of a 95% | UCL are pro | ovided to help the user to select the most appropriate 95% UCL | |
| 90 | Recommendations are based upon data size, | , data distribi | ution, and skewness using results from simulation studies. | |
| 91 | However, simulations results will not cover all Real W | orld data se | ts; for additional insight the user may want to consult a statisticia | an. |
| 92 93 | | | | |
| | UMM-TLB | | | |
| 95 | | | | |
| 96 | = | | Statistics | |
| 97 98 | Total Number of Observations | 12 | Number of Distinct Observations Number of Missing Observations | 12 0 |
| 99 | Minimum | 794.4 | Mean | 4273 |
| 100 | Maximum | | Median | 2907 |
| 101 | SD | 3462 | Std. Error of Mean | 999.4 |
| 102 | Coefficient of Variation | 0.81 | Skewness | 1.061 |
| 103 104 | | Normal C | 205 T | |
| 105 | Shapiro Wilk Test Statistic | 0.864 | GOF Test Shapiro Wilk GOF Test | |
| 106 | 1% Shapiro Wilk Critical Value | 0.805 | Data appear Normal at 1% Significance Level | |
| 107 | Lilliefors Test Statistic | 0.198 | Lilliefors GOF Test | |
| 108 | 1% Lilliefors Critical Value | | Data appear Normal at 1% Significance Level | |
| 109 110 | Data appea | ar Normal at | : 1% Significance Level | |
| 111 | As | suming Norr | mal Distribution | |
| 112 | 95% Normal UCL | | 95% UCLs (Adjusted for Skewness) | |
| 113 | 95% Student's-t UCL | 6067 | 95% Adjusted-CLT UCL (Chen-1995) | |
| 114 115 | | | 95% Modified-t UCL (Johnson-1978) | 6118 |
| 116 | | Gamma (| GOF Test | |
| 117 | A-D Test Statistic | 0.348 | Anderson-Darling Gamma GOF Test | |
| 118 | 5% A-D Critical Value | 0.744 | Detected data appear Gamma Distributed at 5% Significance | ce Level |
| 119 | K-S Test Statistic | 0.167 | Kolmogorov-Smirnov Gamma GOF Test | |
| 120 121 | 5% K-S Critical Value | | Detected data appear Gamma Distributed at 5% Significand stributed at 5% Significance Level | ce Level |
| 122 | Detected data appear | Gaillilla Di | stributed at 5% Significance Level | |
| 123 | | Gamma | Statistics | |
| 124 | k hat (MLE) | 1.747 | k star (bias corrected MLE) | 1.365 |
| 125 126 | Theta hat (MLE) | | Theta star (bias corrected MLE) | |
| 127 | nu hat (MLE) MLE Mean (bias corrected) | 41.92 4273 | nu star (bias corrected) MLE Sd (bias corrected) | 32.77 3656 |
| 128 | WILE Weatt (bias corrected) | 42/3 | Approximate Chi Square Value (0.05) | 20.68 |
| 129 | Adjusted Level of Significance | 0.029 | Adjusted Chi Square Value | 19.23 |
| 130 | | | | |
| 131 132 | | | ma Distribution | 7001 |
| 133 | 95% Approximate Gamma UCL | 0/09 | 95% Adjusted Gamma UCL | /281 |
| 134 | | Lognormal | GOF Test | |
| 135 | Shapiro Wilk Test Statistic | 0.958 | Shapiro Wilk Lognormal GOF Test | |
| 136 137 | 10% Shapiro Wilk Critical Value | 0.883 | Data appear Lognormal at 10% Significance Level | |
| 138 | Lilliefors Test Statistic 10% Lilliefors Critical Value | 0.139 0.223 | Lilliefors Lognormal GOF Test Data appear Lognormal at 10% Significance Level | |
| 139 | | | at 10% Significance Level | |
| 140 | uppour | | | |
| 141 | ••• | | I Statistics | 0.04= |
| 142 143 | Minimum of Logged Data Maximum of Logged Data | 6.678 9.341 | Mean of logged Data SD of logged Data | 8.047 0.845 |
| 144 | waximum of Logged Data | 3.341 | SD or logged Data | 0.045 |
| 145 | Assı | uming Logno | ormal Distribution | |
| 146 | 95% H-UCL | 8758 | 90% Chebyshev (MVUE) UCL | |
| 147 148 | 95% Chebyshev (MVUE) UCL | | 97.5% Chebyshev (MVUE) UCL | 11217 |
| 148 | 99% Chebyshev (MVUE) UCL | 15319 | | |
| 150 | Nonparame | etric Distribu | tion Free UCL Statistics | |
| 151 | | | Discernible Distribution | |
| 152 | - | | | |
| 153 154 | Nonpar 95% CLT UCL | | tribution Free UCLs | 6118 |
| 155 | 95% Standard Bootstrap UCL | | 95% BCA Bootstrap UCL 95% Bootstrap-t UCL | 6817 |
| 156 | 95% Hall's Bootstrap UCL | | 95% Percentile Bootstrap UCL | 5894 |
| 157 | 90% Chebyshev(Mean, Sd) UCL | 7271 | 95% Chebyshev(Mean, Sd) UCL | 8629 |
| 158 159 | 97.5% Chebyshev(Mean, Sd) UCL | 10514 | 99% Chebyshev(Mean, Sd) UCL | 14216 |
| 160 | | Suggested | UCL to Use | |
| 161 | 95% Student's-t UCL | | | |
| 162 | | | | |
| 163 | | | ovided to help the user to select the most appropriate 95% UCL | |
| 164 | | بمائست مناسست | ution, and skewness using results from simulation studies. | |

| 165 | A H | B owever simu | C lations result | D s will not cov | er all Real W | F /orld data se | G ts; for additiona | H al insight th | e user mav | want to consu | Ilt a statisticia | L an |
|-------------------|----------|------------------|---------------------|---------------------|----------------------------------|--------------------|--------------------------------------|--------------------|-----------------|--------------------------------------|----------------------------|----------------|
| 166 167 | | oo. | | | | 0.14 444 00 | | 2o.g | | | | |
| | UMM-TLC | | | | | | | | | | | |
| 169 | | | | | | | a | | | | | |
| 170 171 | | | Total | Number of (| Observations | General 23 | Statistics | | Number | r of Distinct O | bservations | 23 |
| 172 | | | Total | Trumber of C | J D J C I V G II O I I O | | | | | of Missing O | | 0 |
| 173 174 | | | | | Minimum Maximum | | | | | | Mean Median | |
| 175 | | | | | SD | 1871 | | | | Std. Eı | rror of Mean | 390.1 |
| 176 177 | | | | Coefficien | t of Variation | 0.769 | | | | | Skewness | 1.98 |
| 178 | | | | | | Normal (| GOF Test | | | | | |
| 179 | | | | | Test Statistic | 0.814 | | | | lk GOF Test | | |
| 180 181 | | | 1% Sł | | Critical Value Test Statistic | 0.881 0.221 | | Data Not | | 1% Significan GOF Test | ce Level | |
| 182 | | | 1 | | Critical Value | 0.209 | | Data Not | | 1% Significan | ce Level | |
| 183 184 | | | | | Data Not | Normal at 1 | % Significance | | | | | |
| 185 | | | | | As | suming Nor | mal Distribution | n | | | | |
| 186 | | | 95% No | rmal UCL | | | | 95% | | sted for Skev | | |
| 187 188 | | | | 95% Stu | dent's-t UCL | 3103 | | | | ed-CLT UCL (| | |
| 189 | | | | | | | 1 | | 30 /0 IVIOUITIE | ed-t UCL (Joh | III50II-19/8) | 3130 |
| 190 | | | | | T . C | | GOF Test | | | 0 00 | | |
| 191 192 | | | | | Test Statistic Critical Value | 0.308 0.754 | Detected of | | | Gamma GO stributed at 5 | | ce Level |
| 193 | | | | K-S | Test Statistic | 0.132 | | Kolmogo | orov-Smirno | ov Gamma G | OF Test | |
| 194 195 | | | | 5% K-S (| Critical Value | | | | | stributed at 5 | % Significan | ce Level |
| 196 | | | | Detected | і аата арреаі | Gamma Di | stributed at 5% | o Significar | ICE LEVEI | | | |
| 197 | | | | | | | Statistics | | | | 1 | |
| 198 199 | | | | The | k hat (MLE) eta hat (MLE) | 2.179 1116 | | | | star (bias corı star (bias corı | - | 1.924 1265 |
| 200 | | | | | nu hat (MLE) | 100.3 | | | IIIeta | | s corrected) | 88.51 |
| 201 | | | ML | _E Mean (bia | as corrected) | 2433 | | | | MLE Sd (bia | | 1754 |
| 202 203 | | | Δdiuc | ted Level of | Significance | 0.0389 | | <i>F</i> | | <u>Chi Square \</u> djusted Chi S | | 67.82 66.51 |
| 204 | | | Aujus | ica Ecveror | | | | | 710 | ajusteu Oni O | quaic value | 00.01 |
| 205 206 | | | 0E9/ A | nnrovimata (| | | ma Distributio | n | O.F. | 0/ Adjusted C | `amma LICI | 2220 |
| 207 | | | 95% A | pproximate (| Gamma UCL | 31/5 | | | 95 | % Adjusted G | amma UCL | 3238 |
| 208 | | | | | | | GOF Test | | | | | |
| 209 210 | | | 10% Sk | hapiro Wilk | Test Statistic Critical Value | 0.982 0.928 | D | | | inormal GOF at 10% Signif | | |
| 211 | | | 10 70 31 | | Test Statistic | | D. | | | ormal GOF T | | |
| 212 213 | | | 109 | | Critical Value | | | | | at 10% Signif | icance Level | |
| 214 | | | | | Data appear | <u>Lognormai a</u> | at 10% Signific | ance Leve |)I | | | |
| 215 | | | | | | | l Statistics | | | | | |
| 216 217 | | | | | Logged Data Logged Data | 6.016 9.077 | | | | | logged Data logged Data | 7.55 0.73 |
| 218 | | | IV | nazimum Ul | | | | | | 3D 011 | oggou Dala | |
| 219 220 | | | | | | | rmal Distributi | ion | 000/ | Chabriel ··· / | W/UE\ LIQI | 2051 |
| 221 | | | 95% (| Chebvshev (| 95% H-UCL MVUE) UCL | | | | | <u>Chebyshev (I</u> Chebyshev (I | | 3651 4953 |
| 221 222 223 | | | | | MVUE) UCL | | | | 21.070 | | , | |
| 223 224 | | | | | Nonnarame | tric Dietribu | tion Free UCL | Statistics | | | | |
| 225 | | | | | | | Discernible Di | | | | | |
| 226 227 | <u> </u> | | | | Nonna | rametric Dic | tribution Free I | IICI s | | | | |
| 228 229 | | | | 95 | Nonpai 5% CLT UCL | | u ibuuoii Fiee (| OCLS | | 95% BCA Bo | otstrap UCL | 3289 |
| 229 | | | | Standard Bo | ootstrap UCL | 3052 | | | | 95% Boot | tstrap-t UCL | 3446 |
| 230 231 | | | | | ootstrap UCL ean, Sd) UCL | | | | | Percentile Bo nebyshev(Mea | | |
| 232 | _ | | | | an, Sd) UCL | | | | | ebyshev(Mea | | |
| 233 | | | | | | Cummasts - | 1101 40 11 | | | | | |
| 234 235 | | | 959 | % Adjusted (| Gamma UCL | | UCL to Use | | | | | —— |
| 236 | | N . 2 | | | | | | | | | . 050/::- | |
| 237 238 | | | | | | | ovided to help to ution, and skew | | | | | |
| 239 | H | | | | | | ts; for additiona | | | | | an. |
| 240 241 | | | | | | | | | | | | |
| | UMM-WRA | \ | | | | | | | | | | |
| 243 | | - | | | | | | | | | | |
| 244 245 | | | Total | Number of C | Observations | General 16 | Statistics | | Numbo | r of Distinct O | hearvations | 16 |
| 246 | | | 10181 | inullibel of C | Juservations | 10 | | | | of Missing O | | 0 |
| | | | | | | | | | | | | |

| | Α | | В | | (| 2 | Т | D | | Е | F | G | T | Н | | | | | J | | K | T | L |
|------------|--|-------|--------|--------|-------|--------|---------------|------------|---------------|-----------------------|-------------------------|---------------|------------|--------------------------|---------|--------|--------|---------|------------|---------|------------------------|----------|---------------------|
| 247 | | | | | | | | | | /linimum | | <u> </u> | _ | | | | | | | - | Mea | an | 930.7 |
| 248 | | | | | | | | | M | laximum | | | | | | | | | | | Media | | 724.9 |
| 249 250 | | | | | | | | · · | | SD | | | | | | | | | Std | | r of Mea | | 188.3 |
| 251 | | | | | | | <u> </u> | oefficie | nt of \ | /ariation | 0.809 | | | | | | | | | | Skewnes | SS_ | 1.522 |
| 252 | | | | | | | | | | | Normal | GOF Test | | | | | | | | | | | |
| 253 | | | | | | | Shap | iro Wilk | k Test | Statistic | 0.857 | 1001 1001 | | | , | Shapi | ro W | ilk G | OF Te | est | | | |
| 254 | | | | | | 1% S | Shapi | ro Wilk | Critic | al Value | 0.844 | | | Data | appea | | | | | | ce Level | | |
| 255 | ļ | | | | | | | | | Statistic | | | | | | | | | F Test | | | | |
| 256 257 | | | | | | | <u>1% L</u> | illietors | | al Value | e 0.248 ear Normal a | 4 10/ Ciani | <u> </u> | | | ar Nor | mal a | at 1% | Signi | ticano | ce Level | | |
| 258 | | | | | | | | | | ака арре | ai inoilliai a | it 1% Signii | ICa | ince re | vei | | | | | | | | |
| 259 260 | | | | | | | | | | As | ssuming Nor | mal Distrib | uti | on | | | | | | | | | |
| 260 | | | | | 9! | 5% N | | al UCL | | | | | | | | | | | d for S | | | | |
| 261 262 | | | | | | | | 95% St | tudent | 's-t UCL | . 1261 | | | | | | | | | | nen-199 | | 1317 1072 |
| 263 | | | | | | | | | | | | | | | , | 15% IV | /loaii | iea-t | UCL (| Jonns | son-197 | 5) | 12/3 |
| 264 | | | | | | | | | | | Gamma | GOF Test | | | | | | | | | | | |
| 265 | | | | | | | | | | Statistic | 0.198 | | | | | | | | mma (| | | | |
| 266 | <u> </u> | | | | | | | | | al Value | | Detec | <u>ted</u> | | | | | | | | Signific | ance | <u>Level</u> |
| 267 268 | <u> </u> | | | | | | , | | | Statistic | | Datas | | | | | | | | | Test | | . 11 |
| 269 | | | | | | | | | | al Value | e 0.219 ar Gamma Di | Detec | <u>tea</u> | data aj % Sign | ppear | Gami | ma D | vistrit | outea a | it 5% | Signific | ance | <u> Levei</u> |
| 270 | | | | | | | | | <u>su ual</u> | a appea | . Gamma Di | | | ,u Oigil | cari | JU LU | 731 | | | | | | |
| 271 | | | | | | | | | | | | Statistics | | | | | | | | | | | |
| 272 | <u> </u> | | | | | | | | | at (MLE) | | | | | | | | | | | ted MLI | | 1.379 |
| 273 274 | | | | | | | | Th | | at (MLE) at (MLE) | | | | | | Т | neta | | | | cted MLI corrected | | 674.9 44.13 |
| 275 | | | | | | N/ | /II E N | /lean (h | | orrected) | | | | | | | | | | | correcte | _ | 792.5 |
| 276 | | | | | | 17 | <u> /\</u> | caii (b | ,.us cc | co.cu) | | | | | Α | pprox | imat | | | | lue (0.0 | - / | 29.9 |
| 277 | | | | | | Adju | ısted | Level c | of Sigr | nificance | 0.0335 | | | | | | | | | | are Valu | | 28.57 |
| 278 | | | | | | | | | | | | PI | | | | | | | | | | | |
| 279 280 | | | | | | 50/ / | Annr | vimoto | Gam | As ma UCL | suming Gan | nma Distrit | <u>uti</u> | on | | | O | 50/_ ^ | diusts | d С с. | nma UC | ıΤ | 1438 |
| 281 | | | | | ٤ | 1370 F | Appro | жинаце | ; Gam | ilia UCL | . 13/4 | | | | | | 90 |)% A | ujuste | u Gai | IIIIa UC | ,L | 1430 |
| 282 283 | | | | | | | | | | | Lognorma | I GOF Tes | t | | | | | | | | | | |
| 283 | | | | | | | | | | Statistic | 0.955 | | | | | | | | mal G | | | | |
| 284 285 | | | | | 1 | 0% S | | | | al Value | | | [| <u> Data ap</u> | | | | | | | nce Lev | /el | |
| 286 | | | | | | 1/ | | | | Statistic al Value | | | <u> —</u> | Doto on | | | | | al GOI | | it ance Lev | <u></u> | |
| 287 | | | | | | - 10 | J /0 L | illeiois | | | Lognormal | at 10% Sig | ınifi | <u>Jala ap</u> icance | Level | Logno | iiiiai | at II | J /0 SIÇ | JIIIICo | ince rev | /ei | |
| 288 | | | | | | | | | | . арроа. | Lognomia | at 1070 Olg | •••• | Journey | | | | | | | | | |
| 289 | | | | | | | | | | | | al Statistics | ; | | | | | | | | | | |
| 290 291 | | | | | | | | | | ed Data | | | | | | | | | | | ged Da | | 6.502 |
| 292 | | | | | | | waxı | mum o | T Logg | jed Data | 7.979 | | | | | | | | <u> 5D</u> | OT IOC | ged Da | ta | 0.928 |
| 293 | | | | | | | | | | Ass | uming Logn | ormal Distr | ibu | ition | | | | | | | | | |
| 294 295 | | | | | | | | | | 6 H-UCL | 1910 | | | | | | | | | | /UE) UC | | 1739 |
| 295 | | | | | | | | | | JE) UCL | | | | | | 9 | 7.5% | Che | byshe | v (M\ | /UE) UC | ;L: | 2550 |
| 296 297 | | | | | | 99% | Che | byshev | <u>/ (MVL</u> | JE) UCL | 3477 | | | | | | | | | | | | |
| 298 | | | | | | | | | No | nnaram | etric Distribu | ıtion Free l | IC | l Statis | stics | | | | | | | | |
| 299 | | | | | | | | | | | ar to follow a | | | | | | | | | | | | |
| 300 | | | | | | | | | | | | | | | | | | | | | | | |
| 301 302 | | | | | | | | , | OEO/ C | | rametric Dis | tribution F | ree | UCLs | | | | OE0 | DC 4 | Dart | atron III | <u>ч</u> | 1015 |
| 302 | | | | | | 95% | 6 Sta | | | LT UCL rap UCL | | | — | | | | | | | | strap UC rap-t UC | | <u>1315</u> 1422 |
| 304 | | | | | | | | | | rap UCL | | | | | | | 95% | | | | strap UC | | 1262 |
| 305 | | | | | |)% C | heby | shev(M | /lean, S | Sd) UCL | 1496 | | | | | 95 | % C | heby | shev(I | Mean | , Sd) UC | CL | 1752 |
| 306 | <u> </u> | | | | 97.5 | 5% C | heby | shev(N | lean, S | Sd) UCL | 2107 | | | | | 99 | % C | heby | shev(I | Mean | , Sd) UC | ;L_: | 2805 |
| 307 308 | | | | | | | | | | | Suggested | HCL to Us | | | | | | | | | | | |
| 309 | | | | | | | | 95% St | tudent | 's-t UCL | | JOL 10 08 |) U | | | | | | | | | \neg | |
| 310 | | | | | | | | | | | | | _ | | | | | | | | | | |
| 311 | | Note | | | | | | | | | % UCL are pr | | | | | | | | | | | CL. | |
| 312 313 | | Lla | | | | | | | | | e, data distrib | | | | | | | | | | | .: -: | |
| 314 | | nowev | er, si | rnulat | ions | resu | its Wi | ııı not co | over a | ıı Keal V | Vorld data se | eis; for addi | tior | ıaı ınsıç | unt the | user | may | wan | to co | nsult | <u>a statist</u> | ıcıaı | 1. |
| 315 | | - | | | | | | | | | | | | | | | | | | | | | |
| 316 | UMM-WF | ₹В | | | | | | | | | | | | | | | | | | | | | |
| 317 | | | | | | | | | | | | | _ | | | | | | | | | | |
| 318 319 | | | | | | Tata | I NI. | mhar -f | f Oh | rvations | | Statistics | | | | K I - | ımak - | vr of I | Dicti | + 0- | ervation | 20 | 7 |
| 320 | | | | | | rota | ıı ıvul | IIDEI OI | Ouse | ı vauons | 1 | | | | | | | | | | servatior servatior | | 0 |
| 321 | | | | | | | | | | /linimum | 741.1 | | _ | | | 140 | | | | , 000 | | | 4928 |
| 322 | | | | | | | | | | laximum | 14142 | | | | | | | | | | Media | an | 1800 |
| 323 | | | | | | | | 60 . | | SD | | | | | | | | | Std | | r of Mea | | 2367 |
| 324 325 | | | | | | | C | oetticie | nt of \ | /ariation | 1.271 | | | | | | | | | | Skewnes | SS | 1.206 |
| 326 | | N | lote: | Samn | le si | ze is | sma | ll (e.a | . <10) | . if data | are collected | d usina inc | ren | nental s | samnl | ina m | etho | dolo | ıv (ISI | M) an | proach | | |
| 327 | | | | | | | | | | | on ISM (ITR | | | | | | | | | | Judilij | | |
| 328 | | | | | | | | | | | he t-UCL or | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | |

| 220 | Α | | В | | С | | D | | E | F | G | | . Н | | I | | J | | K | \Box | L | |
|------------|---|-------|---------|----------------|-------------------------|---------------|-------------------------------|----------|-----------------------|-------------------------------|---------------|---|------------|---------|----------------------|-------------|---------------------|-----------------------|---------|---|-----------------------|----------|
| 329 330 | | | | | Re | | | | | often results chnical Guid | | | | | | | 21 | | | | | |
| 331 | | | | | 116 | 51G1 U | J uie Fi | OOCL | J.Z 160 | Jillical Guic | ie ioi a uisi | cuss | sion or ar | ie Cili | <u>ebysile</u> | v 00 | <u></u> | | | | | |
| 332 333 | | | | | | | | | | | GOF Test | | | | | | | | | | | |
| 334 | | | | | | | iro Wilk ro Wilk | | | | | | Data N | | napiro V ormal at | | | | Lovol | | | |
| 335 | | | | | 1 /0 3 | | illiefors | | | | | | Data | | Lilliefor: | | | | Level | | | |
| 336 | | | | | | | illiefors | Critica | l Value | 0.35 | | | | | ormal at | | | | Level | | | |
| 337 338 | | | | | | | | D | ata No | t Normal at | 1% Signific | canc | e Level | | | | | | | | | |
| 339 | | | | | | | | | Ας | suming Nor | mal Distrib | outio | n | | | | | | | | | |
| 340 | | | | | 95% N | Norma | al UCL | | | | linai Diotrib | , u.i.o | | % UC | CLs (Adj | juste | ed for S | kewn | ess) | | | |
| 341 342 | | | | | | | 95% St | udent's | s-t UCL | 9528 | | | | | % Adjus | | | | | | 9975 | |
| 343 | | | | | | | | | | | | | | 95 | % Modi | tied- | t UCL (| Johns | on-19 | /8) | 9708 | |
| 344 | | | | | | | | | | Gamma | GOF Test | | | | | | | | | | | |
| 345 | | | | | | | | | Statistic | 0.904 | | | | | n-Darlin | | | | | | | |
| 346 347 | | | | | | 5 | 5% A-D | | | | | Dat | a Not Ga | | | | | | | | <u>əl</u> | |
| 348 | | | | | | | <u>K-S</u> 5% K-S | | Statistic Il Value | | | Dat | a Not Ga | | v-Smirr Distribu | | | | | | al | |
| 349 | | | | | | | | | | ma Distribut | ed at 5% S | | | | | atou | ut 0 70 | Oigiiii | ounce | | | |
| 350 | | | | | | | | | | | | | | | | | | | | | | |
| 351 352 | | | | | | | | k hat | t (MLE) | | Statistics | | | | L | cto. | r (bias | corroc | tod M | <u> </u> | 0.5 | 61 |
| 353 | | | | | | | Th | | t (MLE) | | | | | | | | r (bias | | | | 8783 | 51 |
| 354 | | | | | | | | nu hat | t (MLE) | 11.41 | | | | | | n | u star | (bias c | orrect | ted) | 7.8 | 55 |
| 355 356 | | | | | N. | ALE N | /lean (b | ias cor | rected) | 4928 | | | | Λ | | | LE Sd | | | | 6579 | |
| 357 | | | | | Δdiı | ıstad | Level o | of Signi | ficance | 0.0158 | | | | App | oroximat | | nı Squa sted Cl | | | | 2.6 1.8 | |
| 358 | | | | | 7 (0)0 | <u> 10100</u> | LOVOIO | n Olgin | iioaiioo | 0.0100 | | | | | | lajac | oted of | ii Oqui | arc ve | iide | | |
| 359 | | | | | | | | | | suming Gar | nma Distrit | butic | n | | | | | | | | | |
| 360 361 | | | | | 95% / | Appro | oximate | Gamn | na UCL | 14600 | | | | | 9 | 5% <i>A</i> | Adjuste | ed Gar | nma L | <u> ICL</u> | <u>21154</u> | |
| 362 | | | | | | | | | | Lognorma | I GOF Tes | st | | | | | | | | | | |
| 363 | | | | | | | iro Wilk | | | 0.805 | | | | | Wilk Lo | | | | | | | |
| 364 365 | | | | | 10% 5 | | ro Wilk | | | | | | Data Not | | | | | | | <u>/el</u> | | |
| 366 | | | | | 1 | | <u>illiefors</u> illiefors | | | | | | ata appe | | ors Logi | | | | | ovol | | |
| 367 | | | | | • | 0 70 L | | | | ximate Logr | ormal at 1 | | | | | ıı uı | 10 70 01 | griirioc | 11100 L | 0101 | | |
| 368 | | | | | | | No | te GO | F tests | may be unr | eliable for | sma | II sample | e size | es | | | | | | | |
| 369 370 | | | | | | | | | | Lognorms | al Statistics | | | | | | | | | | | |
| 371 | | | | | | Mini | mum of | f Logge | ed Data | | Journalis | <u>, </u> | | | | | Mean | of log | ged D | ata | 7.7 | 76 |
| 372 | | | | | | Maxi | mum of | f Logge | ed Data | 9.557 | | | | | | | | of log | | | 1.2 | 67 |
| 373 374 | | | | | | | | | ٨٥٥ | uming Logn | ormal Dietr | ribut | ion | | | | | | | | | |
| 375 | | | | | | | | 95% | | 53783 | | IDUL | ion | | 90% | 6 Ch | ebyshe | ev (MV | UE) L | JCL | 10939 | |
| 376 | | | | | 95% | 6 Che | byshev | | | 13851 | | | | | | | ebyshe | | | | | |
| 377 378 | | | | | 99% | 6 Che | byshev | (MVUI | E) UCL | 25834 | | | | | | | | | | | | |
| 379 | | | | | | | | Non | parame | etric Distribu | ıtion Free l | UCL | Statistic | `S | | | | | | | | |
| 380 | | | | | | | | | | ar to follow a | | | | | | | | | | | | |
| 381 | | | | | | | | | | | = | | | | | | | | | | | |
| 382 383 | | | | | | | | | Nonpa T UCL | rametric Dis 8822 | stribution F | ree | UCLS | | | 959 | % BCA | Roots | tran I | ICI | 10249 | |
| 384 | | | | | 95% | % Sta | ndard B | | | | | | | | | 30 | | | | | 47055 | |
| 385 | | | | | | 95% | Hall's B | Bootstra | ap UCL | 50830 | | | | | | | centile | Boots | trap L | JCL | 8686 | |
| 386 387 | | | | _ | <u>90% C</u> 97.5% C | | | | | 12030 | | | | | | | yshev(vshev(| | | | <u>15247</u> 28484 | |
| 388 | | | | | ,,.J/0 U | ,, ieny | or i€v(IVI | ican, S | u, UCL | 13/13 | 1 | | | | 33 /0 C | >⊓GD | yon c v(| ıvı c dil, | ou) C | ,UL | <u> 20404</u> | \dashv |
| 389 | | | | | | | | | | Suggested | UCL to Us | se | | | | | | | | | | |
| 390 391 | | | | Red | commen | ndatio | n canno | ot be pi | rovided | | | | | | | | | | | | | |
| 392 | | | The c | alcul | ated UC | CLs a | re base | ed on a | ssumn | tions that th | e data wer | e co | llected in | n a ra | ndom a | nd u | ınbiase | ed mai | nner. | | | \dashv |
| 393 | | | | a. v ul | | u | | | | data were c | | | | | | | | - a mul | | | | |
| 394 | | | | | | If th | | | | d using judg | | | | | method | ds, | | | | | | |
| 395 396 | | | | | | | t | nen co | ntact a | statistician | to correctly | y cal | icuiate U | CLS. | | | | | | | | \dashv |
| 397 | | Note: | Suaae | estio | ns regar | rdina | the sele | ection o | of a 95% | 6 UCL are p | rovided to h | nelp | the user | to se | lect the | mos | t appro | priate | 95% | UCL | | \dashv |
| 398 | | | Recor | nme | ndations | s are | based ι | upon da | ata size | , data distrib | ution, and | skev | vness us | sing re | esults fro | om s | imulati | on stu | dies. | | | |
| 399 | H | oweve | er, sim | ulatio | ons resu | ılts wi | II not co | over all | Real V | Vorld data se | ets; for addi | ition | al insight | the ι | ıser may | y wa | nt to co | onsult | a stati | sticia | in. | |
| 400 | | | | | | | | | | | | | | | | | | | | | | |

| | A B C | D E | F | G H | l J | K | L |
|----------|--------------------------------|------------------------------|----------------|------------------------------|---|--|----------|
| 1 | | UCL Statis | Stics for Unce | ensored Full Data Sets | | | |
| 2 | User Selected Options | <u> </u> | | | | | |
| 3 | Date/Time of Computation | ProUCL 5.2 11/18/2024 1 | 1·18·00 PM | | | | |
| 4 | From File | WorkSheet.xls | 1.10.001 111 | | | | |
| 5 6 | Full Precision | OFF | | | | | |
| 7 | Confidence Coefficient | 95% | | | | | |
| 8 | Number of Bootstrap Operations | 2000 | | | | | |
| 9 | | | | | | | |
| 10 | | | | | | | |
| 11 | UUMM-WRA | | | | | | |
| 12 | | | | | | | |
| 13 | | | General | Statistics | | | |
| 14 | Total | I Number of Observations | 6 | | Number of Distinct Observ | | 6 |
| 15 | | | | | Number of Missing Observ | | 0 |
| 16 | | Minimum | | | | Mean | 1737 |
| 17 | | Maximum | 2435 | | | ledian | 1704 |
| 18 | | SD Coefficient of Variation | 429.8 0.247 | | Std. Error of | | 175.5 |
| 19 | | Coefficient of Variation | 0.247 | | Ske | wness | 0.556 |
| 20 | Note: Sample size is | small (e.g. <10) if data | are collected | using incremental sampling | ng methodology (ISM) appro | ach | |
| 21 | | , | | C 2020 and ITRC 2012) for | | ao11, | |
| 22 23 | | _ | • | he Chebyshev UCL for sm | - · | | |
| 24 | | | | n gross overestimates of t | | | |
| 25 | Re | <u>-</u> | | e for a discussion of the Ch | | | |
| 26 | | | | | | | |
| 27 | | | Normal C | GOF Test | | | |
| 28 | S | Shapiro Wilk Test Statistic | 0.97 | S | hapiro Wilk GOF Test | | |
| 29 | 1% S | Shapiro Wilk Critical Value | 0.713 | Data appear | Normal at 1% Significance L | .evel | |
| 30 | | Lilliefors Test Statistic | 0.192 | | Lilliefors GOF Test | | |
| 31 | 1 | 1% Lilliefors Critical Value | 0.373 | Data appear | Normal at 1% Significance L | .evel | |
| 32 | | | | 1% Significance Level | | | |
| 33 | | Note GOF tests | may be unre | liable for small sample siz | es | | |
| 34 | | | | and Disability of the | | | |
| 35 | 050/ N | ormal UCL | suming Norr | nal Distribution | Ol a /A divate d fan Olasson a a | <u>, </u> | |
| 36 | 95% N | 95% Student's-t UCL | 2091 | | CLs (Adjusted for Skewness % Adjusted-CLT UCL (Chen- | • | 2068 |
| 37 | | 35 /0 Student S-t UCL | 2031 | | % Adjusted-CLT OCL (Chen- | • | 2008 |
| 38 | | | | 9. | 5.0 MOGINOU-LOOL (JUINSON | .570) | |
| 39 40 | | | Gamma (| GOF Test | | | |
| 41 | | A-D Test Statistic | 0.2 | | n-Darling Gamma GOF Tes | t | |
| 42 | | 5% A-D Critical Value | 0.697 | | Gamma Distributed at 5% Sig | | ce Level |
| 43 | | K-S Test Statistic | 0.164 | | ov-Smirnov Gamma GOF Te | | |
| 44 | | 5% K-S Critical Value | 0.332 | Detected data appear (| Gamma Distributed at 5% Sig | nifican | ce Level |
| 45 | | Detected data appear | r Gamma Dis | stributed at 5% Significanc | e Level | | |
| 46 | | Note GOF tests | may be unre | liable for small sample siz | es | | |
| 47 | | | | | | | |
| 48 | | | Gamma | Statistics | | | |
| 49 | | k hat (MLE) | 19.81 | | k star (bias corrected | , | 10.02 |
| 50 | | Theta hat (MLE) | 87.68 | | Theta star (bias corrected | , | 173.4 |
| 51 | | nu hat (MLE) | | | nu star (bias corr | , | 120.2 |
| 52 | M | ILE Mean (bias corrected) | 1737 | A | MLE Sd (bias corr | - | 548.8 |
| 53 | ٨ ـــانــ ٨ | sted Level of Significance | 0.0122 | Ар | proximate Chi Square Value Adjusted Chi Square | | 95.89 |
| 54 | Adjus | sied Level of Significance | 0.0122 | | Aujusted Uni Square | value | 88.05 |
| 55 | | | | | | | |

| | 56 | Α | | В | | | С | | D | | E As: | F suming Ga | G mma Dis | | Ition H | | | ı | | | J | I | K | | L |
|--|-----|--------------|------|----------|--------|---------|----------|---------|----------|---------|-------------|----------------|--------------|----------|---------------|---------|--------|--------|-------|---------|---------|--------|----------|----------|-------|
| Section Supplier Wilk Fleet Shalates 0.948 Shaptro Wilk Lognomal GOF Test | | · | | | | | 95% A | pprox | imate | Gamn | na UCL | 2178 | | | | | | (| 95% | 6 Adj | usted | Gar | mma | UCL | 2371 |
| Shapiro Wilk Tear Salatistic 0.984 Shapiro Wilk Lognormal GOF Teat | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10% Shapiro Wilk Critical Value 0.826 | 59 | | | | | | | | | | | | al GOF | Гest | | | | | | | | | | | |
| | 60 | | | | | | | | | | | | | | | | | | | | | | | | |
| 10% Lilliefors Critical Value 0.288 Data appear Lognormal at 10% Significance Level | 61 | | | | | | 10% S | | | | | | | | Data ap | | _ | | | | - | | | Level | |
| Detail appear Lognormal at 10% Significance Level | 62 | | | | | | | | | | | | | | | | | | | | | | | | |
| Note GOF tests may be unrelieble for smell sample sizes | 63 | | | | | | 10 | 1% Lill | | | | | 1.1400/ | . | | • | | norma | al at | t 10% | 6 Sign | nitica | ance | Level | |
| | | | | | | | | | | | | | | | | | | | | | | | | | |
| Common Common Common Statistics Common Commo | | | | | | | | | INOI | ie GO | r tests | may be un | reliable | or sr | nali sam | ipie s | sizes | | | | | | | | |
| Minimum of Logged Data 7.065 Mean of logged Data 7.434 | - | | | | | | | | | | | Loanorn | al Statis | tice | | | | | | | | | | | |
| Maximum of Logged Data 7.798 SD of logged Data 0.248 | | | | | | | | Minim | num of | Logge | ed Data | | | | | | | | | M | lean o | of loc | nged | Data | 7.434 |
| Assuming Lognormal Distribution Assu | | | | | | | | | | | | | | | | | | | | | | | | | |
| 172 173 174 175 | | | | | | | | | | 55- | | | | | | | | | | | | | 13 | | |
| Page | | | | | | | | | | | Assı | uming Logi | normal D | istrib | oution | | | | | | | | | | - |
| 95% Chebyshev (MVUE) UCL 2803 97.5% Chebyshev (MVUE) UCL 2805 | | <u></u> | | | | | | | | 95% | | | | | | | | 909 | % C | heby | yshev | (M\ | /UE) | UCL | 2264 |
| 74 | | | | | | | 95% | Cheb | yshev | (MVU | E) UCL | 2503 | | | | | | 97.59 | % C | heby | yshev | (M\ | /UE) | UCL | 2835 |
| Nonparametric Distribution Free UCL Statistics | | | | | | | | | | | | | | | | | | | | | | | | | |
| Nonparametric Distribution Free UCL Statistics Statis | | | | | | | | | | | | | | | | | | | | | | | | | |
| Note | | | | | | | | - | | Non | parame | etric Distrib | ution Fre | e U | CL Statis | stics | | | | | - | | | - | |
| Nonparametric Distribution Free UCLs 2026 95% BCA Bootstrap UCL 2026 2026 95% BCA Bootstrap UCL 2026 2026 95% BCA Bootstrap UCL 20176 2026 2026 95% Bootstrap UCL 20176 2026 20276 20276 20277 2 | 77 | | | | | | | | | Data | a appea | r to follow | a Discer | nible | Distribu | ıtion | | | | | | | | | |
| 80 | 78 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 79 | | | | | | | | | | | | stributio | n Fre | e UCLs | | | | | | | | | | |
| Section Sect | 80 | | | | | | | | | | | | | | | | | | 9 | | | | | | |
| Section Sect | 81 | | | | | | | | | | - | | | | | | | | | | | | | | |
| 84 97.5% Chebyshev(Mean, Sd) UCL 2833 99% Chebyshev(Mean, Sd) UCL 3483 85 Suggested UCL to Use 87 95% Student's-t UCL 2991 Image: Color of Student's Stu | 82 | | | | | | | | | | • | | | | | | | | | | | | | | |
| Suggested UCL to Use | 83 | | | | | | | - | • | | , | | | | | | | | | | • | | . , | | |
| 86 Suggested UCL to Use 87 95% Student's-t UCL 2091 Image: Control of the part of | 84 | | | | | 97. | 5% Ch | nebysl | nev(Me | ean, S | id) UCL | 2833 | | | | | | 99% (| Che | ebysł | nev(M | ean. | , Sd) | UCL | 3483 |
| 87 95% Student's-t UCL 2091 | 85 | | | | | | | | | | | | | | | | | | | | | | | | |
| Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. 10 Recommendations are based upon data size, data distribution, and skewness using results from simulation studies. 10 However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician. 10 However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician. 10 UMM-WRB | | | | | | | | | F0/ O: | | | | d UCL to | Use |) | | | | | | | | | | |
| Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. Recommendations are based upon data size, data distribution, and skewness using results from simulation studies. However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician. WIMM-WRB UUMM-WRB UUMM- | | | | | | | | 9 | 5% Stu | udent's | s-t UCL | 2091 | | | | | | | | | | | | | |
| Recommendations are based upon data size, data distribution, and skewness using results from simulation studies. | | | Not | С | aaat | iono | ro a o r | dina th | م ممام | otion | of a OE0 | / LICL are i | rouidad | to bo | مراد مراد مرا | or to | | ot the | - ma | 201.0 | | rioto | OE 0/ | 1101 | |
| However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician. However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician. Wild | | | NOLE | _ | _ | | - | _ | | | | - | | | - | | | | | | | | | | |
| ST State | | — н | lowe | | | | | | | • | | | | | | | - | | | | | | | | |
| 94 bundward Undward 95 general Statistics 96 general Statistics 97 general Number of Distinct Observations of Distinct Obse | - | | | 701, 311 | iiiuia | itionic | resun | US WIII | 1101 00 | ver an | - Titear vv | | Ct3, 101 d | uuiti | onai mon | giit ti | iic uc | | ay w | vanit i | .0 0011 | Suit | <u> </u> | tioticie | |
| 94 WUMM-WRB 95 General Statistics 97 Total Number of Observations of Observations of Observations of Number of Missing Observations of Number of Missing Observations of | | | | | | | | | | | | | | | | | | | | | | | | | |
| Section Section Statistics Section | | UUMM-WI | 'RB | | | | | | | | | | | | | | | | | | | | | | |
| 96 General Statistics 97 Total Number of Observations 10 Number of Distinct Observations 10 98 Number of Missing Observations 0 99 Minimum 96 Median 137.8 100 Maximum 202 Median 129 101 SD 37.42 Std. Error of Mean 11.83 102 Coefficient of Variation 0.272 Skewness 0.618 103 Normal GOF Test 105 Shapiro Wilk Test Statistic 0.908 Shapiro Wilk GOF Test 106 1% Shapiro Wilk Critical Value 0.781 Data appear Normal at 1% Significance Level 107 Lilliefors Test Statistic 0.179 Lilliefors GOF Test 108 1% Lilliefors Critical Value 0.304 Data appear Normal at 1% Significance Level | | | | | | | | | | | | | | | | | | | | | | | | | |
| 97 Total Number of Observations 10 Number of Distinct Observations 10 98 Number of Missing Observations 0 99 Minimum 96 Mean 137.8 100 Maximum 202 Median 129 101 SD 37.42 Std. Error of Mean 11.83 102 Coefficient of Variation 0.272 Skewness 0.618 103 Normal GOF Test 105 Shapiro Wilk Test Statistic 0.908 Shapiro Wilk GOF Test 106 1% Shapiro Wilk Critical Value 0.781 Data appear Normal at 1% Significance Level 107 Lilliefors Test Statistic 0.179 Lilliefors GOF Test 108 1% Lilliefors Critical Value 0.304 Data appear Normal at 1% Significance Level 109 Data appear Normal at 1% Significance Level | | | | | | | | | | | | Genera | l Statisti | cs | | | | | | | | | | | |
| 98 Number of Missing Observations 0 99 Minimum 96 Mean 137.8 100 Maximum 202 Median 129 101 SD 37.42 Std. Error of Mean 11.83 102 Coefficient of Variation 0.272 Skewness 0.618 103 Normal GOF Test 105 Shapiro Wilk Test Statistic 0.908 Shapiro Wilk GOF Test 106 1% Shapiro Wilk Critical Value 0.781 Data appear Normal at 1% Significance Level 107 Lilliefors Test Statistic 0.179 Lilliefors GOF Test 108 1% Lilliefors Critical Value 0.304 Data appear Normal at 1% Significance Level 109 Data appear Normal at 1% Significance Level | | | | | | | Total | Num | ber of (| Obser | vations | 10 | | | | | | Numb | ber o | of Di | stinct | Obs | erva | tions | 10 |
| 99 Minimum 96 Mean 137.8 100 Maximum 202 Median 129 101 SD 37.42 Std. Error of Mean 11.83 102 Coefficient of Variation 0.272 Skewness 0.618 103 Normal GOF Test 105 Shapiro Wilk Test Statistic 0.908 Shapiro Wilk GOF Test 106 1% Shapiro Wilk Critical Value 0.781 Data appear Normal at 1% Significance Level 107 Lilliefors Test Statistic 0.179 Lilliefors GOF Test 108 1% Lilliefors Critical Value 0.304 Data appear Normal at 1% Significance Level 109 Data appear Normal at 1% Significance Level | | | | | | | | | | | | | | | | | | Numb | ber o | of Mi | ssing | Obs | serva | tions | 0 |
| 100 Maximum 202 Median 129 101 Std. Error of Mean 11.83 102 Coefficient of Variation 0.272 Skewness 0.618 103 Normal GOF Test 104 Normal GOF Test 105 Shapiro Wilk Test Statistic 0.908 Shapiro Wilk GOF Test 106 1% Shapiro Wilk Critical Value 0.781 Data appear Normal at 1% Significance Level 107 Lilliefors GOF Test 108 1% Lilliefors Critical Value 0.304 Data appear Normal at 1% Significance Level 109 Data appear Normal at 1% Significance Level | | | | | | | | | | М | inimum | 96 | | | | | | | | | | | | | 137.8 |
| 101 SD 37.42 Std. Error of Mean 11.83 102 Coefficient of Variation 0.272 Skewness 0.618 103 Normal GOF Test 105 Shapiro Wilk Test Statistic 0.908 Shapiro Wilk GOF Test 106 1% Shapiro Wilk Critical Value 0.781 Data appear Normal at 1% Significance Level 107 Lilliefors Test Statistic 0.179 Lilliefors GOF Test 108 1% Lilliefors Critical Value 0.304 Data appear Normal at 1% Significance Level 109 Data appear Normal at 1% Significance Level | | | | | | | | | | Ma | aximum | 202 | | | | | | | | | | | Me | dian | 129 |
| 102Coefficient of Variation0.272Skewness0.618103104Normal GOF Test105106Shapiro Wilk Test Statistic0.908Shapiro Wilk GOF Test106107Lilliefors Test Statistic0.781Data appear Normal at 1% Significance Level1081081% Lilliefors Critical Value0.304Data appear Normal at 1% Significance Level109Data appear Normal at 1% Significance Level | | · | | | | | | | | | SD | 37.42 | | | | | | | | | Std. | Erro | r of N | /lean | 11.83 |
| 103 Normal GOF Test 105 Shapiro Wilk Test Statistic 0.908 Shapiro Wilk GOF Test 106 1% Shapiro Wilk Critical Value 0.781 Data appear Normal at 1% Significance Level 107 Lilliefors Test Statistic 0.179 Lilliefors GOF Test 108 1% Lilliefors Critical Value 0.304 Data appear Normal at 1% Significance Level 109 Data appear Normal at 1% Significance Level | | | | | | | | Co | efficien | nt of V | ariation | 0.272 | | | | | | | | | | 5 | Skew | ness | 0.618 |
| Normal GOF Test Shapiro Wilk Test Statistic 0.908 Shapiro Wilk GOF Test 106 1% Shapiro Wilk Critical Value 0.781 Data appear Normal at 1% Significance Level 107 Lilliefors Test Statistic 0.179 Lilliefors GOF Test 108 1% Lilliefors Critical Value 0.304 Data appear Normal at 1% Significance Level 109 Data appear Normal at 1% Significance Level | | | | | | | | | | | | | | | | | | | | | | | | | |
| 106 1% Shapiro Wilk Critical Value 0.781 Data appear Normal at 1% Significance Level 107 Lilliefors Test Statistic 0.179 Lilliefors GOF Test 108 1% Lilliefors Critical Value 0.304 Data appear Normal at 1% Significance Level 109 Data appear Normal at 1% Significance Level | | | | | | | | | | | | Normal | GOF Te | est | | | | | | | | | | | |
| 106 1% Shapiro Wilk Critical Value 0.781 Data appear Normal at 1% Significance Level 107 Lilliefors Test Statistic 0.179 Lilliefors GOF Test 108 1% Lilliefors Critical Value 0.304 Data appear Normal at 1% Significance Level 109 Data appear Normal at 1% Significance Level | | | | | | | | - | | | | | | | | | | - | | | | | | | |
| 107 Lilliefors Test Statistic 0.179 Lilliefors GOF Test 108 1% Lilliefors Critical Value 0.304 Data appear Normal at 1% Significance Level 109 Data appear Normal at 1% Significance Level | | | | | | | 1% S | | | | | | | | Data | арре | | | | | - | cand | ce Le | vel | |
| 109 Data appear Normal at 1% Significance Level | | <u> </u> | | | | | | Lil | liefors | Test S | Statistic | | | | | | | | | | | | | | |
| 109 | | | | | | | 1 | % Lill | iefors (| | | | | | | | ear N | lorma | l at | 1% 5 | 3ignifi | cand | ce Le | vel | |
| 440 | 109 | | | | | | | | | Da | ta appe | ar Normal | at 1% Si | gnific | cance Le | vel | | | | | | | | | |
| 110 | 110 | | | | | | | | | | | | | | | | | | | | | | | | |

| 111 | Α | В | | С | D | Е | | g Norm | G nal Distributi | H ion | I | | J | K | | L |
|-----|---|-------------|----------|----------|--------------|--------------|-------------|-----------|---------------------|---|---------------|------------|------------|------------|--------|---------|
| 112 | | | 9! | 5% Nor | mal UCL | | | | | 95% | UCLs (Ad | djusted | for Ske | wness) | | |
| 113 | | | | | 95% Stu | udent's-t U | CL 159 | .5 | | | 95% Adju | sted-CL | T UCL (| Chen-19 | 95) | 159.7 |
| 114 | | | | | | | | | | | 95% Mod | dified-t L | JCL (Jol | nnson-19 | 78) | 159.9 |
| 115 | | | | | | | | | | | | | | | | |
| 116 | | | - | | | | Ga | mma G | OF Test | | | | | | | |
| 117 | | | | | A-D | Test Statis | tic 0. | 383 | | Ande | rson-Darli | ng Gam | ıma GO | F Test | | |
| 118 | | | | | 5% A-D | Critical Val | ue 0. | 725 | Detected | d data appea | ar Gamma | Distribu | uted at 5 | % Signif | icanc | e Level |
| 119 | | | | | K-S | Test Statis | tic 0. | 191 | | Kolmoç | gorov-Smii | rnov Ga | ımma G | OF Test | | |
| 120 | | | | | 5% K-S | Critical Val | ue 0. | 266 | Detected | d data appea | ar Gamma | Distribu | uted at 5 | % Signif | icanc | e Level |
| 121 | | | | | Detecte | d data app | ear Gam | ma Dis | tributed at 5 | % Significa | ance Level | | | | | |
| 122 | | | | | | | | | | | | | | | | |
| 123 | | | | | | | Ga | amma S | Statistics | | | | | | | |
| 124 | | | | | | k hat (ML | | | | | | , | | rected M | | 11.13 |
| 125 | | | | | | eta hat (ML | | 721 | | | The | , | | rected M | | 12.38 |
| 126 | | | | | | nu hat (ML | , | | | | | | | s correct | - 1 | 222.5 |
| 127 | | | | MLE | Mean (bi | as correcte | ed) 137 | .8 | | | | | • | s correct | • | 41.31 |
| 128 | | | | | | | | | | | Approxima | | | • | | 189 |
| 129 | | | | Adjuste | ed Level of | f Significan | ice 0.0 | 0267 | | | | Adjuste | ∍d Chi S | quare Va | ılue | 183.6 |
| 130 | | | | | | | | | | | | | | | | |
| 131 | | | | 250/ 4 | | | | | ma Distributi | ion | | 050/ 4 / | | | T | 407 |
| 132 | | | | 95% App | oroximate | Gamma U | CL 162 | .2 | | | | 95% Ad | ijustea C | Gamma L | ICL | 167 |
| 133 | | | | | | | | | 00F Too! | | | | | | | |
| 134 | | | | Ch | opiro Milk | Test Statis | | 927 | GOF Test | Cha | mino \A/ilk I | | | Toot | | |
| 135 | | | | | • | Critical Val | | 869 | | Sna Data appea | piro Wilk L | | | | | |
| 136 | | | | 0% 5118 | • | Test Statis | | 178 | <u>_</u> | | lliefors Log | | | | evei | |
| 137 | | | | 10% | | Critical Val | | 241 | ſ | Data appea | | - | | | | |
| 138 | | | | 10 /0 | | | | | t 10% Signif | • | | ai at 10 | 70 Sigilii | icance L | CVCI | |
| 139 | | | | | | Data appe | ar Logiic | ninai a | t 1070 Olgilli | | | | | | | |
| 140 | | | | | | | Loa | normal | Statistics | | | | | | | |
| 141 | | | | М | inimum of | Logged Da | _ | 564 | | | | N | Mean of | logged D | ata | 4.894 |
| 143 | | | | | | Logged Da | | 308 | | | | | | logged D | | 0.264 |
| 144 | | | | | | | | | | | | | | | | |
| 145 | | | | | | Α | ssuming | Lognoi | rmal Distribu | ution | | | | | | |
| 146 | | | | | | 95% H-U | CL 164 | | | | 90' | % Cheb | yshev (| MVUE) L | JCL | 172.4 |
| 147 | | | | 95% C | hebyshev | (MVUE) U | CL 188 | .1 | | | 97.5 | % Cheb | yshev (| MVUE) L | JCL | 209.9 |
| 148 | | | | 99% C | hebyshev | (MVUE) U | CL 252 | .8 | | | | | | | \neg | |
| 149 | | | | | | | | | | | | | | | | |
| 150 | | | | | | Nonpara | metric D | istributi | ion Free UC | L Statistics | 3 | | | | | |
| 151 | | | | | | Data app | oear to fo | llow a l | Discernible I | Distribution | | | | | | |
| 152 | | | | | | | | | | | | | | | | |
| 153 | | | | | | | | | ribution Free | UCLs | | | | | | |
| 154 | | | | | | 5% CLT U | | | | | | | | otstrap U | | 159.1 |
| 155 | | | | | | ootstrap U | | | | | | | | tstrap-t L | | 164.5 |
| 156 | | | | | | ootstrap U | | | | | | | | otstrap L | | 157.1 |
| 157 | | | | | • • | ean, Sd) U | | | | | | | • | an, Sd) L | | 189.4 |
| 158 | | | 97.5 | 5% Che | byshev(Me | ean, Sd) U | CL 211 | .7 | | | 99% | Chebys | hev(Me | an, Sd) L | ICL | 255.6 |
| 159 | | | | | | | | | 101 : 1: | | | | | | | |
| 160 | | | | | 050/ 0 | adamet a tra | | | JCL to Use | | | | | | | |
| 161 | | | | | 95% Sti | udent's-t U | CL 159 | .5 | | | | | | | | |
| 162 | | Note: Com | 00tic=- | rogs ==! | a tha = -1 | otion of a | NE0/ 1101 | ore = | wided += !! | n the | 2 00le st 11: | n mc = 1 | nnr' | oto OE0/ | IICI | |
| 163 | | | | • | - | | | | vided to help | | | | | | JUL. | |
| 164 | | | | | | <u>'</u> | - | | • | | | | | | otici- | |
| 165 | H | wever, simi | uiations | results | WIII FIOT CO | vei ali Kea | ıı vvorla d | aid Sets | s; for addition | ıaı ınsıgnt t | ne user ma | ay want | io consi | un a stati | sucia | .11. |

| | Α | В | С | D | Е | F | G | Н | I | J | K | L |
|------------|----------|-----------|---------------|----------------------------|----------------|---------------|----------------|--------------|--------------------|-----------------|----------------|----------|
| 166 | i | | | | | | | | | | | |
| 167 168 | 1 | c | | | | | | | | | | |
| 169 | | | | | | | | | | | | |
| 170 | † | | | | | General | Statistics | | | | | |
| 171 | | | Total | I Number of 0 | Observations | 4 | | | Numbe | r of Distinct (| Observations | 4 |
| 172 | | | | | | | | | Number | r of Missing (| Observations | 0 |
| 173 | | | | | Minimum | 16 | | | | | Mean | 17.75 |
| 174 | | | | | Maximum | 20 | | | | | Median | 17.5 |
| 175 | | | | | SD | 1.708 | | | | Std. E | rror of Mean | 0.854 |
| 176 | | | | Coefficien | t of Variation | 0.0962 | | | | | Skewness | 0.753 |
| 177 | | | | | | II. | II. | | | | | |
| 178 | | Note: Sar | mple size is | small (e.g., | <10), if data | are collected | d using increr | mental sam | pling method | lology (ISM) | approach, | |
| 179 | | | refer also t | o ITRC Tech | Reg Guide | on ISM (ITR | C 2020 and I | TRC 2012) | for additiona | al guidance, | | |
| 180 | | t | out note that | ITRC may re | ecommend t | he t-UCL or t | the Chebyshe | ev UCL for | small sample | e sizes (n < | 7). | |
| 181 | | | | The Cheb | yshev UCL o | often results | in gross over | restimates | of the mean. | | | |
| 182 | | | Ref | fer to the Pro | UCL 5.2 Te | chnical Guid | e for a discus | ssion of the | Chebyshev | UCL. | | |
| 183 | | | | | | | | | | | | |
| 184 | | | | | | | GOF Test | | | | | |
| 185 | | | | Shapiro Wilk | | | | | - | lk GOF Tes | | |
| 186 | | | 1% S | Shapiro Wilk (| | | | Data app | ear Normal a | | ance Level | |
| 187 | | | | | Test Statistic | | | | | GOF Test | | |
| 188 | | | 1 | 1% Lilliefors (| | | 10/ 0: :5 | | ear Normal a | t 1% Signific | ance Level | |
| 189 | | | | NI-4 | | | t 1% Significa | | _• | | | |
| 190 | | | | NOT | e GOF tests | may be unre | eliable for sm | ali sample | SIZES | | | |
| 191 | | | | | ۸۰ | ouming Nor | mal Distributi | ion | | | | |
| 192 | | | 05% N | ormal UCL | As | summy Non | | | 6 UCLs (Adju | eted for Ska | wnee) | |
| 193 | | | | | dent's-t UCL | 19.76 | | 90 / | • • | | (Chen-1995) | 19.5 |
| 194 | | | | | Identia-t dol | 13.70 | | | , | | hnson-1978) | 19.81 |
| 195 | | | | | | | | | - JO 70 WIGGIN | | 11113011 1070) | |
| 196 197 | | | | | | Gamma | GOF Test | | | | | |
| 198 | | | | A-D | Test Statistic | | | Ande | rson-Darling | Gamma GC | F Test | |
| 199 | | | | | Critical Value | | Detected | | | | 5% Significand | ce Level |
| 200 | | | | K-S | Test Statistic | 0.189 | | Kolmo | gorov-Smirno | ov Gamma C | OF Test | |
| 201 | | | | 5% K-S (| Critical Value | 0.394 | Detected | d data appe | ar Gamma D | istributed at | 5% Significand | ce Level |
| 202 | | | | Detected | d data appea | r Gamma Di | stributed at 5 | % Significa | ance Level | | | |
| 203 | 1 | | | Not | e GOF tests | may be unre | eliable for sm | all sample | sizes | | | |
| 204 | | | | | | | | | | | | |
| 205 | 1 | | | | | Gamma | Statistics | | | | | |
| 206 | | | | | k hat (MLE) | 146.8 | | | k | star (bias co | rrected MLE) | 36.88 |
| 207 | | | | The | eta hat (MLE) | 0.121 | | | Theta | star (bias co | rrected MLE) | 0.481 |
| 208 | | | | | nu hat (MLE) | | | | | • | as corrected) | 295 |
| 209 | | | М | ILE Mean (bia | as corrected) | 17.75 | | | | • | as corrected) | 2.923 |
| 210 | | | | | | | | | | | Value (0.05) | 256.2 |
| 211 | | | Adjus | sted Level of | Significance | N/A | | | A | djusted Chi S | Square Value | N/A |
| 212 | | | | | | | | _ | | | | |
| 213 | | | | | | | nma Distribut | ion | | | | |
| 214 | 1 | | 95% A | Approximate (| Jamma UCL | 20.44 | | | 95 | % Adjusted | Gamma UCL | N/A |
| 215 | | | | | | 1 | 10055 | | | | | |
| 216 | | | | Ohamina MARU I | Tank Otali ii | | I GOF Test | OI- | mine JABU- I | maurial OC | C Tost | |
| 217 | | | | Shapiro Wilk | | | | | piro Wilk Log | | | |
| 218 | | | 10% S | Shapiro Wilk (| | | | | | | ificance Level | |
| 219 | 1 | | | Lilliefors 0% Lilliefors (| Test Statistic | | | | lliefors Lognormal | | ificance Level | |
| 220 | | | 10 | , 70 LINEIUIS (| onucai value | 0.340 | | vara appea | ıı Loğnonnal | at 10 /0 SIYN | ncance Level | |

| 221 | Α | В | С | D [| E Data appear l | F Lognormal a | G at 10% Signific | H ance Leve | | J | K | L |
|---|----------|-------------|---|--|--|--|---|---|--|--|--|----------------------------|
| 222 | | | | Note | GOF tests | may be unre | liable for sma | II sample s | izes | | | |
| 223 | | | | | | | | | | | | |
| 224 | | | | | | Lognorma | l Statistics | | | | | |
| 225 | | | | Minimum of L | | 2.773 | | | | Mean of lo | | 2.873 |
| 226 | | | ı | Maximum of L | ogged Data | 2.996 | | | | SD of lo | gged Data | 0.0949 |
| 227 | | | | | · | | | | | | | |
| 228 | | | | | | | rmal Distribut | on | | | | |
| 229 | | | | | 95% H-UCL | N/A | | | | Chebyshev (M | · 1 | 20.27 |
| 230 | | | | Chebyshev (I | | 21.42 | | | 97.5% | Chebyshev (M | VUE) UCL | 23.01 |
| 231 | | | 99% | Chebyshev (I | MVUE) UCL | 26.13 | | | | | | |
| 232 | | | | | | | | | | | | |
| 233 | | | | | - | | tion Free UCL | | | | | |
| 234 | | | | | Data appea | r to follow a | Discernible D | istribution | | | | |
| 235 | | | | | | | | | | | | |
| 236 | | | | | - | | tribution Free | UCLs | | | 1 | |
| 237 | | | | | % CLT UCL | 19.15 | | | | 95% BCA Boot | · · | N/A |
| 238 | | | | Standard Bo | - | N/A | | | | 95% Boots | · | N/A |
| 239 | | | | 95% Hall's Bo | • | N/A | | | | Percentile Boot | | N/A |
| 240 | | | | nebyshev(Mea | • | 20.31 | | | | nebyshev(Mear | . , | 21.47 |
| 241 | | | 97.5% Ch ——— | nebyshev(Mea | an, Sd) UCL | 23.08 | | | 99% Cl | nebyshev(Mear | n, Sd) UCL | 26.25 |
| 242 | | | | | | | | | | | | |
| 243 | | | | 050/ 01 | | | UCL to Use | | | | | |
| 244 | | | | 95% Stud | dent's-t UCL | 19.76 | | | | | | |
| 245 | | lata: Cuma | | | +if - OF0/ | LICI ava va | والمواجه المواجه | | | | - 0E% LICI | |
| 246 | 1 | | | | | | · · | | | nost appropriate m simulation st | | |
| 247 | Но | | | • | | | | | | want to consul | | n e |
| 248 | 110 | wever, simu | | LS WIII HOL COV | - all i teal vv | ond data se | is, for additions | ai irisigiit tii | e user may | want to consul | t a statisticio | |
| 249 | | | | | | | | | | | | |
| 250 | UUMM-WRI | D | | | | | | | | | | |
| 201 | | | | | | | | | | | | |
| 252 253 | | | | | | | | | | | | |
| 254 | | | | | | General | Statistics | | | | | |
| 255 | | | Total | I Number of O | bservations | General 5 | Statistics | | Numbe | r of Distinct Ob | servations | 4 |
| 256 | | | Total | Number of O | bservations | | Statistics | | | | | 4 0 |
| 257 | | | Total | Number of C | Observations Minimum | | Statistics | | | r of Distinct Ob | | |
| 237 | | | Total | I Number of C | | 5 | Statistics | | | | servations | 0 |
| 258 | | | Total | Number of C | Minimum | 5 269 | Statistics | | | r of Missing Ob | servations | 0 286.6 |
| 258 259 | | | Total | | Minimum Maximum | 5 269 334 | Statistics | | | r of Missing Ob | Mean Median | 0 286.6 279 |
| 259 | | | Total | | Minimum Maximum SD | 5 269 334 27.13 | Statistics | | | r of Missing Ob | Mean Median or of Mean | 0 286.6 279 12.14 |
| 259 260 | | Note: Sai | | Coefficient | Minimum Maximum SD t of Variation | 5 269 334 27.13 0.0947 | | ental samp | Numbe | r of Missing Ob | Mean Median or of Mean Skewness | 0 286.6 279 12.14 |
| 259 260 261 | | Note: Sai | mple size is s | Coefficient | Minimum Maximum SD t of Variation | 5 269 334 27.13 0.0947 | | | Number | std. Erro | Mean Median or of Mean Skewness | 0 286.6 279 12.14 |
| 259 260 261 262 | | | mple size is s | Coefficient small (e.g., < to ITRC Tech | Minimum Maximum SD of Variation 410), if data a | 5 269 334 27.13 0.0947 are collected on ISM (ITR | using increme | RC 2012) 1 | Number | std. Erro | Mean Median or of Mean Skewness | 0 286.6 279 12.14 |
| 259 260 261 262 263 | | | mple size is s | Coefficient small (e.g., < to ITRC Tech ITRC may re | Minimum Maximum SD t of Variation 410), if data a Reg Guide of | 5 269 334 27.13 0.0947 are collected on ISM (ITRee t-UCL or t | using increme | RC 2012) 1 UCL for s | Number | Std. Erro Std. Erro dology (ISM) ap al guidance, e sizes (n < 7). | Mean Median or of Mean Skewness | 0 286.6 279 12.14 |
| 259 260 261 262 263 264 | | | mple size is a refer also to but note that | Coefficient small (e.g., < to ITRC Tech ITRC may re The Cheby | Minimum Maximum SD of Variation 410), if data a Reg Guide of commend the syshev UCL of | 269 334 27.13 0.0947 are collected on ISM (ITRe e t-UCL or to ften results) | using increme C 2020 and IT he Chebyshev | RC 2012) for some stimates of | Number strong method for additional sample f the mean. | std. Errodology (ISM) apal guidance, e sizes (n < 7). | Mean Median or of Mean Skewness | 0 286.6 279 12.14 |
| 259 260 261 262 263 264 265 | | | mple size is a refer also to but note that | Coefficient small (e.g., < to ITRC Tech ITRC may re The Cheby | Minimum Maximum SD of Variation 410), if data a Reg Guide of commend the syshev UCL of | 269 334 27.13 0.0947 are collected on ISM (ITRe e t-UCL or to ften results) | using increme C 2020 and IT he Chebyshev in gross overe | RC 2012) for some stimates of | Number strong method for additional sample f the mean. | std. Errodology (ISM) apal guidance, e sizes (n < 7). | Mean Median or of Mean Skewness | 0 286.6 279 12.14 |
| 259 260 261 262 263 264 265 266 | | | mple size is a refer also to but note that | Coefficient small (e.g., < to ITRC Tech ITRC may re The Cheby | Minimum Maximum SD of Variation 410), if data a Reg Guide of commend the syshev UCL of | 269 334 27.13 0.0947 are collected on ISM (ITRe e t-UCL or t ften results hnical Guide | using increme C 2020 and IT he Chebyshev in gross overe | RC 2012) for some stimates of | Number strong method for additional sample f the mean. | std. Errodology (ISM) apal guidance, e sizes (n < 7). | Mean Median or of Mean Skewness | 0 286.6 279 12.14 |
| 259 260 261 262 263 264 265 266 267 | | | mple size is a refer also to but note that | Coefficient small (e.g., < to ITRC Tech ITRC may re The Cheby | Minimum Maximum SD of Variation (10), if data a Reg Guide of ecommend the yshev UCL of UCL 5.2 Tec | 269 334 27.13 0.0947 are collected on ISM (ITRe e t-UCL or t ften results hnical Guide | using increme C 2020 and IT he Chebyshev in gross overe e for a discuss | RC 2012) for some stimates of | Number sling method for additional sample f the mean. | std. Errodology (ISM) apal guidance, e sizes (n < 7). | Mean Median or of Mean Skewness | 0 286.6 279 12.14 |
| 259 260 261 262 263 264 265 266 267 268 | | | mple size is a refer also to but note that | Coefficient small (e.g., < to ITRC Tech ITRC may re The Cheby fer to the Pro | Minimum Maximum SD of Variation A10), if data a Reg Guide of commend the comme | 269 334 27.13 0.0947 are collected on ISM (ITR) e t-UCL or t ften results hnical Guide | using increme C 2020 and IT he Chebyshev in gross overe e for a discuss | RC 2012) t UCL for s stimates o ion of the | Number Shapiro Wi | std. Errodology (ISM) apal guidance, e sizes (n < 7). | Mean Median or of Mean Skewness | 0 286.6 279 12.14 |
| 259 260 261 262 263 264 265 266 267 268 269 | | | mple size is a refer also to but note that | Coefficient small (e.g., < to ITRC Tech ITRC may re The Cheby fer to the Pro | Minimum Maximum SD of Variation A10), if data a Reg Guide of commend the comme | 269 334 27.13 0.0947 are collected on ISM (ITRe e t-UCL or t ften results hnical Guide Normal C 0.729 | using increme C 2020 and IT he Chebyshev in gross overe e for a discuss | RC 2012) t UCL for s stimates o ion of the | Number Shapiro William Normal a | Std. Erro Std. Erro dology (ISM) ap al guidance, e sizes (n < 7). UCL. | Mean Median or of Mean Skewness | 0 286.6 279 12.14 |
| 259 260 261 262 263 264 265 266 267 268 269 270 | | | mple size is a refer also to out note that Ref | Coefficient small (e.g., < to ITRC Tech ITRC may re The Cheby fer to the Pro | Minimum Maximum SD of Variation At 10), if data a Reg Guide of Commend the com | 269 334 27.13 0.0947 are collected on ISM (ITRe e t-UCL or t ften results hnical Guide Normal C 0.729 0.686 | using increme C 2020 and IT he Chebyshev in gross overe e for a discuss | RC 2012) 1 UCL for s stimates o ion of the 0 | Number Shapiro Wiar Normal a | Std. Erro Std. Erro dology (ISM) apal guidance, e sizes (n < 7). UCL. ilk GOF Test at 1% Significan | servations Mean Median or of Mean Skewness pproach, | 0 286.6 279 12.14 |
| 259 260 261 262 263 264 265 266 267 268 269 | | | mple size is a refer also to out note that Ref | Coefficient small (e.g., < to ITRC Tech ITRC may re The Cheby fer to the Prof | Minimum Maximum SD of Variation A10), if data a Reg Guide of commend the commend that the commend | 5 269 334 27.13 0.0947 are collected on ISM (ITRe e t-UCL or t ften results hnical Guide 0.729 0.686 0.367 0.396 | using increme C 2020 and IT he Chebyshev in gross overe e for a discuss | RC 2012) for some stimates or ion of the of | Number Shapiro Wiar Normal a | std. Erro Std. Erro dology (ISM) ap al guidance, e sizes (n < 7). UCL. ilk GOF Test at 1% Significan | servations Mean Median or of Mean Skewness pproach, | 0 286.6 279 12.14 |
| 259 260 261 262 263 264 265 266 267 268 269 270 271 | | | mple size is a refer also to out note that Ref | Coefficient small (e.g., < to ITRC Tech ITRC may re The Cheby fer to the Prof Shapiro Wilk T chapiro Wilk C Lilliefors T | Minimum Maximum SD of Variation 10), if data a Reg Guide of the commend the c | 269 334 27.13 0.0947 are collected on ISM (ITRe et-UCL or the results hnical Guide Normal Co.729 0.686 0.367 0.396 ar Normal at | using increme C 2020 and IT he Chebyshev in gross overe e for a discuss | RC 2012) if UCL for s stimates or ion of the C | Number Nu | std. Erro Std. Erro dology (ISM) ap al guidance, e sizes (n < 7). UCL. ilk GOF Test at 1% Significan | servations Mean Median or of Mean Skewness pproach, | 0 286.6 279 12.14 |
| 259 260 261 262 263 264 265 266 267 268 269 270 | | | mple size is a refer also to out note that Ref | Coefficient small (e.g., < to ITRC Tech ITRC may re The Cheby fer to the Prof Shapiro Wilk T chapiro Wilk C Lilliefors T | Minimum Maximum SD of Variation 10), if data a Reg Guide of the commend the c | 269 334 27.13 0.0947 are collected on ISM (ITRe et-UCL or the results hnical Guide Normal Co.729 0.686 0.367 0.396 ar Normal at | using increme C 2020 and IT he Chebyshev in gross overe e for a discuss GOF Test | RC 2012) if UCL for s stimates or ion of the C | Number Nu | std. Erro Std. Erro dology (ISM) ap al guidance, e sizes (n < 7). UCL. ilk GOF Test at 1% Significan | servations Mean Median or of Mean Skewness pproach, | 0 286.6 279 12.14 |

| 276 | Α | В | 95% No | D ormal UCL | Е | F | G | H 95% | UCLs (Adjusted for | K Skewness) | L |
|------------|--|------------|----------------|------------------------------|---------------------------|----------------|----------------|-----------------|---------------------------------------|-----------------------------------|---------------|
| 277 | | | | 95% Stu | dent's-t UCL | 312.5 | | | 95% Adjusted-CLT U | CL (Chen-1995) | 318.1 |
| 278 | | | | | | | | | 95% Modified-t UCL | (Johnson-1978) | 314.3 |
| 279 | | | | | | | | | | | |
| 280 | | | | | | | GOF Test | | | | |
| 281 | | | | | Test Statistic | 0.747 | _ | | rson-Darling Gamma | | |
| 282 | | | | | Critical Value | 0.678 | Da | | nma Distributed at 5% | | el |
| 283 | | | | | Test Statistic | 0.367 | D- | | jorov-Smirnov Gamm | | -1 |
| 284 | | | | | Critical Value | 0.357 | | | nma Distributed at 5% | Significance Leve | el |
| 285 | | | | Da | ata Not Gami | na Distribute | eu at 5% Sigi | nincance Le | evei | | |
| 286 | | | | | | Gamma | Statietice | | | | |
| 287 | | | | | k hat (MLE) | 149.4 | | | k star (bias | corrected MLE) | 59.88 |
| 288 | | | | The | ta hat (MLE) | 1.919 | | | Theta star (bias | · | 4.786 |
| 289 290 | | | | | nu hat (MLE) | 1494 | | | • | (bias corrected) | 598.8 |
| 291 | | | M | LE Mean (bia | , , | 286.6 | | | | (bias corrected) | 37.04 |
| 292 | | | | | <u> </u> | | | | Approximate Chi Squ | are Value (0.05) | 543.1 |
| 293 | | | Adjus | sted Level of | Significance | 0.0086 | | | Adjusted C | hi Square Value | 519.5 |
| 294 | | | | | | | I | | | | |
| 295 | | | | | Ass | suming Gam | ma Distributi | ion | | | |
| 296 | | | 95% A | pproximate (| Gamma UCL | 316 | | | 95% Adjust | ed Gamma UCL | 330.4 |
| 297 | | | | | | | 1 | | | <u>"</u> | |
| 298 | | | | | | | GOF Test | | | | |
| 299 | | | | Shapiro Wilk | | 0.744 | | - | oiro Wilk Lognormal (| | |
| 300 | | | 10% S | hapiro Wilk C | | 0.806 | | | ognormal at 10% Sig | | |
| 301 | | | | | Test Statistic | 0.357 | | | liefors Lognormal GC | | |
| 302 | | | 10 | % Lilliefors C | | 0.319 | | | ognormal at 10% Sig | nificance Level | |
| 303 | | | | | Data Not Lo | ognormal at | 10% Signific | ance Level | | | |
| 304 | | | | | | | l Otatiania | | | | |
| 305 | | | | Minimum of I | agged Date | Lognorma | I Statistics | | Maay | o of logged Data | E 655 |
| 306 | | | | Minimum of I Maximum of I | | 5.595 5.811 | | | | n of logged Data O of logged Data | 5.655 0.09 |
| 307 | | | | viaximum or i | Logged Data | 3.011 | | | | o i logged Data | |
| 308 | | | | | Assı | ımina Loana | rmal Distribu | ıtion | | | |
| 309 | | | | | 95% H-UCL | N/A | | | 90% Chebysh | ev (MVUE) UCL | 321.2 |
| 310 311 | | | 95% | Chebyshev (| | 336.8 | | | 97.5% Chebysh | | 358.6 |
| 312 | | | | Chebyshev (| • | 401.3 | | | · · · · · · · · · · · · · · · · · · · | , | |
| 313 | | | | | | | | | | | |
| 314 | | | | | Nonparame | tric Distribu | tion Free UC | L Statistics | | | |
| 315 | | | | | Data appea | r to follow a | Discernible I | Distribution | | | |
| 316 | | | | | | | | | | | |
| 317 | | | | | ·= | | tribution Free | UCLs | | | |
| 318 | | | | | 5% CLT UCL | 306.6 | | | | A Bootstrap UCL | N/A |
| 319 | | | | Standard Bo | - | N/A | | | | Bootstrap-t UCL | N/A |
| 320 | | | | 95% Hall's Bo | | N/A | | | | Bootstrap UCL | N/A |
| 321 | | | | nebyshev(Me | - | 323 | | | 95% Chebyshev | | 339.5 |
| 322 | | | 97.5% Ch | nebyshev(Me | an, Sd) UCL | 362.4 | | | 99% Chebyshev | (Mean, Sd) UCL | 407.3 |
| 323 | | | | | | Suggested | IICI to line | | | | |
| 324 | | | | Q5% C+ | dent's-t UCL | 312.5 | JOL IO USE | | | | |
| 325 | | | | 30 /0 Siu | u o ni 5-i UUL | J 1Z.Ü | | | | | |
| 326 | | Note: Suga | estions regard | ling the selec | tion of a 95% | UCL are pro | ovided to help | the user to | select the most appro | onriate 95% LICI | |
| 327 | | | _ | _ | | - | - | | g results from simulat | - | |
| 328 | —————————————————————————————————————— | | | | | | | | he user may want to c | | an. |
| 329 | | | | | | | , addition | | acc. may want to c | | |
| 330 | | | | | | | | | | | |

| 331 | А | В | С | D | E | F | G | Н | l | J | K | L |
|-----|----------|----------|---------------|----------------|-----------------|----------------|------------------|---|---------------|-----------------|----------------|----------|
| 332 | UUMM-WRI | Ē | | | | | | | | | | |
| 333 | | | | | | | | | | | | |
| 334 | | | | | | General | Statistics | | | | | |
| 335 | | | Total | Number of C | bservations | 4 | | | Numbe | r of Distinct C |)bservations | 3 |
| 336 | | | | | | | | | Numbe | r of Missing C |)bservations | 0 |
| 337 | | | | | Minimum | 24 | | | | | Mean | 24.75 |
| 338 | | | | | Maximum | 26 | | | | | Median | 24.5 |
| 339 | | | | | SD | 0.957 | | | | Std. E | rror of Mean | 0.479 |
| 340 | | | | Coefficient | of Variation | 0.0387 | | | | | Skewness | 0.855 |
| 341 | | | | | | | | | | | | |
| 342 | | Note: Sa | mple size is | small (e.g., < | :10), if data a | are collected | using incre | mental sam | pling method | dology (ISM) | approach, | |
| 343 | | | refer also to | o ITRC Tech | Reg Guide | on ISM (ITR | C 2020 and I | ITRC 2012) | for additiona | al guidance, | | |
| 344 | | t | out note that | ITRC may re | commend th | e t-UCL or t | he Chebysh | ev UCL for s | small sample | e sizes (n < 7 | <u>').</u> | |
| 345 | | | | The Cheby | shev UCL o | ften results i | in gross ove | restimates o | of the mean. | | | |
| 346 | | | Ref | er to the Pro | UCL 5.2 Ted | hnical Guide | e for a discu | ssion of the | Chebyshev | UCL. | | |
| 347 | | | | | | | | | | | | |
| 348 | | | | | | Normal C | GOF Test | | | | | |
| 349 | | | S | hapiro Wilk 1 | est Statistic | 0.865 | | | Shapiro Wi | ilk GOF Test | | |
| 350 | | | 1% S | hapiro Wilk C | critical Value | 0.687 | | Data appe | ear Normal a | t 1% Signific | ance Level | |
| 351 | | | | Lilliefors 7 | est Statistic | 0.283 | | | Lilliefors | GOF Test | | |
| 352 | | | 1 | % Lilliefors C | critical Value | 0.413 | | Data appe | ear Normal a | t 1% Signific | ance Level | |
| 353 | | | | | Data appe | ar Normal at | 1% Signification | ance Level | | | | |
| 354 | | | | Note | GOF tests | may be unre | liable for sm | all sample : | sizes | | | |
| 355 | | | | | | | | | | | | |
| 356 | | | | | As | suming Norr | nal Distribut | ion | | | | |
| 357 | | | 95% No | ormal UCL | | | | 95% | UCLs (Adju | sted for Ske | wness) | |
| 358 | | | | 95% Stu | dent's-t UCL | 25.88 | | | • | ed-CLT UCL | ` | 25.76 |
| 359 | | | | | | | | | 95% Modifi | ed-t UCL (Jol | nnson-1978) | 25.91 |
| 360 | | | | | | | | | | | | |
| 361 | | | | | | Gamma (| GOF Test | | | | | |
| 362 | | | | A-D 1 | est Statistic | 0.427 | | Ande | rson-Darling | Gamma GO | F Test | |
| 363 | | | | 5% A-D C | critical Value | 0.657 | Detected | | | | 5% Significand | ce Level |
| 364 | | | | K-S 1 | est Statistic | 0.318 | | | | ov Gamma G | | |
| 365 | | | | | critical Value | 0.394 | | | | istributed at 5 | 5% Significand | ce Level |
| 366 | | | <u> </u> | | data appear | | | _ | | | | |
| 367 | | | | Note | GOF tests | may be unre | liable for sm | nall sample | sizes | | | |
| 368 | | | | | | | | | | | | |
| 369 | | | | | | Gamma | Statistics | | | | | |
| 370 | | | | | k hat (MLE) | 900.3 | | | | star (bias cor | <i>´</i> | 225.2 |
| 371 | | | | | ta hat (MLE) | 0.0275 | | | Theta | star (bias cor | * | 0.11 |
| 372 | | | | | nu hat (MLE) | | | | | • | as corrected) | 1802 |
| 373 | | | M | LE Mean (bia | s corrected) | 24.75 | | | | • | as corrected) | 1.649 |
| 374 | | | | | | | | | | e Chi Square | ` ′ | 1704 |
| 375 | | | Adjus | sted Level of | Significance | N/A | | | A | djusted Chi S | quare Value | N/A |
| 376 | | | | | | | | | | | | |
| 377 | | | | | | suming Gam | ma Distribut | tion | | | | |
| 378 | | | 95% A | pproximate C | amma UCL | 26.17 | | | 95 | % Adjusted 0 | jamma UCL | N/A |
| 379 | | | | | | | | | | | | |
| 380 | | | | | | | GOF Test | | | | | |
| 381 | | | | hapiro Wilk T | | 0.865 | | | | gnormal GOF | | |
| 382 | | | 10% S | hapiro Wilk C | | 0.792 | | • | | | ficance Level | |
| 383 | | | | | est Statistic | 0.284 | | | - | ormal GOF T | | |
| 384 | | | 10 | % Lilliefors C | | 0.346 | | | _ | at 10% Signi | ficance Level | |
| 385 | | | | | Data appear | Lognormal a | at 10% Signif | ricance Leve | ei | | | |

| 386 | Α | В | С | D No | E ote GOF tests | F may be unre | G eliable for si | H nall sample s | izes | J | K | L |
|------------|---------|-------------|---------------|-----------------|----------------------------------|------------------|---------------------|--------------------|----------------|-------------------------------|------------------|------------|
| 387 | | | | | | | | | | | | |
| 388 | | | | | | Lognorma | l Statistics | | | | | |
| 389 | | | | Minimum c | of Logged Data | 3.178 | | | | Mean of I | ogged Data | 3.208 |
| 390 | | | | Maximum o | of Logged Data | 3.258 | | | | SD of I | ogged Data | 0.0384 |
| 391 | | | | | | | | | | | " | |
| 392 | | | | | Assı | uming Logno | rmal Distrib | oution | | | | |
| 393 | | | | | 95% H-UCL | N/A | | | | Chebyshev (N | | 26.17 |
| 394 | | | | | v (MVUE) UCL | | | | 97.5% | Chebyshev (N | MVUE) UCL | 27.72 |
| 395 | | | 99% | 6 Chebyshev | v (MVUE) UCL | 29.48 | | | | | | |
| 396 | | | | | | | | | | | | |
| 397 | | | | | • | etric Distribut | | | | | | |
| 398 | | | | | Data appea | ar to follow a | Discernible | Distribution | | | | |
| 399 | | | | | Nonna | rametric Dist | tribution Ere | a IICI e | | | | |
| 400 | | | | | 95% CLT UCL | | | e octs | | 95% BCA Bo | ntetran LICI | N/A |
| 401 | | | 059 | | Bootstrap UCL | | | | | | strap-t UCL | N/A |
| 402 | | | 30. | | Bootstrap UCL | | | | 05% | Percentile Bo | | N/A N/A |
| 403 | | | 90% C | | Mean, Sd) UCL | | | | | ebyshev(Mea | • | 26.84 |
| 404 405 | | | | , | /lean, Sd) UCL /lean, Sd) UCL | | | | | ebyshev(Mea | | 29.51 |
| 405 | | | 37.370 | | | | | | 0070 01 | ,(14100 | , 54, 562 | |
| 406 | | | | | | Suggested | UCL to Use | ı | | | | |
| 407 408 | | | | 95% S | tudent's-t UCL | 25.88 | | | | | | |
| 409 | | | | | | | | | | | | |
| 410 | 1 | Note: Sugge | estions rega | rding the sel | ection of a 95% | 6 UCL are pr | ovided to he | lp the user to | select the m | nost appropria | ite 95% UCL | |
| 411 | | Recon | nmendation | s are based | upon data size | , data distribi | ution, and sl | ewness usin | g results fro | m simulation s | studies. | |
| 412 | Ho | wever, simu | ulations resu | ults will not c | over all Real W | Vorld data se | ts; for additi | onal insight th | ne user may | want to consu | ılt a statistici | an. |
| 413 | | | | | | | | | | | | |
| 414 | | | | | | | | | | | | |
| 415 | UUMM-WR | F | | | | | | | | | | |
| 416 | | | | | | | | | | | | |
| 417 | | | | | | General | Statistics | | | | | |
| 418 | | | Tot | al Number of | f Observations | 11 | | | | r of Distinct O | | 11 |
| 419 | | | | | | | | | Number | of Missing O | bservations | 0 |
| 420 | | | | | Minimum | | | | | | Mean | 528.1 |
| 421 | | | | | Maximum | 786 | | | | | Median | 534 |
| 422 | | | | | SD | | | | | Std. Er | ror of Mean | 44.31 |
| 423 | | | | Coefficie | ent of Variation | 0.278 | | | | | Skewness | 0.243 |
| 424 | | | | | | No | 20E T | | | | | |
| 425 | | | | Chanira Mai | L Toot Ctoticti | | GOF Test | | Chemire W | IL COE Taat | | |
| 426 | | | | - | k Test Statistic | | | Data anna | | Ik GOF Test t 1% Significa | neo I ovel | |
| 427 | | | 1% | | c Critical Value | | | рата арре | | GOF Test | ince Level | |
| 428 | | | | | S Test Statistic | | | Data anna | | t 1% Significa | nce I ovol | |
| 429 | | | | - /o LIIIIEIUIS | | ear Normal at | 1% Signific | | ai ivuiillai a | L 1 /0 SIGIIIICA | HICE LEVEI | |
| 430 | | | | | | | . i /o Oigiiiil | AIIOE LEVEI | | | | |
| 431 | | | | | Δο | suming Norr | mal Distribu | tion | | | | |
| 432 | | | 95% ! | Normal UCL | | | 5.00150 | | UCLs (Adio | sted for Skev | vness) | |
| 433 | | | 55701 | | tudent's-t UCL | 608.4 | | | | d-CLT UCL (| • | 604.4 |
| 434 435 | | | | | | | | | | ed-t UCL (Joh | , | 608.9 |
| 435 436 | | | | | | <u> </u> | | | | 3 2 2 (0011 | | |
| 436 437 | | | | | | Gamma (| GOF Test | | | | | |
| 437 | | | | A-[| D Test Statistic | | - 7 | Ander | son-Darlina | Gamma GO | F Test | |
| 439 | | | | | Critical Value | | Detecte | | _ | stributed at 5 | | ce Level |
| | | | | | | | | F F 7 ** | | | | |
| 440 | | | | | S Test Statistic | 0.0977 | | Kolmoa | orov-Smirno | v Gamma G | | |

| March Marc |
|--|
| Add MLE Mean (bias corrected) 528.1 MLE Sd (bias corrected) 166. |
| Mate |
| Approximate Chi Square Value (0.05) 187. |
| Adjusted Level of Significance 0.0278 |
| Assuming Gamma Distribution Section 2007 Sect |
| Assuming Gamma Distribution G22.2 95% Adjusted Gamma UCL G39.3 |
| |
| |
| |
| Shapiro Wilk Test Statistic 0.981 Shapiro Wilk Lognormal GOF Test |
| 10% Shapiro Wilk Critical Value 0.876 Data appear Lognormal at 10% Significance Level |
| Lilliefors Test Statistic 0.111 Lilliefors Lognormal GOF Test |
| 10% Lilliefors Critical Value 0.231 Data appear Lognormal at 10% Significance Level |
| Data appear Lognormal at 10% Significance Level |
| Lognormal Statistics |
| Lognormal Statistics |
| Minimum of Logged Data 5.67 Mean of logged Data 6.28 |
| Maximum of Logged Data 6.667 SD of logged Data 0.2 |
| Assuming Lognormal Distribution 95% H-UCL 634.1 90% Chebyshev (MVUE) UCL 668.1 95% Chebyshev (MVUE) UCL 731.8 97.5% Chebyshev (MVUE) UCL 819.1 999% Chebyshev (MVUE) UCL 992.3 99% Chebyshev (MVUE) UCL 992.3 90% Chebyshev (MVUE) UCL 819.1 992.3 998.2 998. |
| Assuming Lognormal Distribution 95% H-UCL 634.1 90% Chebyshev (MVUE) UCL 668.5 95% Chebyshev (MVUE) UCL 731.8 97.5% Chebyshev (MVUE) UCL 819.5 99% Chebyshev (MVUE) UCL 992.3 90% Chebyshev (MVUE) UCL 992.3 99% Chebyshev (MVUE) UCL 819.5 99% Chebyshev (MVUE) UCL 9 |
| 95% H-UCL 634.1 90% Chebyshev (MVUE) UCL 668.5 |
| 95% Chebyshev (MVUE) UCL 731.8 97.5% Chebyshev (MVUE) UCL 819.3 |
| 99% Chebyshev (MVUE) UCL 992.3 |
| Nonparametric Distribution Free UCL Statistics |
| Nonparametric Distribution Free UCL Statistics |
| A71 |
| Nonparametric Distribution Free UCLs |
| Nonparametric Distribution Free UCLs 95% CLT UCL 601 95% BCA Bootstrap UCL 604.3 95% Standard Bootstrap UCL 598.2 95% Bootstrap-t UCL 621.0 95% Hall's Bootstrap UCL 620.6 95% Percentile Bootstrap UCL 598.3 95% Percentile Bootstrap UCL 95% Percentile Boots |
| 475 95% CLT UCL 601 95% BCA Bootstrap UCL 604. 476 95% Standard Bootstrap UCL 598.2 95% Bootstrap-t UCL 621.0 477 95% Hall's Bootstrap UCL 620.6 95% Percentile Bootstrap UCL 598.2 |
| 476 95% Standard Bootstrap UCL 598.2 95% Bootstrap-t UCL 621.0 477 95% Hall's Bootstrap UCL 620.6 95% Percentile Bootstrap UCL 598.2 |
| 477 95% Hall's Bootstrap UCL 620.6 95% Percentile Bootstrap UCL 598.3 |
| |
| |
| 90% Chebyshev (Mean, Sd) UCL 661 95% Chebyshev (Mean, Sd) UCL 721. |
| 479 97.5% Chebyshev(Mean, Sd) UCL 804.8 99% Chebyshev(Mean, Sd) UCL 969 |
| 480 Suggested LICL to Lice |
| Suggested UCL to Use 95% Student's-t UCL 608.4 |
| 702 |
| Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. |
| |
| |
| 100 |
| 487 |

| \Box | A B C D E | F | G H I J K | L |
|----------|---|----------------|---|-------------------|
| 2 | UCL Statis | stics for Unc | ensored Full Data Sets | |
| 3 | User Selected Options | 0.E7.20 DM | | |
| 5 | Date/Time of Computation ProUCL 5.2 10/31/2024 From File ProUCL Input.xls | 3:57:38 PIVI | | |
| 6 | Full Precision OFF | | | |
| 7 | Confidence Coefficient 95% Number of Bootstrap Operations 2000 | | | |
| 9 | Number of Booletrap Operations (2000 | | | |
| 10 11 | CEM-WRA-0.5-1 | | | |
| 12 | <u>DEIM-VVRA-0.5-1</u> | | | |
| 13 14 | Total Number of Observations | | Statistics Number of Distinct Changetions | |
| 15 | Total Number of Observations | 4 | Number of Distinct Observations Number of Missing Observations | 0 |
| 16 | Minimum | | Mean | 56.25 |
| 17 18 | Maximum SD | | Median Std. Error of Mean | <u>55</u> 3.01 |
| 19 | Coefficient of Variation | | Skewness | 0.762 |
| 20 21 | Note: Comple size is small (a.g. <10) if date | ara callacted | using ingremental compling mothedalogy (ICM) approach | |
| 22 | | | using incremental sampling methodology (ISM) approach, C 2020 and ITRC 2012) for additional guidance, | |
| 23 | but note that ITRC may recommend the | ne t-UCL or t | he Chebyshev UCL for small sample sizes (n < 7). | |
| 24 25 | | | in gross overestimates of the mean. e for a discussion of the Chebyshev UCL. | |
| 26 | THEIGH TO THE THOO SEE SEE THE | | • | |
| 27 28 | Shapiro Wilk Test Statistic | | GOF Test Shapiro Wilk GOF Test | |
| 29 | Snapiro Wilk Test Statistic 1% Shapiro Wilk Critical Value | | Data appear Normal at 1% Significance Level | |
| 30 31 | Lilliefors Test Statistic | 0.26 | Lilliefors GOF Test | |
| 32 | 1% Lilliefors Critical Value Data appe | | Data appear Normal at 1% Significance Level 1% Significance Level | |
| 33 | | | eliable for small sample sizes | |
| 34 35 | Λ. | eumina No- | mal Distribution | |
| 36 | 95% Normal UCL | suming Non | 95% UCLs (Adjusted for Skewness) | |
| 37 | 95% Student's-t UCL | 63.33 | 95% Adjusted-CLT UCL (Chen-1995) | 62.43 |
| 38 39 | | | 95% Modified-t UCL (Johnson-1978) | 63.53 |
| 40 | | | GOF Test | |
| 41 42 | A-D Test Statistic 5% A-D Critical Value | | Anderson-Darling Gamma GOF Test Detected data appear Gamma Distributed at 5% Significance | Lovel |
| 43 | K-S Test Statistic | | Kolmogorov-Smirnov Gamma GOF Test | Level |
| 44 45 | 5% K-S Critical Value | | Detected data appear Gamma Distributed at 5% Significance | Level |
| 46 | | | stributed at 5% Significance Level sliable for small sample sizes | |
| 47 | | | | |
| 48 49 | k hat (MLE) | | Statistics k star (bias corrected MLE) | 29.92 |
| 50 | Theta hat (MLE) | | Theta star (bias corrected MLE) | 1.88 |
| 51 52 | nu hat (MLE) | | nu star (bias corrected) MLE Sd (bias corrected) | 239.4 |
| 53 | MLE Mean (bias corrected) | 56.25 | | 10.28 204.5 |
| 54 55 | Adjusted Level of Significance | N/A | | N/A |
| 56 | Δε | sumina Gam | ma Distribution | |
| 57 | 95% Approximate Gamma UCL | | | N/A |
| 58 59 | | Lognormo | GOF Test | |
| 60 | Shapiro Wilk Test Statistic | 0.913 | Shapiro Wilk Lognormal GOF Test | |
| 61 62 | 10% Shapiro Wilk Critical Value | 0.792 | Data appear Lognormal at 10% Significance Level | |
| 63 | Lilliefors Test Statistic 10% Lilliefors Critical Value | | Lilliefors Lognormal GOF Test Data appear Lognormal at 10% Significance Level | |
| 64 | Data appear | Lognormal a | at 10% Significance Level | |
| 65 66 | Note GOF tests | may be unre | eliable for small sample sizes | |
| 67 | | | I Statistics | |
| 68 69 | Minimum of Logged Data | 3.932 | Mean of logged Data | 4.026 |
| 70 | Maximum of Logged Data | 4.159 | SD of logged Data | 0.105 |
| 71 | Assı | uming Logno | ormal Distribution | 05.40 |
| 72 73 | 95% H-UCL 95% Chebyshev (MVUE) UCL | 64.52 69.15 | 90% Chebyshev (MVUE) UCL 97.5% Chebyshev (MVUE) UCL | 65.13 74.74 |
| 74 | 99% Chebyshev (MVUE) UCL | | 57.576 GREDYSHEV (WIVOL) OCL | , 7./7 |
| 75 76 | No. | otrio Diotalba | tion Eron LICI Statistics | |
| 77 | | | tion Free UCL Statistics Discernible Distribution | |
| 78 | | | | |
| 79 80 | Nonpal 95% CLT UCL | | tribution Free UCLs 95% BCA Bootstrap UCL | N/A |
| 81 | 95% Standard Bootstrap UCL | N/A | 95% Bootstrap-t UCL | N/A |
| 82 | 95% Hall's Bootstrap UCL | N/A | 95% Percentile Bootstrap UCL | N/A |

| | Α | В | С | D | E | F | G | Н | | J | K | L |
|----|----|--------------|----------------|----------------|---------------|----------------|-----------------|----------------|----------------|---------------|-----------------|-------|
| 83 | | | 90% Ch | ebyshev(Me | an, Sd) UCL | 65.28 | | | 95% Ch | ebyshev(Me | an, Sd) UCL | 69.37 |
| 84 | | | 97.5% Ch | ebyshev(Me | an, Sd) UCL | 75.05 | | | 99% Ch | ebyshev(Me | an, Sd) UCL | 86.2 |
| 85 | | | | | | | | | | | | |
| 86 | | | | | | Suggested | UCL to Use | | | | | |
| 87 | | | | 95% Stu | dent's-t UCL | 63.33 | | | | | | |
| 88 | | | | | | | • | | | | | |
| 89 | | Note: Sugges | stions regard | ing the selec | tion of a 95% | 6 UCL are pr | ovided to hel | p the user to | select the m | nost appropri | ate 95% UCL | |
| 90 | | Recom | mendations | are based up | on data size | , data distrib | ution, and sk | ewness usin | g results fror | m simulation | studies. | |
| 91 | Но | wever, simu | lations result | s will not cov | er all Real W | /orld data se | ts; for additio | nal insight th | ne user may | want to cons | ult a statistic | ian. |
| 92 | | | | | | | | | | | | |

| 4 | A B C D E | F | G H I J K | L |
|----------|---|-----------------------------|--|----------------|
| 2 | | tics for Unc | ensored Full Data Sets | |
| 3 | User Selected Options Date/Time of Computation ProUCL 5.2 10/31/2024 4 | 1.01.02 DM | | |
| 5 | From File ProUCL Input.xls | +.U 1.UZ PIVI | | |
| 6 7 | Full Precision OFF Confidence Coefficient 95% | | | |
| 8 | Number of Bootstrap Operations 2000 | | | |
| 9 10 | | | | |
| 11 | CEM-WRA-0.5-2 | | | |
| 12 13 | | General | Statistics | |
| 14 15 | Total Number of Observations | 10 | Number of Distinct Observations | 10 |
| 16 | Minimum | 100 | Number of Missing Observations Mean | 0 166.2 |
| 17 18 | Maximum | 264 | Median | 150 |
| 19 | SD Coefficient of Variation | 48.81 0.294 | Std. Error of Mean Skewness | 15.43 0.898 |
| 20 | | | | |
| 21 22 | Shapiro Wilk Test Statistic | 0.913 | GOF Test Shapiro Wilk GOF Test | |
| 23 24 | 1% Shapiro Wilk Critical Value | 0.781 | Data appear Normal at 1% Significance Level | |
| 25 | Lilliefors Test Statistic 1% Lilliefors Critical Value | 0.242 0.304 | Lilliefors GOF Test Data appear Normal at 1% Significance Level | |
| 26 | | | 1% Significance Level | |
| 27 28 | Ası | sumina Nori | mal Distribution | |
| 29 30 | 95% Normal UCL | | 95% UCLs (Adjusted for Skewness) | 100.0 |
| 31 | 95% Student's-t UCL | 194.5 | 95% Adjusted-CLT UCL (Chen-1995) 95% Modified-t UCL (Johnson-1978) | 196.3 195.2 |
| 32 | | 0 | | |
| 34 | A-D Test Statistic | 0.393 | GOF Test Anderson-Darling Gamma GOF Test | |
| 35 36 | 5% A-D Critical Value | 0.725 | Detected data appear Gamma Distributed at 5% Significance | e Level |
| 37 | K-S Test Statistic 5% K-S Critical Value | 0.211 0.266 | Kolmogorov-Smirnov Gamma GOF Test Detected data appear Gamma Distributed at 5% Significance | e Level |
| 38 39 | Detected data appear | Gamma Di | stributed at 5% Significance Level | |
| 40 | | Gamma | Statistics | |
| 41 | k hat (MLE) | 13.79 | k star (bias corrected MLE) | 9.722 |
| 43 | Theta hat (MLE) nu hat (MLE) | 12.05 275.9 | Theta star (bias corrected MLE) nu star (bias corrected) | 17.1 194.4 |
| 44 45 | MLE Mean (bias corrected) | 166.2 | MLE Sd (bias corrected) Approximate Chi Square Value (0.05) | 53.3 163.2 |
| 46 | Adjusted Level of Significance | 0.0267 | Approximate Chi Square Value (0.05) Adjusted Chi Square Value | 158.2 |
| 47 48 | Λος | numing Car | nma Distribution | |
| 49 | 95% Approximate Gamma UCL | 198 | 95% Adjusted Gamma UCL | 204.3 |
| 50 51 | | Lognorma | GOF Test | |
| 52 | Shapiro Wilk Test Statistic | 0.955 | Shapiro Wilk Lognormal GOF Test | |
| 53 54 | 10% Shapiro Wilk Critical Value Lilliefors Test Statistic | 0.869 0.193 | Data appear Lognormal at 10% Significance Level Lilliefors Lognormal GOF Test | |
| 55 | 10% Lilliefors Critical Value | 0.241 | Data appear Lognormal at 10% Significance Level | |
| 56 57 | Data appear | Lognormal a | at 10% Significance Level | |
| 58 | | | Statistics | |
| 59 60 | Minimum of Logged Data Maximum of Logged Data | 4.605 5.576 | Mean of logged Data SD of logged Data | 5.077 0.283 |
| 61 62 | | | | |
| 63 | Assu 95% H-UCL | <u>ıming Logno</u> 200.6 | prmal Distribution 90% Chebyshev (MVUE) UCL | 210.9 |
| 64 65 | 95% Chebyshev (MVUE) UCL | 231.2 | 97.5% Chebyshev (MVUE) UCL | 259.4 |
| 66 | 99% Chebyshev (MVUE) UCL | 314.8 | | |
| 67 68 | | | tion Free UCL Statistics | |
| 69 | Data appea | r to tollow a | Discernible Distribution | |
| 70 71 | | | tribution Free UCLs | 10F 2 |
| 72 | 95% CLT UCL 95% Standard Bootstrap UCL | 191.6 190.1 | 95% BCA Bootstrap UCL 95% Bootstrap-t UCL | 195.2 202.4 |
| 73 74 | 95% Hall's Bootstrap UCL | 198.8 | 95% Percentile Bootstrap UCL 95% Chebyshev(Mean, Sd) UCL | 191.5 |
| 75 | 90% Chebyshev(Mean, Sd) UCL 97.5% Chebyshev(Mean, Sd) UCL | 212.5 262.6 | 95% Chebyshev(Mean, Sd) UCL 99% Chebyshev(Mean, Sd) UCL | 233.5 319.8 |
| 76 77 | | | | |
| 78 | 95% Student's-t UCL | 194.5 | UCL to Use | |
| 79 80 | | | ovided to help the upperte select the most approximate OF9/ LIQL | |
| 81 | | | ovided to help the user to select the most appropriate 95% UCL. ution, and skewness using results from simulation studies. | |
| 82 | | | ts; for additional insight the user may want to consult a statisticia | n. |

83 B C D E F G H I J K L

| | A B C D E | F | G H I J K | L |
|----------|---|----------------|--|----------------|
| 2 | UCL Statis | stics for Unc | ensored Full Data Sets | |
| 3 | User Selected Options Date/Time of Computation ProUCL 5.2 10/31/2024 | 4.00.00 DM | | |
| 5 | Date/Time of Computation ProUCL 5.2 10/31/2024 ProUCL Input.xls | 4:02:36 PIVI | | |
| 6 7 | Full Precision OFF | | | |
| 8 | Confidence Coefficient 95% Number of Bootstrap Operations 2000 | | | |
| 9 | | | | |
| 10 11 | CEM-WRA-0.5-3 | | | |
| 12 | OLINIWI WY 0.0-0 | | | |
| 13 14 | Total Number of Observations | General 4 | Statistics Number of Distinct Observations | 4 |
| 15 | Total Number of Observations | 7 | Number of Missing Observations | 0 |
| 16 17 | Minimum Maximum | 37 44 | Mean Median | 41 41.5 |
| 18 | SD Waxiifulii | 3.162 | Std. Error of Mean | 1.581 |
| 19 20 | Coefficient of Variation | 0.0771 | Skewness | -0.632 |
| 21 | Note: Sample size is small (e.g., <10), if data a | are collected | using incremental sampling methodology (ISM) approach, | |
| 22 | refer also to ITRC Tech Reg Guide | on ISM (ITR | C 2020 and ITRC 2012) for additional guidance, | |
| 23 24 | | | he Chebyshev UCL for small sample sizes (n < 7). in gross overestimates of the mean. | |
| 25 | | | e for a discussion of the Chebyshev UCL. | |
| 26 27 | | Normal (| GOF Test | |
| 28 | Shapiro Wilk Test Statistic | 0.941 | Shapiro Wilk GOF Test | |
| 29 30 | 1% Shapiro Wilk Critical Value | | Data appear Normal at 1% Significance Level | |
| 31 | Lilliefors Test Statistic 1% Lilliefors Critical Value | | Lilliefors GOF Test Data appear Normal at 1% Significance Level | |
| 32 | Data appe | ar Normal at | 1% Significance Level | |
| 33 34 | Note GOF tests | may be unre | eliable for small sample sizes | |
| 35 | | suming Nor | nal Distribution | |
| 36 37 | 95% Normal UCL 95% Student's-t UCL | 44.72 | 95% UCLs (Adjusted for Skewness) 95% Adjusted-CLT UCL (Chen-1995) | 43.07 |
| 38 | 55 /o Students-t OCL | 44.72 | 95% Adjusted-CE1 OCE (Cheri-1993) 95% Modified-t UCL (Johnson-1978) | 44.64 |
| 39 40 | | 0 | 00F T | |
| 41 | A-D Test Statistic | 0.297 | GOF Test Anderson-Darling Gamma GOF Test | |
| 42 43 | 5% A-D Critical Value | 0.657 | Detected data appear Gamma Distributed at 5% Significance | Level |
| 43 | K-S Test Statistic 5% K-S Critical Value | | Kolmogorov-Smirnov Gamma GOF Test Detected data appear Gamma Distributed at 5% Significance | l evel |
| 45 | Detected data appear | r Gamma Di | stributed at 5% Significance Level | 20101 |
| 46 47 | Note GOF tests | may be unre | eliable for small sample sizes | |
| 48 | | | Statistics | |
| 49 50 | k hat (MLE) | 219.9 0.186 | k star (bias corrected MLE) Theta star (bias corrected MLE) | 55.15 0.743 |
| 51 | Theta hat (MLE) nu hat (MLE) | 1759 | nu star (bias corrected) | 441.2 |
| 52 53 | MLE Mean (bias corrected) | | MLE Sd (bias corrected) | 5.521 |
| 54 | Adjusted Level of Significance | N/A | | 393.5 N/A |
| 55 | | ! | | |
| 56 57 | As: 95% Approximate Gamma UCL | | ma Distribution 95% Adjusted Gamma UCL | N/A |
| 58 | 55 % Approximate damina OCE | | | |
| 59 60 | Shapiro Wilk Test Statistic | | GOF Test Shapiro Wilk Lognormal GOF Test | |
| 61 | 10% Shapiro Wilk Critical Value | 0.792 | Data appear Lognormal at 10% Significance Level | |
| 62 63 | Lilliefors Test Statistic | | Lilliefors Lognormal GOF Test | |
| 64 | 10% Lilliefors Critical Value Data appear | | Data appear Lognormal at 10% Significance Level at 10% Significance Level | |
| 65 66 | | | liable for small sample sizes | |
| 66 67 | | Lognorma | I Statistics | |
| 68 | Minimum of Logged Data | 3.611 | Mean of logged Data | 3.711 |
| 69 70 | Maximum of Logged Data | 3.784 | SD of logged Data | 0.0783 |
| 71 | Assı | uming Logno | ormal Distribution | |
| 72 73 | 95% H-UCL | N/A | 90% Chebyshev (MVUE) UCL | 45.81 |
| 74 | 95% Chebyshev (MVUE) UCL 99% Chebyshev (MVUE) UCL | 47.99 56.96 | 97.5% Chebyshev (MVUE) UCL | 51.02 |
| 75 | | • | | |
| 76 77 | | | tion Free UCL Statistics Discernible Distribution | |
| 78 | | | | |
| 79 80 | | | tribution Free UCLs | NI/A |
| 81 | 95% CLT UCL 95% Standard Bootstrap UCL | 43.6 N/A | 95% BCA Bootstrap UCL 95% Bootstrap-t UCL | N/A N/A |
| 82 | 95% Hall's Bootstrap UCL | 1 | | N/A |

| | Α | В | С | D | E | F | G | Н | I | J | K | L | | |
|----|---|--------------|----------------|----------------|---------------|----------------|-----------------------------------|----------------|----------------|---------------|-----------------|-------|--|--|
| 83 | | - | 90% Ch | ebyshev(Me | an, Sd) UCL | 45.74 | 95% Chebyshev(Mean, Sd) UCL 47.89 | | | | | | | |
| 84 | | | 97.5% Ch | ebyshev(Me | an, Sd) UCL | 50.87 | | | 99% Ch | ebyshev(Me | an, Sd) UCL | 56.73 | | |
| 85 | | | | | | | | | | | | | | |
| 86 | Cuggotto CCL to CCC | | | | | | | | | | | | | |
| 87 | 00 / 0 Ottadont 3 t OOL 44.72 | | | | | | | | | | | | | |
| 88 | Recommended UCL exceeds the maximum observation | | | | | | | | | | | | | |
| 89 | | | | | | | | | | | | | | |
| 90 | | Note: Sugges | stions regard | ling the selec | tion of a 95% | 6 UCL are pr | ovided to hel | p the user to | select the m | nost appropri | ate 95% UCL | | | |
| 91 | | Recom | mendations | are based up | on data size | , data distrib | ution, and sk | ewness usin | g results from | m simulation | studies. | | | |
| 92 | Но | wever, simul | lations result | s will not cov | er all Real V | /orld data se | ts; for addition | nal insight th | ne user may | want to cons | ult a statistic | ian. | | |
| 93 | | | | | | | | | | | | | | |
| 94 | | Note: For | highly negat | ively-skewe | d data, confi | dence limits | (e.g., Chen, | Johnson, Lo | ognormal, ar | nd Gamma) i | may not be | | | |
| 95 | | | reliable. | Chen's and J | lohnson's m | ethods provi | de adjustme | nts for posit | vely skewed | data sets. | | | | |
| 96 | | | | | | | | | | | | | | |

| | A B C D E | F | G H I J K | L |
|----------|---|----------------|---|----------------|
| 2 | UCL Statis | stics for Unc | ensored Full Data Sets | |
| 3 | User Selected Options Date/Time of Computation ProUCL 5.2 10/31/2024 | 4.00.E0 DM | | |
| 5 | Date/Time of Computation ProUCL 5.2 10/31/2024 | 4:03:59 PIVI | | |
| 6 | Full Precision OFF | | | |
| 7 8 | Confidence Coefficient 95% Number of Bootstrap Operations 2000 | | | |
| 9 | Number of Booletrap Operations (2000 | | | |
| 10 11 | CEM-WRA-0.5-4 | | | |
| 12 | OLIM-44174-0.3-4 | | | |
| 13 14 | Total Number of Observations | | Statistics Number of Distinct Observations | 4 |
| 15 | Total Nulliber of Observations | 4 | Number of Missing Observations | 0 |
| 16 17 | Minimum | | Mean | 72.75 73 |
| 18 | Maximum SD | | Median Std. Error of Mean | 6.933 |
| 19 | Coefficient of Variation | | | -0.0961 |
| 20 21 | Note: Sample size is small (e.g., <10), if data: | are collected | using incremental sampling methodology (ISM) approach, | |
| 22 | refer also to ITRC Tech Reg Guide | on ISM (ITR | C 2020 and ITRC 2012) for additional guidance, | |
| 23 24 | | | he Chebyshev UCL for small sample sizes (n < 7). | |
| 25 | | | in gross overestimates of the mean. e for a discussion of the Chebyshev UCL. | |
| 26 27 | | | - | |
| 28 | Shapiro Wilk Test Statistic | | GOF Test Shapiro Wilk GOF Test | |
| 29 | 1% Shapiro Wilk Critical Value | 0.687 | Data Not Normal at 1% Significance Level | |
| 30 31 | Lilliefors Test Statistic 1% Lilliefors Critical Value | | Lilliefors GOF Test Data appear Normal at 1% Significance Level | |
| 32 | Data appear App | roximate No | rmal at 1% Significance Level | |
| 33 34 | Note GOF tests | may be unre | eliable for small sample sizes | |
| 35 | | suming Non | mal Distribution | |
| 36 37 | 95% Normal UCL | | 95% UCLs (Adjusted for Skewness) | 00.0 |
| 38 | 95% Student's-t UCL | 89.07 | 95% Adjusted-CLT UCL (Chen-1995) 95% Modified-t UCL (Johnson-1978) | 83.8 89.01 |
| 39 | | | | |
| 40 41 | A-D Test Statistic | | GOF Test Anderson-Darling Gamma GOF Test | |
| 42 | 5% A-D Critical Value | | Detected data appear Gamma Distributed at 5% Significance | Level |
| 43 44 | K-S Test Statistic | | Kolmogorov-Smirnov Gamma GOF Test | a Lawal |
| 45 | 5% K-S Critical Value Detected data appear | | Detected data appear Gamma Distributed at 5% Significance stributed at 5% Significance Level | Level |
| 46 47 | Note GOF tests | may be unre | liable for small sample sizes | |
| 48 | | Gamma | Statistics | |
| 49 | k hat (MLE) | 35.74 | k star (bias corrected MLE) | 9.102 |
| 50 51 | Theta hat (MLE) nu hat (MLE) | | Theta star (bias corrected MLE) nu star (bias corrected) | 7.992 72.82 |
| 52 | MLE Mean (bias corrected) | | MLE Sd (bias corrected) | 24.11 |
| 53 54 | Aditional Level of Cimpificance | NI/A | Approximate Chi Square Value (0.05) | 54.17 |
| 55 | Adjusted Level of Significance | N/A | Adjusted Chi Square Value | N/A |
| 56 57 | | | ma Distribution | N1/A |
| 58 | 95% Approximate Gamma UCL | 97.8 | 95% Adjusted Gamma UCL | N/A |
| 59 | | | GOF Test | |
| 60 61 | Shapiro Wilk Test Statistic 10% Shapiro Wilk Critical Value | | Shapiro Wilk Lognormal GOF Test Data appear Lognormal at 10% Significance Level | |
| 62 | Lilliefors Test Statistic | 0.171 | Lilliefors Lognormal GOF Test | |
| 63 64 | 10% Lilliefors Critical Value | | Data appear Lognormal at 10% Significance Level | |
| 65 | | | at 10% Significance Level eliable for small sample sizes | |
| 66 67 | | - | · | |
| 67 68 | Minimum of Logged Data | | I Statistics Mean of logged Data | 4.273 |
| 69 | Maximum of Logged Data | | SD of logged Data | 0.195 |
| 70 71 | Ann | umina I cara | armal Distribution | |
| 72 | ASSI 95% H-UCL | | ormal Distribution 90% Chebyshev (MVUE) UCL | 94.01 |
| 73 74 | 95% Chebyshev (MVUE) UCL | | | 117 |
| 74 75 | 99% Chebyshev (MVUE) UCL | 143.2 | | |
| 76 | | | tion Free UCL Statistics | |
| 77 78 | Data appea | ar to follow a | Discernible Distribution | |
| 79 | | | tribution Free UCLs | |
| 80 81 | 95% CLT UCL | 84.15 | 95% BCA Bootstrap UCL | N/A |
| 82 | 95% Standard Bootstrap UCL 95% Hall's Bootstrap UCL | | 95% Bootstrap-t UCL 95% Percentile Bootstrap UCL | N/A N/A |
| | 00 /0 Tidil 3 Doolstidp OOL | | 30 /0 1 Groomale Doolstrap GOL | |

| | Α | В | С | D | E | F | G | Н | I | J | K | L | |
|----|---------------------------|--------------|----------------|----------------|---------------|-----------------|---------------------------------|----------------|----------------|---------------|-----------------|------|--|
| 83 | | | 90% Ch | ebyshev(Me | an, Sd) UCL | 93.55 | 95% Chebyshev(Mean, Sd) UCL 103 | | | | | | |
| 84 | | | | | | | | | | | | | |
| 85 | | | | | | | | | | | | | |
| 86 | | | | | | | | | | | | | |
| 87 | 95% Student's-t UCL 89.07 | | | | | | | | | | | | |
| 88 | | | | Red | commended | UCL exceed | is the maxin | num observa | ation | | | | |
| 89 | | | | | | | | | | | | | |
| 90 | | | Wher | a data set fo | llows an app | proximate dis | tribution pas | sing only on | e of the GOF | tests, | | | |
| 91 | | | it is su | ggested to us | e a UCL bas | sed upon a di | istribution pa | ssing both C | OF tests in I | ProUCL | | | |
| 92 | | | | | | | | | | | | | |
| 93 | 1 | Note: Sugges | stions regard | ing the selec | tion of a 95% | UCL are pro | ovided to hel | p the user to | select the m | nost appropri | ate 95% UCL | | |
| 94 | | Recom | mendations | are based up | on data size | , data distribi | ution, and sk | ewness usin | g results fror | m simulation | studies. | | |
| 95 | Ho | wever, simu | lations result | s will not cov | er all Real W | orld data se | ts; for addition | nal insight th | ne user may | want to cons | ult a statistic | ian. | |
| 96 | | | | | | | | | | | | | |
| 97 | | Note: For | highly negat | ively-skewe | d data, confi | dence limits | (e.g., Chen, | Johnson, Lo | ognormal, ar | nd Gamma) ı | may not be | | |
| 98 | | | reliable. | Chen's and J | ohnson's me | ethods provi | de adjustme | nts for posit | vely skewed | data sets. | | | |
| 99 | | | | | | | | | | | | | |
| - | | | | | | | | | | | | | |

| | A B C D E | F | G H I J K | L |
|----------|---|----------------|--|----------------|
| 2 | UCL Statis | stics for Unc | ensored Full Data Sets | |
| 3 | User Selected Options | | | |
| 4 5 | Date/Time of Computation ProUCL 5.2 10/31/2024 | 4:05:27 PM | | |
| 6 | Full Precision OFF | | | |
| 7 | Confidence Coefficient 95% Number of Bootstrap Operations 2000 | | | |
| 9 | Number of Bootstrap Operations (2000 | | | |
| 10 | CEM-WRA-0.5-4-DS | | | |
| 12 | <u> </u> | | | |
| 13 14 | Total Number of Observations | | Statistics Number of Distinct Observations | 4 |
| 15 | Total Number of Observations | 4 | Number of Distinct Observations Number of Missing Observations | 0 |
| 16 17 | Minimum | 30 | Mean | 33.25 |
| 18 | Maximum SD | 38 3.594 | Median Std. Error of Mean | 32.5 1.797 |
| 19 | Coefficient of Variation | | Skewness | 0.889 |
| 20 | Note: Sample size is small (e.g. <10) if data | are collected | using incremental sampling methodology (ISM) approach, | |
| 22 | refer also to ITRC Tech Reg Guide | on ISM (ITR | C 2020 and ITRC 2012) for additional guidance, | |
| 23 24 | | | he Chebyshev UCL for small sample sizes (n < 7). in gross overestimates of the mean. | |
| 25 | | | e for a discussion of the Chebyshev UCL. | |
| 26 27 | | Normal (| GOF Test | |
| 28 | Shapiro Wilk Test Statistic | | Shapiro Wilk GOF Test | |
| 29 30 | 1% Shapiro Wilk Critical Value | 0.687 | Data appear Normal at 1% Significance Level | |
| 31 | Lilliefors Test Statistic 1% Lilliefors Critical Value | | Lilliefors GOF Test Data appear Normal at 1% Significance Level | |
| 32 | Data appe | ar Normal at | 1% Significance Level | |
| 33 34 | Note GOF tests | may be unre | eliable for small sample sizes | |
| 35 | | suming Nor | mal Distribution | |
| 36 37 | 95% Normal UCL 95% Student's-t UCL | 37.48 | 95% UCLs (Adjusted for Skewness) 95% Adjusted-CLT UCL (Chen-1995) | 37.06 |
| 38 | 33 /o Students-t OCL | 37.40 | | 37.61 |
| 39 40 | | Commo | COF Took | |
| 41 | A-D Test Statistic | 0.3 | GOF Test Anderson-Darling Gamma GOF Test | |
| 42 43 | 5% A-D Critical Value | | Detected data appear Gamma Distributed at 5% Significance | Level |
| 44 | K-S Test Statistic 5% K-S Critical Value | | Kolmogorov-Smirnov Gamma GOF Test Detected data appear Gamma Distributed at 5% Significance | Level |
| 45 | Detected data appear | r Gamma Di | stributed at 5% Significance Level | |
| 46 47 | Note GOF tests | may be unre | eliable for small sample sizes | |
| 48 | | | Statistics | |
| 49 50 | k hat (MLE) Theta hat (MLE) | 117.2 0.284 | k star (bias corrected MLE) Theta star (bias corrected MLE) | 29.47 1.128 |
| 51 | nu hat (MLE) | 937.7 | nu star (bias corrected) 2 | 235.8 |
| 52 53 | MLE Mean (bias corrected) | 33.25 | MLE Sd (bias corrected) | 6.125 |
| 54 | Adjusted Level of Significance | N/A | | 201.2 N/A |
| 55 56 | | | | |
| 57 | 95% Approximate Gamma UCL | | ma Distribution 95% Adjusted Gamma UCL 1 | N/A |
| 58 59 | | | | |
| 60 | Shapiro Wilk Test Statistic | | GOF Test Shapiro Wilk Lognormal GOF Test | |
| 61 | 10% Shapiro Wilk Critical Value | 0.792 | Data appear Lognormal at 10% Significance Level | |
| 62 63 | Lilliefors Test Statistic 10% Lilliefors Critical Value | | Lilliefors Lognormal GOF Test Data appear Lognormal at 10% Significance Level | |
| 64 | Data appear | Lognormal a | at 10% Significance Level | |
| 65 66 | Note GOF tests | may be unre | eliable for small sample sizes | |
| 67 | | | I Statistics | |
| 68 69 | Minimum of Logged Data | 3.401 | Mean of logged Data | 3.5 |
| 70 | Maximum of Logged Data | 3.638 | SD of logged Data | 0.106 |
| 71 72 | Assi | uming Logno | ormal Distribution | 20.52 |
| 73 | 95% H-UCL 95% Chebyshev (MVUE) UCL | 38.18 40.93 | | 38.53 44.25 |
| 74 | 99% Chebyshev (MVUE) UCL | 50.78 | 5 5 | |
| 75 76 | Nonnarame | etric Distribu | tion Free UCL Statistics | |
| 77 | | | Discernible Distribution | |
| 78 79 | None | rametric Dis | tribution Free LICLs | |
| 80 | Nonpa 95% CLT UCL | | tribution Free UCLs 95% BCA Bootstrap UCL | N/A |
| 81 82 | 95% Standard Bootstrap UCL | N/A | 95% Bootstrap-t UCL | N/A |
| . x/ | 95% Hall's Bootstrap UCL | N/A | 95% Percentile Bootstrap UCL 1 | N/A |

| | Α | В | С | D | E | F | G | Н | ı | J | K | L | |
|----|----------------------|--------------|----------------|----------------|---------------|--------------|-----------------------------------|----------------|--------------|----------------|-----------------|------|--|
| 83 | | | 90% Ch | ebyshev(Me | an, Sd) UCL | 38.64 | 95% Chebyshev(Mean, Sd) UCL 41.0 | | | | | | |
| 84 | | | 97.5% Ch | ebyshev(Me | an, Sd) UCL | 44.47 | 99% Chebyshev(Mean, Sd) UCL 51.13 | | | | | | |
| 85 | | | | | | | | | | | | | |
| 86 | Cuggotica COL to COC | | | | | | | | | | | | |
| 87 | | | | | | | | | | | | | |
| 88 | | | | | | | | | | | | | |
| 89 | ľ | Note: Sugges | stions regard | ing the selec | tion of a 95% | UCL are pr | ovided to hel | p the user to | select the m | nost appropria | ate 95% UCL | | |
| 90 | | | | | | | | | | | | | |
| 91 | Но | wever, simul | lations result | s will not cov | er all Real W | orld data se | ts; for addition | nal insight th | ne user may | want to cons | ult a statistic | ian. | |
| 92 | | | | | | | | | | | | | |

| -1 | A B C D E | F tics for Unc | G H ensored Full Data Se | l ate | J | K | L |
|----------|---|-----------------------|-----------------------------|-----------------------------------|---|-------------------------------|----------------|
| 2 | | 101 0110 | | ,,,, | | | |
| 3 | User Selected Options | 1.00.EE DN4 | | | | | |
| 5 | Date/Time of Computation ProUCL 5.2 10/31/2024 4 From File ProUCL Input.xls | 1:08:55 PIVI | | | | | |
| 6 | Full Precision OFF | | | | | | |
| 7 | Confidence Coefficient 95% | | | | | | |
| 8 | Number of Bootstrap Operations 2000 | | | | | | |
| 10 | | | | | | | |
| 11 | CEM-WRB-0.5-1 | | | | | | |
| 12 13 | | General | Statistics | | | | |
| 14 | Total Number of Observations | 10 | Stationio | Numb | er of Distinct (| Observations | 10 |
| 15 16 | Main | 105 | | Numb | er of Missing (| | 0 |
| 17 | Minimum Maximum | 125 242 | | | | Mean Median | 169.8 158 |
| 18 | SD | 41.87 | | | Std. E | rror of Mean | 13.24 |
| 19 20 | Coefficient of Variation | 0.247 | | | | Skewness | 0.567 |
| 21 | | Normal (| GOF Test | | | | |
| 22 | Shapiro Wilk Test Statistic | 0.907 | | | Vilk GOF Tes | | |
| 23 24 | 1% Shapiro Wilk Critical Value | 0.781 | Data a | appear Normal | | ance Level | |
| 25 | Lilliefors Test Statistic 1% Lilliefors Critical Value | 0.173 0.304 | Data a | Lillietor appear Normal | s GOF Test at 1% Signific | ance I evel | |
| 26 | | 0.00. | 1% Significance Lev | | at 170 Olgillill | | |
| 27 28 | | | | | | | |
| 29 | 95% Normal UCL | suming Nor | nal Distribution | 5% UCLs (Ad | justed for Ske | wness) | |
| 30 | 95% Student's-t UCL | 194.1 | | 95% Adjus | ted-CLT UCL | (Chen-1995) | 194.1 |
| 31 32 | | | | | | hnson-1978) | 194.5 |
| 33 | | Gamma | GOF Test | | | | |
| 34 | A-D Test Statistic | 0.388 | Ar | nderson-Darlin | | | |
| 35 | 5% A-D Critical Value | 0.725 | Detected data ap | pear Gamma I | Distributed at | 5% Significand | ce Level |
| 36 37 | K-S Test Statistic 5% K-S Critical Value | 0.164 0.266 | Kolr Detected data ap | nogorov-Smiri | | | o Lovol |
| 38 | Detected data appear | Gamma Di | stributed at 5% Signi | ficance Level | ייסוויטעו כ ע dl : | o /o olgillilcalic | C FEAGI |
| 39 | | | | | _ | _ | |
| 40 41 | k hat (MLE) | Gamma 19.02 | Statistics | I | star (bias co | rrected MI EV | 13.38 |
| 42 | Theta hat (MLE) | 8.927 | | | a star (bias co | | 12.69 |
| 43 | nu hat (MLE) | | | | nu star (bia | as corrected) | 267.6 |
| 44 45 | MLE Mean (bias corrected) | 169.8 | | Annrovima | | as corrected) Value (0.05) | 46.42 230.7 |
| 46 | Adjusted Level of Significance | 0.0267 | | | | Square Value | |
| 47 48 | | | ma Diatelle at a | | | | |
| 48 | Ass 95% Approximate Gamma UCL | | ma Distribution | Q | 5% Adjusted | Gamma UCI | 202.2 |
| 50 | 50% Approximate dumina 60E | | | | _ / · · · · · · · · · · · · · · · · · · | | |
| 51 52 | Obj. 1 Mart T. (Co. 11 of | | GOF Test | hamir- Marii ' | | | |
| 53 | Shapiro Wilk Test Statistic 10% Shapiro Wilk Critical Value | 0.92 0.869 | | Shapiro Wilk Lo bear Lognorma | | | |
| 54 | Lilliefors Test Statistic | 0.147 | | Lilliefors Log | normal GOF | Test | |
| 55 56 | 10% Lilliefors Critical Value | 0.241 | | oear Lognorma | | | |
| 57 | Data appear | <u>Lognormal</u> : | t 10% Significance I | _evei | | | |
| 58 | | | l Statistics | | | | |
| 59 60 | Minimum of Logged Data | 4.828 | | | | logged Data | 5.108 |
| 61 | Maximum of Logged Data | 5.489 | | | 2D 01 | logged Data | 0.241 |
| 62 | | | rmal Distribution | | | | |
| 63 64 | 95% H-UCL | 198.6 | | | Chebyshev | | 208.7 |
| 65 | 95% Chebyshev (MVUE) UCL 99% Chebyshev (MVUE) UCL | 226.3 298.9 | | 97.5% | Chebyshev | (IVIVUE) UCL | 250.8 |
| 66 | | | | | | | |
| 67 68 | | | tion Free UCL Statis | | | | |
| 69 | Data appea | I LU TOIIOW A | Discernible Distribut | IION | | | |
| 70 | | | ribution Free UCLs | | | 7 | |
| 71 72 | 95% CLT UCL | 191.6 | | | | ootstrap UCL | 192.4 |
| 73 | 95% Standard Bootstrap UCL 95% Hall's Bootstrap UCL | 190 190.5 | | 95% | 95% Boo Percentile Bo | otstrap-t UCL ootstrap UCL | 196.5 190.4 |
| 74 | 90% Chebyshev(Mean, Sd) UCL | 209.5 | | | Chebyshev(Me | | 227.5 |
| 75 76 | 97.5% Chebyshev(Mean, Sd) UCL | 252.5 | | 99% (| hebyshev(Me | ean, Sd) UCL | 301.6 |
| 76 77 | | Suggested | UCL to Use | | | | |
| 78 | 95% Student's-t UCL | 194.1 | | | | | |
| 79 80 | Nets Commentions and the Comment | 1101 - | and a large front of | | | OF0/ LIO! | |
| 81 | Note: Suggestions regarding the selection of a 95% Recommendations are based upon data size, | | | | | | |
| 82 | However, simulations results will not cover all Real W | | | | | | an. |
| | | | | | | | |

83 B C D E F G H I J K L

| UCL Statistics for Uncensored Full Data Sets User Selected Options Date/Time of Computation ProUCL 5.2 10/31/2024 4:10:58 PM | |
|--|--|
| 4 Date/Time of Computation ProUCL 5.2 10/31/2024 4:10:58 PM | |
| | |
| From File ProUCL Input.xls | |
| 6 Full Precision OFF | |
| 7 Confidence Coefficient 95% 8 Number of Bootstrap Operations 2000 | |
| 9 Traines of Bostolian Sportations | |
| 10 11 CEM-WRC-0.5-1 | |
| [12] | |
| 13 General Statistics 14 Total Number of Observations 9 Nu | umber of Distinct Observations 9 |
| 15 NL | umber of Missing Observations 0 |
| 16 Minimum 94 | Mean 127.3 Median 121 |
| 18 SD 31.91 | Median 121 Std. Error of Mean 10.64 |
| Coefficient of Variation 0.251 | Skewness 1.079 |
| 20 21 Note: Sample size is small (e.g., <10), if data are collected using incremental sampling m | ethodology (ISM) approach. |
| refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for add | ditional guidance, |
| but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small st The Chebyshev UCL often results in gross overestimates of the magnetic states. | |
| Refer to the ProUCL 5.2 Technical Guide for a discussion of the Cheby | |
| 26 Normal GOF Test | |
| 28 Shapiro Wilk Test Statistic 0.876 Shapi | iro Wilk GOF Test |
| 29 1% Shapiro Wilk Critical Value 0.764 Data appear Nor | mal at 1% Significance Level |
| | efors GOF Test mal at 1% Significance Level |
| 32 Data appear Normal at 1% Significance Level | at the digital desired Edvol |
| Note GOF tests may be unreliable for small sample sizes 34 | |
| 35 Assuming Normal Distribution | |
| 36 95% Normal UCL 95% UCLs | (Adjusted for Skewness) |
| 0070 010001110 1 002 1 1 1 1 1 1 1 1 1 1 1 | djusted-CLT UCL (Chen-1995) 148.9 Modified-t UCL (Johnson-1978) 147.8 |
| 39 | |
| 40 Gamma GOF Test 41 A-D Test Statistic 0.44 Anderson-Da | arling Gamma GOF Test |
| 42 5% A-D Critical Value 0.721 Detected data appear Gami | ma Distributed at 5% Significance Level |
| | ma Distributed at 5% Significance Level |
| 45 Detected data appear Gamma Distributed at 5% Significance Le | |
| Note GOF tests may be unreliable for small sample sizes 47 | |
| 48 Gamma Statistics | |
| k hat (MLE) 19.75 | k star (bias corrected MLE) 13.24 |
| 50 Theta hat (MLE) 6.446 T 51 nu hat (MLE) 355.6 | heta star (bias corrected MLE) 9.615 nu star (bias corrected) 238.4 |
| 52 MLE Mean (bias corrected) 127.3 | MLE Sd (bias corrected) 34.99 |
| 53 Approx 54 Adjusted Level of Significance 0.0231 | kimate Chi Square Value (0.05) 203.6 Adjusted Chi Square Value 196.8 |
| 55 | Aujusteu Otti Oquale Value 180.0 |
| 56 Assuming Gamma Distribution 57 95% Approximate Gamma UCI 149 1 | 95% Adjusted Gamma UCL 154.2 |
| 58 | 95% Adjusted Gamma UCL 154.2 |
| 59 Lognormal GOF Test 60 Shapiro Wilk Test Statistic 0.917 Shapiro Wil | III Lamannal COF Task |
| | Ik Lognormal GOF Test ormal at 10% Significance Level |
| 62 Lilliefors Test Statistic 0.182 Lilliefors | Lognormal GOF Test |
| Data appear Lognormal at 10% Significance Level | ormal at 10% Significance Level |
| 65 Note GOF tests may be unreliable for small sample sizes | |
| 66 67 Lognormal Statistics | |
| 68 Minimum of Logged Data 4.543 | Mean of logged Data 4.821 |
| Maximum of Logged Data 5.231 | SD of logged Data 0.235 |
| 71 Assuming Lognormal Distribution | |
| 72 95% H-UCL 149.9 | 90% Chebyshev (MVUE) UCL 157.1 |
| 74 99% Chebyshey (MVUF) UCL 226.5 | 7.5% Chebyshev (MVUE) UCL 189.5 |
| 75 | |
| 76 Nonparametric Distribution Free UCL Statistics 77 Data appear to follow a Discernible Distribution | |
| 78 | |
| 79 Nonparametric Distribution Free UCLs | 050/ DOA D |
| 80 95% CLT UCL 144.8 81 95% Standard Bootstrap UCL 143.7 | 95% BCA Bootstrap UCL 148.3 95% Bootstrap-t UCL 161.6 |
| | 95% Percentile Bootstrap UCL 145.4 |

| | Α | В | С | D | E | F | G | Н | I | J | K | L | |
|----|----|--------------|----------------|----------------|---------------|----------------|-----------------------------------|----------------|----------------|---------------|------------------|------|--|
| 83 | | | 90% Ch | ebyshev(Me | an, Sd) UCL | 159.2 | 95% Chebyshev(Mean, Sd) UCL 173.7 | | | | | | |
| 84 | | | 97.5% Ch | ebyshev(Me | an, Sd) UCL | 193.8 | 99% Chebyshev(Mean, Sd) UCL 233.2 | | | | | | |
| 85 | 5 | | | | | | | | | | | | |
| 86 | | | | | | | | | | | | | |
| 87 | | | | 95% Stu | dent's-t UCL | 147.1 | | | | | | | |
| 88 | | | | | | • | • | | | | | | |
| 89 | 1 | Note: Sugges | stions regard | ing the selec | tion of a 95% | 6 UCL are pr | ovided to hel | p the user to | select the m | ost appropria | ate 95% UCL | | |
| 90 | | Recom | mendations | are based up | on data size | , data distrib | ution, and sk | ewness usin | g results fror | n simulation | studies. | | |
| 91 | Но | wever, simul | lations result | s will not cov | er all Real V | Vorld data se | ts; for addition | nal insight th | ne user may | want to cons | ult a statistici | ian. | |
| 92 | | | | | | | | | | | | | |

| | A B C D E | F | G H I J K | L | | | | | | | | |
|----------|---|-------------------------------|---|----------------|--|--|--|--|--|--|--|--|
| 2 | UCL Statis | stics for Unc | ensored Full Data Sets | | | | | | | | | |
| 3 | User Selected Options | 4.10.00 DM | | | | | | | | | | |
| 5 | Date/Time of Computation ProUCL 5.2 10/31/2024 ProUCL Input.xls | 4:12:20 PM | | | | | | | | | | |
| 6 | Full Precision OFF | | | | | | | | | | | |
| 7 | Confidence Coefficient 95% Number of Bootstrap Operations 2000 | | | | | | | | | | | |
| 9 | Number of Booletrap Operations (2000 | | | | | | | | | | | |
| 10 11 | CEM-WRC-0.5-2 | | | | | | | | | | | |
| 12 | OLIW-WYNO-0.5-2 | | | | | | | | | | | |
| 13 14 | Total Number of Observations | | Statistics Number of Distinct Observations | 4 | | | | | | | | |
| 15 | Total Nulliber of Observations | 4 | Number of Missing Observations | 0 | | | | | | | | |
| 16 17 | Minimum | | Mean | 60.25 60.5 | | | | | | | | |
| 18 | Maximum SD | | Median Std. Error of Mean | 3.568 | | | | | | | | |
| 19 | Coefficient of Variation | | | -0.142 | | | | | | | | |
| 20 21 | Note: Sample size is small (e.g., <10), if data: | are collected | using incremental sampling methodology (ISM) approach, | | | | | | | | | |
| 22 | refer also to ITRC Tech Reg Guide | on ISM (ITR | C 2020 and ITRC 2012) for additional guidance, | | | | | | | | | |
| 23 24 | | | he Chebyshev UCL for small sample sizes (n < 7). in gross overestimates of the mean. | | | | | | | | | |
| 25 | | | e for a discussion of the Chebyshev UCL. | | | | | | | | | |
| 26 27 | | Normal | GOF Test | | | | | | | | | |
| 28 | Shapiro Wilk Test Statistic | | Shapiro Wilk GOF Test | | | | | | | | | |
| 29 30 | 1% Shapiro Wilk Critical Value | | Data appear Normal at 1% Significance Level | | | | | | | | | |
| 31 | Lilliefors Test Statistic 1% Lilliefors Critical Value | | Lilliefors GOF Test Data appear Normal at 1% Significance Level | | | | | | | | | |
| 32 | Data appe | ar Normal at | 1% Significance Level | | | | | | | | | |
| 33 34 | Note GOF tests | liable for small sample sizes | | | | | | | | | | |
| 35 | Assuming Normal Distribution 95% Normal LICI 95% Normal LICI 95% Normal LICI | | | | | | | | | | | |
| 36 37 | 95% Normal UCL 95% Student's-t UCL | | 95% UCLs (Adjusted for Skewness) 95% Adjusted-CLT UCL (Chen-1995) | 65.85 | | | | | | | | |
| 38 | 95% Student s-t UCL | 68.65 | 95% Adjusted-CLT UCL (Chen-1995) 95% Modified-t UCL (Johnson-1978) | 68.6 | | | | | | | | |
| 39 40 | | | | | | | | | | | | |
| 41 | A-D Test Statistic | | GOF Test Anderson-Darling Gamma GOF Test | | | | | | | | | |
| 42 | 5% A-D Critical Value | 0.656 | Detected data appear Gamma Distributed at 5% Significance | Level | | | | | | | | |
| 43 44 | K-S Test Statistic 5% K-S Critical Value | | Kolmogorov-Smirnov Gamma GOF Test Detected data appear Gamma Distributed at 5% Significance | Level | | | | | | | | |
| 45 | Detected data appear | r Gamma Di | stributed at 5% Significance Level | | | | | | | | | |
| 46 47 | Note GOF tests | may be unre | eliable for small sample sizes | | | | | | | | | |
| 48 | | | Statistics | | | | | | | | | |
| 49 50 | k hat (MLE) Theta hat (MLE) | | k star (bias corrected MLE) Theta star (bias corrected MLE) | 23.66 2.547 | | | | | | | | |
| 51 | nu hat (MLE) | 751.6 | nu star (bias corrected) | 2.547 189.2 | | | | | | | | |
| 52 53 | MLE Mean (bias corrected) | | MLE Sd (bias corrected) | 12.39 | | | | | | | | |
| 54 | Adjusted Level of Significance | N/A | | 158.4 N/A | | | | | | | | |
| 55 | | ! | | | | | | | | | | |
| 56 57 | As: 95% Approximate Gamma UCL | | ma Distribution 95% Adjusted Gamma UCL | N/A | | | | | | | | |
| 58 | 55707 pproximate dumina OCE | | | | | | | | | | | |
| 59 60 | Shapiro Wilk Test Statistic | | GOF Test Shapiro Wilk Lognormal GOF Test | | | | | | | | | |
| 61 | 10% Shapiro Wilk Critical Value | 0.792 | Data appear Lognormal at 10% Significance Level | | | | | | | | | |
| 62 63 | Lilliefors Test Statistic | | Lilliefors Lognormal GOF Test | | | | | | | | | |
| 64 | 10% Lilliefors Critical Value Data appear | Lognormal a | Data appear Lognormal at 10% Significance Level at 10% Significance Level | | | | | | | | | |
| 65 66 | Note GOF tests | may be unre | liable for small sample sizes | | | | | | | | | |
| 66 67 | | Lognorma | I Statistics | | | | | | | | | |
| 68 | Minimum of Logged Data | 3.951 | Mean of logged Data | 4.093 | | | | | | | | |
| 69 70 | Maximum of Logged Data | 4.22 | SD of logged Data | 0.12 | | | | | | | | |
| 71 | | | rmal Distribution | | | | | | | | | |
| 72 73 | 95% H-UCL | 70.57 | 90% Chebyshev (MVUE) UCL | 71.05 | | | | | | | | |
| 74 | 95% Chebyshev (MVUE) UCL 99% Chebyshev (MVUE) UCL | 75.94 96.07 | 97.5% Chebyshev (MVUE) UCL | 82.73 | | | | | | | | |
| 75 | | | | | | | | | | | | |
| 76 77 | | | tion Free UCL Statistics Discernible Distribution | | | | | | | | | |
| 78 | | | | | | | | | | | | |
| 79 80 | | | tribution Free UCLs | NI/A | | | | | | | | |
| 81 | 95% CLT UCL 95% Standard Bootstrap UCL | | | N/A N/A | | | | | | | | |
| 82 | 95% Hall's Bootstrap UCL | | | N/A | | | | | | | | |

| | Α | В | С | D | Е | F | G | Н | I | J | K | L | | |
|----|---|--|----------------|----------------|---------------|----------------|------------------|----------------|----------------|--------------|-----------------|-------|--|--|
| 83 | | | 90% Ch | ebyshev(Me | an, Sd) UCL | 70.95 | | | 95% Ch | ebyshev(Me | an, Sd) UCL | 75.8 | | |
| 84 | | | 97.5% Ch | ebyshev(Me | an, Sd) UCL | 82.53 | | | 99% Ch | ebyshev(Me | an, Sd) UCL | 95.75 | | |
| 85 | | | | | | | | | | | | | | |
| 86 | | | | | | Suggested | UCL to Use | | | | | | | |
| 87 | | 95% Student's-t UCL 68.65 | | | | | | | | | | | | |
| 88 | Recommended UCL exceeds the maximum observation | | | | | | | | | | | | | |
| 89 | | | | | | | | | | | | | | |
| 90 | | Note: Sugges | stions regard | ing the selec | tion of a 95% | 6 UCL are pr | ovided to hel | p the user to | select the m | ost appropri | ate 95% UCL | | | |
| 91 | | Recom | mendations | are based up | on data size | , data distrib | ution, and sk | ewness usin | g results fror | m simulation | studies. | | | |
| 92 | Но | wever, simul | lations result | s will not cov | er all Real V | Vorld data se | ts; for addition | nal insight th | ne user may | want to cons | ult a statistic | ian. | | |
| 93 | | | | | | | | | | | | | | |
| 94 | | Note: For | highly negat | ively-skewe | d data, confi | dence limits | (e.g., Chen, | Johnson, Lo | ognormal, ar | nd Gamma) ı | may not be | | | |
| 95 | | reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets. | | | | | | | | | | | | |
| 96 | | | | | | | | | | | | | | |

| 178 | | A B C D E | F | G H I J K | L | | | | | | | | |
|--|----------|--|----------------|---|--------|--|--|--|--|--|--|--|--|
| Date/Time of Constation PropUCL, 52 1931/2024 477-04 PM | 2 | UCL Statis | stics for Unc | ensored Full Data Sets | | | | | | | | | |
| From File Production OFF | | | 4.07.04.D14 | | | | | | | | | | |
| The Character 1975 | | | 4:07:04 PIVI | | | | | | | | | | |
| Number of Bootstrap Operations | | Full Precision OFF | | | | | | | | | | | |
| Color | | | | | | | | | | | | | |
| Total Number of Observations | 9 | Number of Bootstrap Operations (2000 | | | | | | | | | | | |
| Total Number of Observations | | CEM-WPD-0 5-1 | | | | | | | | | | | |
| Total Number of Observations 4 | 12 | SCINITALD-0:3-1 | | | | | | | | | | | |
| Minimum S6 | | Total Number of Observations | | | 4 | | | | | | | | |
| Maximum 87 | 15 | Total Number of Observations | 4 | | | | | | | | | | |
| 18 | | | | | | | | | | | | | |
| Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach, refer also to ITRC Tech Reg Quide on ISM (ITRC 2012) for additional guidance, but note that ITRC may recommend the -UCL or the Chebyshev UCL for small sample sizes (n < 7). | 18 | | | | 6.958 | | | | | | | | |
| Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (15M) approach, refer also to ITRG Tech Reg Guide on ISM (ITRC 2020 and ITRC 2020 a | | Coefficient of Variation | | | 1.781 | | | | | | | | |
| The content of the | | Note: Sample size is small (e.g., <10), if data: | are collected | using incremental sampling methodology (ISM) approach. | | | | | | | | | |
| The Chebyshev UCL often results in gross overestimates of the mean. Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL. Normal GOF Test Shapiro Wilk Test Statistic Normal GOF Test Shapiro Wilk Critical Value 0.887 Data appear Normal at 1% Significance Level 11% Shapiro Wilk Critical Value 0.887 Data appear Normal at 1% Significance Level 11% Shapiro Wilk Critical Value 137 14% Lillefors Test Statistic 0.377 Data appear Normal at 1% Significance Level 138 14 Data appear Normal at 1% Significance Level 139 14 Data appear Normal at 1% Significance Level 140 150 151 152 153 154 155 155 155 155 155 155 155 155 155 | 22 | refer also to ITRC Tech Reg Guide | on ISM (ITR | C 2020 and ITRC 2012) for additional guidance, | | | | | | | | | |
| Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL Normal GOF Test | 23 | | | | | | | | | | | | |
| Normal GOF Test | 25 | | | | | | | | | | | | |
| Shapiro Wilk Test Statistic 0.793 | | | Normal C | POE Toet | | | | | | | | | |
| 1% Shapiro Wilk Critical Value 0.687 Data appear Normal at 1% Significance Level | 28 | Shapiro Wilk Test Statistic | | | | | | | | | | | |
| 132 | | | | | | | | | | | | | |
| Data appear Normal at 1% Significance Level | 31 | | | | | | | | | | | | |
| Assuming Normal Distribution 95% UCLs (Adjusted for Skewness) 35 | 32 | Data appe | ar Normal at | 1% Significance Level | | | | | | | | | |
| Assuming Normal Distribution 95% Normal UCL 82.88 95% Adjusted for Skewness 95% Normal UCL 82.88 95% Adjusted-CLT UCL (Chen-1995) 84.57 83.91 95% Adjusted-CLT UCL (Chen-1995) 84.57 83.91 95% Modified-t UCL (Johnson-1978) 83.91 84.57 83.91 84.57 | | 4 | | | | | | | | | | | |
| Second Color | 35 | | | | | | | | | | | | |
| Samma GOF Test | | 95% Normal UCL | | 95% UCLs (Adjusted for Skewness) | 94 57 | | | | | | | | |
| Camma GOF Test | 38 | 95% Students-t OCL | 02.00 | | | | | | | | | | |
| A-D Test Statistic | | | | | | | | | | | | | |
| S% A-D Critical Value 0.657 Detected data appear Gamma Distributed at 5% Significance Level | | A-D Test Statistic | | | | | | | | | | | |
| 145 | 42 | 5% A-D Critical Value | 0.657 | Detected data appear Gamma Distributed at 5% Significance | Level | | | | | | | | |
| Detected data appear Gamma Distributed at 5% Significance Level | | | | | l evel | | | | | | | | |
| AF | 45 | Detected data appea | r Gamma Di | stributed at 5% Significance Level | LOVOI | | | | | | | | |
| Residence Resi | 46 | Note GOF tests | may be unre | eliable for small sample sizes | | | | | | | | | |
| Theta hat (MLE) | 48 | | | Statistics | | | | | | | | | |
| The color of the | | | | | 8.606 | | | | | | | | |
| MLE Mean (bias corrected) 66.5 MLE Sd (bias corrected) 22.67 | 51 | 1 / | | | 68.85 | | | | | | | | |
| 54 Adjusted Level of Significance N/A Adjusted Chi Square Value N/A 55 Assuming Gamma Distribution 56 Assuming Gamma Distribution 95% Adjusted Gamma UCL N/A 57 95% Approximate Gamma UCL 90.22 95% Adjusted Gamma UCL N/A 58 Lognormal GOF Test 59 Lognormal GOF Test 60 Shapiro Wilk Test Statistic 0.824 Shapiro Wilk Lognormal GOF Test 61 10% Shapiro Wilk Critical Value 0.792 Data appear Lognormal at 10% Significance Level 62 Lilliefors Test Statistic 0.362 Lilliliefors Lognormal GOF Test 63 10% Lilliefors Critical Value 0.362 Lilliliefors Lognormal at 10% Significance Level 64 Data appear Approximate Lognormal at 10% Significance Level Significance Level 65 Note GOF tests may be unreliable for small sample sizes 66 Note GOF tests may be unreliable for small sample sizes 68 Minimum of Logged Data 4.025 Mean of logged Data 4.182 69 Maximum of Logged Data 4.866 SD of logged Data 9.194 <th>52</th> <th></th> <th>66.5</th> <th>MLE Sd (bias corrected)</th> <th>22.67</th> | 52 | | 66.5 | MLE Sd (bias corrected) | 22.67 | | | | | | | | |
| Assuming Gamma Distribution 95% Approximate Gamma UCL 90.22 95% Adjusted Gamma UCL N/A 95% Approximate Gamma UCL 90.22 95% Adjusted Gamma UCL N/A 58 | ეპ 54 | Adjusted Level of Significance | N/A | | | | | | | | | | |
| S7 | 55 | | | | | | | | | | | | |
| Saming Lognormal GOF Test | | | | | N/A | | | | | | | | |
| 60 Shapiro Wilk Test Statistic 0.824 Shapiro Wilk Lognormal GOF Test 61 10% Shapiro Wilk Critical Value 0.792 Data appear Lognormal at 10% Significance Level 62 Lilliefors Test Statistic 0.362 Lilliefors Lognormal GOF Test 63 10% Lilliefors Critical Value 0.346 Data Not Lognormal at 10% Significance Level 64 Data appear Approximate Lognormal at 10% Significance Level 65 Note GOF tests may be unreliable for small sample sizes 66 Lognormal Statistics 68 Minimum of Logged Data 4.025 Mean of logged Data 4.18 69 Maximum of Logged Data 4.466 SD of logged Data 0.19 70 Assuming Lognormal Distribution 72 95% H-UCL 87.85 90% Chebyshev (MVUE) UCL 85.76 73 95% Chebyshev (MVUE) UCL 94.5 97.5% Chebyshev (MVUE) UCL 106.6 74 99% Chebyshev (MVUE) UCL 130.5 97.5% Chebyshev (MVUE) UCL 106.6 76 Nonparametric Distribution Free UCL Statistics 77 Data appear to follow a D | 58 | 93 % Approximate damina OCL | | | 14// | | | | | | | | |
| 61 10% Shapiro Wilk Critical Value 0.792 Data appear Lognormal at 10% Significance Level 62 Lilliefors Test Statistic 0.362 Lilliefors Lognormal GOF Test 63 10% Lilliefors Critical Value 0.346 Data Not Lognormal at 10% Significance Level 64 Data appear Approximate Lognormal at 10% Significance Level 65 Note GOF tests may be unreliable for small sample sizes 66 Lognormal Statistics 68 Minimum of Logged Data 4.025 69 Maximum of Logged Data 4.466 70 SD of logged Data 0.19 71 Assuming Lognormal Distribution 72 95% H-UCL 87.85 90% Chebyshev (MVUE) UCL 85.76 73 95% Chebyshev (MVUE) UCL 94.5 97.5% Chebyshev (MVUE) UCL 106.6 74 99% Chebyshev (MVUE) UCL 130.5 97.5% Chebyshev (MVUE) UCL 106.6 76 Nonparametric Distribution Free UCL Statistics 77 Data appear to follow a Discernible Distribution | | Chanira Wills Took Chadishia | | | | | | | | | | | |
| 62 Lilliefors Test Statistic 0.362 Lilliefors Lognormal GOF Test 63 10% Lilliefors Critical Value 0.346 Data Not Lognormal at 10% Significance Level 64 Data appear Approximate Lognormal at 10% Significance Level 65 Note GOF tests may be unreliable for small sample sizes 66 Lognormal Statistics 68 Minimum of Logged Data 4.025 Mean of logged Data 4.182 69 Maximum of Logged Data 4.466 SD of logged Data 0.194 70 Assuming Lognormal Distribution 72 95% H-UCL 87.85 90% Chebyshev (MVUE) UCL 85.76 73 95% Chebyshev (MVUE) UCL 94.5 97.5% Chebyshev (MVUE) UCL 106.6 74 99% Chebyshev (MVUE) UCL 130.5 Nonparametric Distribution Free UCL Statistics 76 Nonparametric Distribution Free UCL Statistics 77 Data appear to follow a Discernible Distribution | 61 | | | | | | | | | | | | |
| Data appear Approximate Lognormal at 10% Significance Level 65 Note GOF tests may be unreliable for small sample sizes 66 Lognormal Statistics 68 Minimum of Logged Data 4.025 Mean of logged Data 4.182 69 Maximum of Logged Data 4.466 SD of logged Data 0.194 70 Assuming Lognormal Distribution 72 95% H-UCL 87.85 90% Chebyshev (MVUE) UCL 85.76 73 95% Chebyshev (MVUE) UCL 94.5 97.5% Chebyshev (MVUE) UCL 106.6 75 Nonparametric Distribution Free UCL Statistics 76 Nonparametric Distribution Free UCL Statistics 77 Data appear to follow a Discernible Distribution | | Lilliefors Test Statistic | 0.362 | Lilliefors Lognormal GOF Test | | | | | | | | | |
| Note GOF tests may be unreliable for small sample sizes | 64 | | | | | | | | | | | | |
| Lognormal Statistics 68 Minimum of Logged Data 4.025 Mean of logged Data 4.182 69 Maximum of Logged Data 4.466 SD of logged Data 0.194 70 71 Assuming Lognormal Distribution 72 95% H-UCL 87.85 90% Chebyshev (MVUE) UCL 85.76 73 95% Chebyshev (MVUE) UCL 94.5 97.5% Chebyshev (MVUE) UCL 106.6 74 99% Chebyshev (MVUE) UCL 130.5 130.5 76 Nonparametric Distribution Free UCL Statistics 77 Data appear to follow a Discernible Distribution | 65 | | | | | | | | | | | | |
| 68 Minimum of Logged Data 4.025 Mean of logged Data 4.182 69 Maximum of Logged Data 4.466 SD of logged Data 0.194 70 71 Assuming Lognormal Distribution 72 95% H-UCL 87.85 90% Chebyshev (MVUE) UCL 85.76 73 95% Chebyshev (MVUE) UCL 94.5 97.5% Chebyshev (MVUE) UCL 106.6 74 99% Chebyshev (MVUE) UCL 130.5 130.5 Nonparametric Distribution Free UCL Statistics 76 Nonparametric Distribution Free UCL Statistics Data appear to follow a Discernible Distribution | | | Lognormo | I Statistics | | | | | | | | | |
| 69 Maximum of Logged Data 4.466 SD of logged Data 0.194 70 71 Assuming Lognormal Distribution 72 95% H-UCL 87.85 90% Chebyshev (MVUE) UCL 85.76 73 95% Chebyshev (MVUE) UCL 94.5 97.5% Chebyshev (MVUE) UCL 106.6 74 99% Chebyshev (MVUE) UCL 130.5 75 76 Nonparametric Distribution Free UCL Statistics 77 Data appear to follow a Discernible Distribution | 68 | | 4.025 | Mean of logged Data | 4.182 | | | | | | | | |
| Assuming Lognormal Distribution 72 95% H-UCL 87.85 90% Chebyshev (MVUE) UCL 85.76 73 95% Chebyshev (MVUE) UCL 94.5 97.5% Chebyshev (MVUE) UCL 106.6 74 99% Chebyshev (MVUE) UCL 130.5 | | Maximum of Logged Data | 4.466 | SD of logged Data | 0.194 | | | | | | | | |
| 72 95% H-UCL 87.85 90% Chebyshev (MVUE) UCL 85.76 73 95% Chebyshev (MVUE) UCL 94.5 97.5% Chebyshev (MVUE) UCL 106.6 74 99% Chebyshev (MVUE) UCL 130.5 130. | 71 | Ass | uming Loand | ormal Distribution | | | | | | | | | |
| 74 99% Chebyshev (MVUE) UCL 130.5 75 76 Nonparametric Distribution Free UCL Statistics 77 Data appear to follow a Discernible Distribution | 72 | 95% H-UCL | 87.85 | 90% Chebyshev (MVUE) UCL | 85.76 | | | | | | | | |
| 75 76 Nonparametric Distribution Free UCL Statistics 77 Data appear to follow a Discernible Distribution | 74 | | | 97.5% Chebyshev (MVUE) UCL | 106.6 | | | | | | | | |
| 77 Data appear to follow a Discernible Distribution | 75 | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| <u> </u> | 78 | | ai to ioliow a | DISCOLLING DISTUNCTION | | | | | | | | | |
| 79 Nonparametric Distribution Free UCLs | 79 | | | | NI/A | | | | | | | | |
| 80 95% CLT UCL 77.95 95% BCA Bootstrap UCL N/A 81 95% Standard Bootstrap UCL N/A 95% Bootstrap t UCL N/A | | | | | | | | | | | | | |
| 82 95% Hall's Bootstrap UCL N/A 95% Percentile Bootstrap UCL N/A | | | | | | | | | | | | | |

| | Α | В | С | D | E | F | G | Н | I | J | K | L | |
|----|--|--------------|---------------|---------------|---------------|------------|-----------------------------------|---------------|--------------|---------------|-------------|-------|--|
| 83 | | | 90% Ch | ebyshev(Me | an, Sd) UCL | 87.37 | 95% Chebyshev(Mean, Sd) UCL 96.83 | | | | | | |
| 84 | | | 97.5% Ch | ebyshev(Me | an, Sd) UCL | 110 | | | 99% Ch | ebyshev(Me | an, Sd) UCL | 135.7 | |
| 85 | | | | | | | | | | | | | |
| 86 | Suggested UCL to Use | | | | | | | | | | | | |
| 87 | 95% Student's-t UCL 82.88 | | | | | | | | | | | | |
| 88 | | | | | | | | | | | | | |
| 89 | 1 | Note: Sugges | stions regard | ing the selec | tion of a 95% | UCL are pr | ovided to hel | p the user to | select the m | nost appropri | ate 95% UCL | | |
| 90 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. Recommendations are based upon data size, data distribution, and skewness using results from simulation studies. | | | | | | | | | | | | |
| 91 | However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician. | | | | | | | | | | | | |
| 92 | | | | | | | | | | | | | |

| 4 | A B C D E | F | G H I J K | L | | | | | | | | |
|----------|--|-----------------------|--|----------------|--|--|--|--|--|--|--|--|
| 2 | UCL Statis | tics for Unc | ensored Full Data Sets | | | | | | | | | |
| 3 | User Selected Options | | | | | | | | | | | |
| 4 5 | Date/Time of Computation ProUCL 5.2 10/28/2024 3 From File WorkSheet.xls | 3:34:54 PM | | | | | | | | | | |
| 6 | Full Precision OFF | | | | | | | | | | | |
| 7 | Confidence Coefficient 95% Number of Bootstrap Operations 2000 | | | | | | | | | | | |
| 9 | Number of Bootstrap Operations 2000 | | | | | | | | | | | |
| 10 | OM Discour Octalle | | | | | | | | | | | |
| 12 | CM-Placer Spoils | | | | | | | | | | | |
| 13 | | | Statistics | | | | | | | | | |
| 14 15 | Total Number of Observations | 4 | Number of Distinct Observations Number of Missing Observations | 0 | | | | | | | | |
| 16 | Minimum | 25 | Mean | 32.5 | | | | | | | | |
| 17 18 | Maximum SD | 36 5.196 | Median Std. Error of Mean | 34.5 2.598 | | | | | | | | |
| 19 | Coefficient of Variation | 0.16 | | -1.597 | | | | | | | | |
| 20 | N. O. I. I. II. (40.161) | | | | | | | | | | | |
| 21 22 | | | l using incremental sampling methodology (ISM) approach, C 2020 and ITRC 2012) for additional guidance, | | | | | | | | | |
| 23 | but note that ITRC may recommend the | e t-UCL or t | he Chebyshev UCL for small sample sizes (n < 7). | | | | | | | | | |
| 24 25 | | | in gross overestimates of the mean. e for a discussion of the Chebyshev UCL. | | | | | | | | | |
| 26 | Neiel to the F100CL 3.2 Tec | illical Guid | e for a discussion of the Chebyshev OCL. | | | | | | | | | |
| 27 28 | Objection MERC To be On the City | | GOF Test | | | | | | | | | |
| 29 | Shapiro Wilk Test Statistic 1% Shapiro Wilk Critical Value | 0.802 0.687 | Shapiro Wilk GOF Test Data appear Normal at 1% Significance Level | | | | | | | | | |
| 30 | Lilliefors Test Statistic | 0.288 | Lilliefors GOF Test | | | | | | | | | |
| 31 32 | 1% Lilliefors Critical Value | | Data appear Normal at 1% Significance Level 1 1% Significance Level | | | | | | | | | |
| 33 | | | eliable for small sample sizes | | | | | | | | | |
| 34 35 | Assuming Normal Distribution | | | | | | | | | | | |
| 36 | 95% Normal UCL | suming Nori | 95% UCLs (Adjusted for Skewness) | | | | | | | | | |
| 37 | 95% Student's-t UCL | 38.61 | 95% Adjusted-CLT UCL (Chen-1995) | 34.56 | | | | | | | | |
| 38 39 | | | 95% Modified-t UCL (Johnson-1978) | 38.27 | | | | | | | | |
| 40 | Gamma GOF Test | | | | | | | | | | | |
| 41 42 | A-D Test Statistic 5% A-D Critical Value | 0.57 0.656 | Anderson-Darling Gamma GOF Test Detected data appear Gamma Distributed at 5% Significance | Lovol | | | | | | | | |
| 43 | K-S Test Statistic | 0.030 | Kolmogorov-Smirnov Gamma GOF Test | | | | | | | | | |
| 44 45 | 5% K-S Critical Value | 0.394 | Detected data appear Gamma Distributed at 5% Significance | Level | | | | | | | | |
| 46 | Note GOF tests | may be unre | stributed at 5% Significance Level | | | | | | | | | |
| 47 | | - | | | | | | | | | | |
| 48 49 | k hat (MLE) | <u>Gamma</u> 47.18 | Statistics k star (bias corrected MLE) | 11.96 | | | | | | | | |
| 50 | Theta hat (MLE) | 0.689 | Theta star (bias corrected MLE) | 2.717 | | | | | | | | |
| 51 52 | nu hat (MLE) MLE Mean (bias corrected) | 377.5 32.5 | nu star (bias corrected) MLE Sd (bias corrected) | 95.7 9.397 | | | | | | | | |
| 53 | IVILE Mean (bias corrected) | 32.3 | Approximate Chi Square Value (0.05) | 74.13 | | | | | | | | |
| 54 55 | Adjusted Level of Significance | N/A | | N/A | | | | | | | | |
| 56 | Ass | sumina Gam | ıma Distribution | | | | | | | | | |
| 57 | 95% Approximate Gamma UCL | | | N/A | | | | | | | | |
| 58 59 | | Lognorma | GOF Test | | | | | | | | | |
| 60 | Shapiro Wilk Test Statistic | 0.785 | Shapiro Wilk Lognormal GOF Test | | | | | | | | | |
| 61 62 | 10% Shapiro Wilk Critical Value Lilliefors Test Statistic | 0.792 0.31 | Data Not Lognormal at 10% Significance Level Lilliefors Lognormal GOF Test | | | | | | | | | |
| 63 | 10% Lilliefors Critical Value | 0.346 | Data appear Lognormal at 10% Significance Level | | | | | | | | | |
| 64 65 | Data appear Approx | | ormal at 10% Significance Level | | | | | | | | | |
| 66 | Note GOF tests I | may be unre | eliable for small sample sizes | | | | | | | | | |
| 67 | | | Statistics | | | | | | | | | |
| 68 69 | Minimum of Logged Data Maximum of Logged Data | 3.219 3.584 | Mean of logged Data SD of logged Data | 3.471 0.173 | | | | | | | | |
| 70 | | | | 0.175 | | | | | | | | |
| 71 72 | | | ormal Distribution | 40.02 | | | | | | | | |
| 73 | 95% H-UCL 95% Chebyshev (MVUE) UCL | 41.43 44.73 | 90% Chebyshev (MVUE) UCL 97.5% Chebyshev (MVUE) UCL | 40.92 50.02 | | | | | | | | |
| 74 | 99% Chebyshev (MVUE) UCL | 60.4 | | | | | | | | | | |
| 75 76 | Nonnarama | tric Dietribu | tion Free UCL Statistics | | | | | | | | | |
| 77 | | | Discernible Distribution | | | | | | | | | |
| 78 79 | | | | | | | | | | | | |
| 80 | Nonpar 95% CLT UCL | 36.77 | tribution Free UCLs 95% BCA Bootstrap UCL | N/A | | | | | | | | |
| 81 | 95% Standard Bootstrap UCL | N/A | 95% Bootstrap-t UCL | N/A | | | | | | | | |
| 82 | 95% Hall's Bootstrap UCL | N/A | 95% Percentile Bootstrap UCL | N/A | | | | | | | | |

| | Α | В | С | D | E | F | G | Н | I | J | K | L | | |
|----|---|--------------|----------------|----------------|---------------|----------------|------------------|-----------------------------------|----------------|--------------|-----------------|-------|--|--|
| 83 | | - | 90% Ch | ebyshev(Me | an, Sd) UCL | 40.29 | | 95% Chebyshev(Mean, Sd) UCL 43.82 | | | | | | |
| 84 | | | 97.5% Ch | ebyshev(Me | an, Sd) UCL | 48.72 | | | 99% Ch | ebyshev(Me | an, Sd) UCL | 58.35 | | |
| 85 | | | | | | | | | | | | | | |
| 86 | | | | | | Suggested | UCL to Use | | | | | | | |
| 87 | 95% Student's-t UCL 38.61 | | | | | | | | | | | | | |
| 88 | Recommended UCL exceeds the maximum observation | | | | | | | | | | | | | |
| 89 | | | | | | | | | | | | | | |
| 90 | 1 | Note: Sugges | stions regard | ling the selec | tion of a 95% | 6 UCL are pr | ovided to hel | p the user to | select the m | ost appropri | ate 95% UCL | | | |
| 91 | | Recom | mendations | are based up | on data size | , data distrib | ution, and sk | ewness usin | g results from | n simulation | studies. | | | |
| 92 | Ho | wever, simul | lations result | s will not cov | er all Real V | Vorld data se | ts; for addition | nal insight th | ne user may | want to cons | ult a statistic | ian. | | |
| 93 | | | | | | | | | | | | | | |
| 94 | | Note: For | highly negat | ively-skewe | d data, confi | dence limits | (e.g., Chen, | Johnson, Lo | ognormal, ar | nd Gamma) i | may not be | | | |
| 95 | | | reliable. | Chen's and J | lohnson's m | ethods provi | de adjustme | nts for posit | vely skewed | data sets. | | | | |
| 96 | | | | | | | | | | | | | | |

| | A B C D E | F | G H I J K | L | | | | | | | | |
|----------|--|--------------------------------|--|----------------|--|--|--|--|--|--|--|--|
| 2 | UCL Statis | tics for Unc | ensored Full Data Sets | | | | | | | | | |
| 3 | User Selected Options | 2.20.20 DM | | | | | | | | | | |
| 5 | Date/Time of Computation ProUCL 5.2 10/28/2024 3 From File WorkSheet.xls | 3:30:20 PIVI | | | | | | | | | | |
| 6 | Full Precision OFF | | | | | | | | | | | |
| 7 8 | Confidence Coefficient 95% Number of Bootstrap Operations 2000 | | | | | | | | | | | |
| 9 | Number of Boolettap Operations (2000 | | | | | | | | | | | |
| 10 11 | CM-WRA-0.5-1 | | | | | | | | | | | |
| 12 | ON-WA-0.5-1 | | | | | | | | | | | |
| 13 14 | Total Number of Observations | General 4 | Statistics Number of Distinct Observations | 3 | | | | | | | | |
| 15 | Total Number of Observations | 4 | Number of Missing Observations | 0 | | | | | | | | |
| 16 17 | Minimum | <u>5</u> 9 | Mean | 7 | | | | | | | | |
| 18 | Maximum SD | 1.633 | Median Std. Error of Mean | 0.816 | | | | | | | | |
| 19 | Coefficient of Variation | 0.233 | Skewness | 0 | | | | | | | | |
| 20 21 | Note: Sample size is small (e.g., <10), if data a | re collected | I using incremental sampling methodology (ISM) approach, | | | | | | | | | |
| 22 | refer also to ITRC Tech Reg Guide of | on ISM (ITR | C 2020 and ITRC 2012) for additional guidance, | | | | | | | | | |
| 23 24 | | | the Chebyshev UCL for small sample sizes (n < 7). in gross overestimates of the mean. | | | | | | | | | |
| 25 | | | e for a discussion of the Chebyshev UCL. | | | | | | | | | |
| 26 27 | | Normal C | GOF Test | | | | | | | | | |
| 28 | Shapiro Wilk Test Statistic | 0.944 | Shapiro Wilk GOF Test | | | | | | | | | |
| 29 30 | 1% Shapiro Wilk Critical Value | 0.687 | Data appear Normal at 1% Significance Level | | | | | | | | | |
| 31 | Lilliefors Test Statistic 1% Lilliefors Critical Value | 0.25 0.413 | Lilliefors GOF Test Data appear Normal at 1% Significance Level | | | | | | | | | |
| 32 | Data appea | ar Normal at | 1% Significance Level | | | | | | | | | |
| 33 34 | Note GOF tests | eliable for small sample sizes | | | | | | | | | | |
| 35 | Assuming Normal Distribution 95% Normal LICI 95% LICI's (Adjusted for Skewness) | | | | | | | | | | | |
| 36 37 | 95% Normal UCL 95% Student's-t UCL | 8.922 | 95% UCLs (Adjusted for Skewness) 95% Adjusted-CLT UCL (Chen-1995) | 8.343 | | | | | | | | |
| 38 | 93% Students-t OCL | 0.922 | 95% Adjusted-CET OCE (Chen-1995) 95% Modified-t UCL (Johnson-1978) | 8.922 | | | | | | | | |
| 39 40 | | | | | | | | | | | | |
| 41 | A-D Test Statistic | 0.338 | GOF Test Anderson-Darling Gamma GOF Test | | | | | | | | | |
| 42 | 5% A-D Critical Value | 0.657 | Detected data appear Gamma Distributed at 5% Significance | e Level | | | | | | | | |
| 43 44 | K-S Test Statistic 5% K-S Critical Value | 0.277 0.394 | Kolmogorov-Smirnov Gamma GOF Test Detected data appear Gamma Distributed at 5% Significance | a Level | | | | | | | | |
| 45 | Detected data appear | Gamma Di | stributed at 5% Significance Level |) LOVOI | | | | | | | | |
| 46 47 | Note GOF tests | may be unre | eliable for small sample sizes | | | | | | | | | |
| 48 | | Gamma | Statistics | | | | | | | | | |
| 49 50 | k hat (MLE) | 23.65 | k star (bias corrected MLE) | 6.079 | | | | | | | | |
| 51 | Theta hat (MLE) nu hat (MLE) | 0.296 189.2 | Theta star (bias corrected MLE) nu star (bias corrected) | 1.151 48.64 | | | | | | | | |
| 52 | MLE Mean (bias corrected) | 7 | MLE Sd (bias corrected) | 2.839 | | | | | | | | |
| 53 54 | Adjusted Level of Significance | N/A | Approximate Chi Square Value (0.05) Adjusted Chi Square Value | 33.63 N/A | | | | | | | | |
| 55 | | | | | | | | | | | | |
| 56 57 | Ass 95% Approximate Gamma UCL | suming Gam 10.12 | ma Distribution 95% Adjusted Gamma UCL | N/A | | | | | | | | |
| 58 | 5076 Approximate damina OCE | | | | | | | | | | | |
| 59 60 | Shapiro Wilk Test Statistic | Lognorma 0.935 | I GOF Test Shapiro Wilk Lognormal GOF Test | | | | | | | | | |
| 61 | 10% Shapiro Wilk Critical Value | 0.792 | Data appear Lognormal at 10% Significance Level | | | | | | | | | |
| 62 63 | Lilliefors Test Statistic | 0.285 | Lilliefors Lognormal GOF Test | | | | | | | | | |
| 64 | 10% Lilliefors Critical Value Data appear | 0.346 Lognormal a | Data appear Lognormal at 10% Significance Level at 10% Significance Level | | | | | | | | | |
| 65 66 | | | eliable for small sample sizes | | | | | | | | | |
| 66 67 | | Lognorma | I Statistics | | | | | | | | | |
| 68 | Minimum of Logged Data | 1.609 | Mean of logged Data | 1.925 | | | | | | | | |
| 69 70 | Maximum of Logged Data | 2.197 | SD of logged Data | 0.241 | | | | | | | | |
| 71 | Assu | ıming Logno | ormal Distribution | | | | | | | | | |
| 72 73 | 95% H-UCL | 10.11 | 90% Chebyshev (MVUE) UCL | 9.526 | | | | | | | | |
| 74 | 95% Chebyshev (MVUE) UCL 99% Chebyshev (MVUE) UCL | 10.67 15.37 | 97.5% Chebyshev (MVUE) UCL | 12.25 | | | | | | | | |
| 75 | | | | | | | | | | | | |
| 76 77 | | | tion Free UCL Statistics Discernible Distribution | | | | | | | | | |
| 78 | | | | | | | | | | | | |
| 79 80 | | | tribution Free UCLs | NI/A | | | | | | | | |
| 81 | 95% CLT UCL 95% Standard Bootstrap UCL | 8.343 N/A | 95% BCA Bootstrap UCL 95% Bootstrap-t UCL | N/A N/A | | | | | | | | |
| 82 | 95% Hall's Bootstrap UCL | N/A | 95% Percentile Bootstrap UCL | N/A | | | | | | | | |

| | Α | В | С | D | E | F | G | Н | I | J | K | L | |
|----|--|--------------|---------------|---------------|---------------|------------|---------------|---------------|--------------|----------------|-------------|-------|--|
| 83 | | | 90% Ch | ebyshev(Me | an, Sd) UCL | 9.449 | | | 95% Ch | ebyshev(Me | an, Sd) UCL | 10.56 | |
| 84 | | | 97.5% Ch | ebyshev(Me | an, Sd) UCL | 12.1 | | | 99% Ch | ebyshev(Me | an, Sd) UCL | 15.12 | |
| 85 | | | | | | | | | | | | | |
| 86 | Suggested UCL to Use | | | | | | | | | | | | |
| 87 | 95% Student's-t UCL 8.922 | | | | | | | | | | | | |
| 88 | | | | | | | | | | | | | |
| 89 | 1 | Note: Sugges | stions regard | ing the selec | tion of a 95% | UCL are pr | ovided to hel | p the user to | select the m | nost appropria | ate 95% UCL | | |
| 90 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. Recommendations are based upon data size, data distribution, and skewness using results from simulation studies. | | | | | | | | | | | | |
| 91 | However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician. | | | | | | | | | | | | |
| 92 | | | | | | | | | | | | | |

| | A B C D E | F | G H I J K | L | | | | | | | | |
|----------|--|--------------------------------|--|----------------|--|--|--|--|--|--|--|--|
| 2 | UCL Statis | tics for Unc | ensored Full Data Sets | | | | | | | | | |
| 3 | User Selected Options | 0-20-40 DM | | | | | | | | | | |
| 5 | Date/Time of Computation ProUCL 5.2 10/28/2024 3 From File WorkSheet.xls | 3:32:42 PIVI | | | | | | | | | | |
| 6 | Full Precision OFF | | | | | | | | | | | |
| 7 8 | Confidence Coefficient 95% Number of Bootstrap Operations 2000 | | | | | | | | | | | |
| 9 | Number of Booleting Operations (2000 | | | | | | | | | | | |
| 10 11 | CM-WRA-0.5-2 | | | | | | | | | | | |
| 12 | ON-WIA-0.3-2 | | | | | | | | | | | |
| 13 14 | Total Number of Observations | General 4 | Statistics Number of Distinct Observations | 3 | | | | | | | | |
| 15 | Total Number of Observations | 4 | Number of Missing Observations | 0 | | | | | | | | |
| 16 17 | Minimum | 11 13 | Mean | 12 12 | | | | | | | | |
| 18 | Maximum SD | 0.816 | Median Std. Error of Mean | 0.408 | | | | | | | | |
| 19 | Coefficient of Variation | 0.068 | Skewness | 0 | | | | | | | | |
| 20 21 | Note: Sample size is small (e.g., <10), if data a | re collected | using incremental sampling methodology (ISM) approach, | | | | | | | | | |
| 22 | refer also to ITRC Tech Reg Guide of | on ISM (ITR | C 2020 and ITRC 2012) for additional guidance, | | | | | | | | | |
| 23 24 | | | he Chebyshev UCL for small sample sizes (n < 7). in gross overestimates of the mean. | | | | | | | | | |
| 25 | | | e for a discussion of the Chebyshev UCL. | | | | | | | | | |
| 26 27 | | Normal (| GOF Test | | | | | | | | | |
| 28 | Shapiro Wilk Test Statistic | 0.944 | Shapiro Wilk GOF Test | | | | | | | | | |
| 29 30 | 1% Shapiro Wilk Critical Value | 0.687 | Data appear Normal at 1% Significance Level | | | | | | | | | |
| 31 | Lilliefors Test Statistic 1% Lilliefors Critical Value | 0.25 0.413 | Lilliefors GOF Test Data appear Normal at 1% Significance Level | | | | | | | | | |
| 32 | Data appea | ar Normal at | 1% Significance Level | | | | | | | | | |
| 33 34 | Note GOF tests | eliable for small sample sizes | | | | | | | | | | |
| 35 | Assuming Normal Distribution | | | | | | | | | | | |
| 36 37 | 95% Normal UCL 95% Student's-t UCL | 12.96 | 95% UCLs (Adjusted for Skewness) | 12.67 | | | | | | | | |
| 38 | 93% Students-t OCL | 12.90 | 95% Adjusted-CET OCE (Chen-1995) 95% Modified-t UCL (Johnson-1978) | 12.07 | | | | | | | | |
| 39 40 | | | | | | | | | | | | |
| 41 | A-D Test Statistic | 0.331 | GOF Test Anderson-Darling Gamma GOF Test | | | | | | | | | |
| 42 | 5% A-D Critical Value | 0.657 | Detected data appear Gamma Distributed at 5% Significance | Level | | | | | | | | |
| 43 44 | K-S Test Statistic 5% K-S Critical Value | 0.258 0.394 | Kolmogorov-Smirnov Gamma GOF Test Detected data appear Gamma Distributed at 5% Significance | Level | | | | | | | | |
| 45 | Detected data appear | Gamma Di | stributed at 5% Significance Level | LCVCI | | | | | | | | |
| 46 47 | Note GOF tests | may be unre | eliable for small sample sizes | | | | | | | | | |
| 48 | | Gamma | Statistics | | | | | | | | | |
| 49 50 | k hat (MLE) | 287.2 | | 71.96 | | | | | | | | |
| 51 | Theta hat (MLE) nu hat (MLE) | 0.0418 2297 | Theta star (bias corrected MLE) nu star (bias corrected) 5 | 0.167 575.7 | | | | | | | | |
| 52 | MLE Mean (bias corrected) | 12 | MLE Sd (bias corrected) | 1.415 | | | | | | | | |
| 53 54 | Adjusted Level of Significance | N/A | | 521 N/A | | | | | | | | |
| 55 | | | | 1 | | | | | | | | |
| 56 57 | Ass 95% Approximate Gamma UCL | | ma Distribution 95% Adjusted Gamma UCL | N/A | | | | | | | | |
| 58 | ээ ло дургохинасе daniilid UCL | | | 11/7 | | | | | | | | |
| 59 60 | Chanira Willy Task Chaking | | GOF Test | | | | | | | | | |
| 61 | Shapiro Wilk Test Statistic 10% Shapiro Wilk Critical Value | 0.944 0.792 | Shapiro Wilk Lognormal GOF Test Data appear Lognormal at 10% Significance Level | | | | | | | | | |
| 62 63 | Lilliefors Test Statistic | 0.26 | Lilliefors Lognormal GOF Test | | | | | | | | | |
| 64 | 10% Lilliefors Critical Value Data appear | 0.346 Lognormal a | Data appear Lognormal at 10% Significance Level at 10% Significance Level | | | | | | | | | |
| 65 | Note GOF tests | may be unre | eliable for small sample sizes | | | | | | | | | |
| 66 67 | | Lognorma | I Statistics | | | | | | | | | |
| 68 | Minimum of Logged Data | 2.398 | Mean of logged Data | 2.483 | | | | | | | | |
| 69 70 | Maximum of Logged Data | 2.565 | SD of logged Data | 0.0682 | | | | | | | | |
| 71 | Assu | ıming Logno | ormal Distribution | | | | | | | | | |
| 72 73 | 95% H-UCL | N/A | 90% Chebyshev (MVUE) UCL | 13.23 | | | | | | | | |
| 74 | 95% Chebyshev (MVUE) UCL 99% Chebyshev (MVUE) UCL | 13.78 16.07 | 97.5% Chebyshev (MVUE) UCL | 14.56 | | | | | | | | |
| 75 | | | | | | | | | | | | |
| 76 77 | | | tion Free UCL Statistics Discernible Distribution | | | | | | | | | |
| 78 | | | | | | | | | | | | |
| 79 80 | Nonpar 95% CLT UCL | ametric Dis 12.67 | tribution Free UCLs 95% BCA Bootstrap UCL | N/A | | | | | | | | |
| 81 | 95% Standard Bootstrap UCL | 12.67 N/A | | N/A N/A | | | | | | | | |
| 82 | 95% Hall's Bootstrap UCL | N/A | | N/A | | | | | | | | |

| | Α | В | С | D | E | F | G | Н | I | J | K | L | | |
|----|---|--------------|---------------|---------------|---------------|--------------|---------------|-----------------------------------|--------------|---------------|-------------|-------|--|--|
| 83 | | | 90% Ch | ebyshev(Me | an, Sd) UCL | 13.22 | | 95% Chebyshev(Mean, Sd) UCL 13.78 | | | | | | |
| 84 | | | 97.5% Ch | ebyshev(Me | an, Sd) UCL | 14.55 | | | 99% Ch | ebyshev(Me | an, Sd) UCL | 16.06 | | |
| 85 | | | | | | | | | | | | | | |
| 86 | Suggested UCL to Use | | | | | | | | | | | | | |
| 87 | 95% Student's-t UCL 12.96 | | | | | | | | | | | | | |
| 88 | | | | | | | | | | | | | | |
| 89 | 1 | Note: Sugges | stions regard | ing the selec | tion of a 95% | 6 UCL are pr | ovided to hel | p the user to | select the m | ost appropria | ate 95% UCL | | | |
| 90 | | | | | | | | | | | | | | |
| 91 | However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician. | | | | | | | | | | | | | |
| 92 | | | | | | | | | | | | | | |

| | A B C D E | F | G H I J K | L | | | | | | | | |
|----------|--|---------------------|---|-----------------|--|--|--|--|--|--|--|--|
| 2 | UCL Statis | stics for Unc | ensored Full Data Sets | | | | | | | | | |
| 3 | User Selected Options | | | | | | | | | | | |
| 4 5 | Date/Time of Computation ProUCL 5.2 10/28/2024 From File WorkSheet.xls | 3:39:21 PM | | | | | | | | | | |
| 6 | Full Precision OFF | | | | | | | | | | | |
| 7 | Confidence Coefficient 95% Number of Bootstrap Operations 2000 | | | | | | | | | | | |
| 9 | Number of Bootstrap Operations 2000 | | | | | | | | | | | |
| 10 | OM WDD 4 | | | | | | | | | | | |
| 12 | CM-WRB-1 | | | | | | | | | | | |
| 13 | | | Statistics | | | | | | | | | |
| 14 15 | Total Number of Observations | 4 | Number of Distinct Observations Number of Missing Observations | 0 | | | | | | | | |
| 16 | Minimum | 5 | Mean | 8.5 | | | | | | | | |
| 17 18 | Maximum | | Median | 9 | | | | | | | | |
| 19 | SD Coefficient of Variation | | Std. Error of Mean Skewness | 1.323 -0.864 | | | | | | | | |
| 20 | | | | 0.001 | | | | | | | | |
| 21 | | | I using incremental sampling methodology (ISM) approach, C 2020 and ITRC 2012) for additional guidance, | | | | | | | | | |
| 23 | | | the Chebyshev UCL for small sample sizes (n < 7). | | | | | | | | | |
| 24 25 | The Chebyshev UCL o | often results | in gross overestimates of the mean. | | | | | | | | | |
| 26 | Refer to the ProUCL 5.2 Tec | <u>ennical Guid</u> | e for a discussion of the Chebyshev UCL. | | | | | | | | | |
| 27 | | | GOF Test | | | | | | | | | |
| 28 29 | Shapiro Wilk Test Statistic 1% Shapiro Wilk Critical Value | | Shapiro Wilk GOF Test Data appear Normal at 1% Significance Level | | | | | | | | | |
| 30 | 1% Snapiro Wilk Critical Value Lilliefors Test Statistic | | Lilliefors GOF Test | | | | | | | | | |
| 31 | 1% Lilliefors Critical Value | 0.413 | Data appear Normal at 1% Significance Level | | | | | | | | | |
| 32 33 | | | t 1% Significance Level eliable for small sample sizes | | | | | | | | | |
| 34 | Assuming Normal Distribution | | | | | | | | | | | |
| 35 36 | | suming Norr | | | | | | | | | | |
| 37 | 95% Normal UCL 95% Student's-t UCL | 11.61 | 95% UCLs (Adjusted for Skewness) 95% Adjusted-CLT UCL (Chen-1995) | 10.07 | | | | | | | | |
| 38 | 0070 010001110 1 002 | 11.01 | 95% Modified-t UCL (Johnson-1978) | 11.52 | | | | | | | | |
| 39 40 | | | COF Took | | | | | | | | | |
| 41 | A-D Test Statistic | | GOF Test Anderson-Darling Gamma GOF Test | | | | | | | | | |
| 42 | 5% A-D Critical Value | 0.657 | Detected data appear Gamma Distributed at 5% Significance | Level | | | | | | | | |
| 43 44 | K-S Test Statistic 5% K-S Critical Value | | Kolmogorov-Smirnov Gamma GOF Test Detected data appear Gamma Distributed at 5% Significance | a Lovol | | | | | | | | |
| 45 | | | stributed at 5% Significance Level | ; Level | | | | | | | | |
| 46 47 | Note GOF tests | may be unre | eliable for small sample sizes | | | | | | | | | |
| 47 | | Gamma | Statistics | | | | | | | | | |
| 49 | k hat (MLE) | | k star (bias corrected MLE) | 3.133 | | | | | | | | |
| 50 51 | Theta hat (MLE) | | Theta star (bias corrected MLE) | 2.713 | | | | | | | | |
| 52 | nu hat (MLE) MLE Mean (bias corrected) | | nu star (bias corrected) MLE Sd (bias corrected) | 25.07 4.802 | | | | | | | | |
| 53 | | | Approximate Chi Square Value (0.05) | 14.66 | | | | | | | | |
| 54 55 | Adjusted Level of Significance | N/A | Adjusted Chi Square Value | N/A | | | | | | | | |
| 56 | As | suming Garr | nma Distribution | | | | | | | | | |
| 57 58 | 95% Approximate Gamma UCL | | 95% Adjusted Gamma UCL | N/A | | | | | | | | |
| 58 | | Lognorma | I GOF Test | | | | | | | | | |
| 60 | Shapiro Wilk Test Statistic | 0.905 | Shapiro Wilk Lognormal GOF Test | | | | | | | | | |
| 61 62 | 10% Shapiro Wilk Critical Value | | Data appear Lognormal at 10% Significance Level | | | | | | | | | |
| 63 | Lilliefors Test Statistic 10% Lilliefors Critical Value | | Lilliefors Lognormal GOF Test Data appear Lognormal at 10% Significance Level | | | | | | | | | |
| 64 | Data appear | Lognormal a | at 10% Significance Level | | | | | | | | | |
| 65 66 | Note GOF tests | may be unre | eliable for small sample sizes | | | | | | | | | |
| 67 | | Lognorma | I Statistics | | | | | | | | | |
| 68 | Minimum of Logged Data | 1.609 | Mean of logged Data | 2.097 | | | | | | | | |
| 69 70 | Maximum of Logged Data | 2.398 | SD of logged Data | 0.352 | | | | | | | | |
| 71 | | | ormal Distribution | | | | | | | | | |
| 72 73 | 95% H-UCL | 15.84 | 90% Chebyshev (MVUE) UCL | 12.98 | | | | | | | | |
| 74 | 95% Chebyshev (MVUE) UCL 99% Chebyshev (MVUE) UCL | | 97.5% Chebyshev (MVUE) UCL | 17.8 | | | | | | | | |
| 75 | | | | | | | | | | | | |
| 76 77 | | | tion Free UCL Statistics | | | | | | | | | |
| 78 | Data appea | ar to follow a | Discernible Distribution | | | | | | | | | |
| 79 | | | tribution Free UCLs | | | | | | | | | |
| 80 81 | 95% CLT UCL | 10.68 | 95% BCA Bootstrap UCL | N/A | | | | | | | | |
| 82 | 95% Standard Bootstrap UCL 95% Hall's Bootstrap UCL | | 95% Bootstrap-t UCL 95% Percentile Bootstrap UCL | N/A N/A | | | | | | | | |
| | 33 /0 Hall S DOUISHAD UCL | 1.1/7 | , John elemine bootstrap OCL | 11// 1 | | | | | | | | |

| | Α | В | С | D | Е | F | G | Н | I | J | K | L | |
|----|--|---|----------------|----------------|---------------|----------------|-----------------|----------------|----------------|---------------|-----------------|-------|---|
| 83 | | | 90% Ch | ebyshev(Me | an, Sd) UCL | 12.47 | | | 95% Ch | ebyshev(Me | an, Sd) UCL | 14.27 | 1 |
| 84 | | | 97.5% Ch | ebyshev(Me | an, Sd) UCL | 16.76 | | | 99% Ch | ebyshev(Me | an, Sd) UCL | 21.66 | |
| 85 | | | | | | | | | | | | | |
| 86 | | | | | | Suggested | UCL to Use | | | | | | |
| 87 | 95% Student's-t UCL 11.61 | | | | | | | | | | | | |
| 88 | Recommended UCL exceeds the maximum observation | | | | | | | | | | | | |
| 89 | | | | | | | | | | | | | |
| 90 | 1 | Note: Sugges | stions regard | ing the selec | tion of a 95% | UCL are pr | ovided to hel | p the user to | select the m | ost appropria | ate 95% UCL | | |
| 91 | | Recom | mendations a | are based up | on data size | , data distrib | ution, and sk | ewness usin | g results fror | m simulation | studies. | | |
| 92 | Ho | wever, simu | lations result | s will not cov | er all Real W | orld data se | ts; for additio | nal insight th | ne user may | want to cons | ult a statistic | ian. | |
| 93 | | | | | | | | | | | | | |
| 94 | | Note: For | highly negat | ively-skewe | d data, confi | dence limits | (e.g., Chen, | Johnson, Lo | ognormal, ar | nd Gamma) r | may not be | | |
| 95 | reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets. | | | | | | | | | | | | |
| 96 | | reliable. Cherrs and Johnson's methods provide adjustments for positively skewed data sets. | | | | | | | | | | | |

| | A B C D E | F | G H I J K | L | | | | | | | |
|----------|--|--|--|----------------|--|--|--|--|--|--|--|
| 2 | UCL Statis | tics for Unc | ensored Full Data Sets | | | | | | | | |
| 3 | User Selected Options | 0.07.40 DM | | | | | | | | | |
| 5 | Date/Time of Computation ProUCL 5.2 10/28/2024 3 From File WorkSheet.xls | 3:37:19 PM | | | | | | | | | |
| 6 | Full Precision OFF | | | | | | | | | | |
| 7 8 | Confidence Coefficient 95% Number of Bootstrap Operations 2000 | | | | | | | | | | |
| 9 | Number of Boolettap Operations (2000 | | | | | | | | | | |
| 10 11 | CM-WRB-2 | | | | | | | | | | |
| 12 | CNI-WAD-2 | | | | | | | | | | |
| 13 14 | Total Number of Observations | General 4 | Statistics Number of Distinct Observations | 3 | | | | | | | |
| 15 | Total Number of Observations | 4 | Number of Missing Observations | 0 | | | | | | | |
| 16 17 | Minimum | 11 14 | Mean | 12.25 | | | | | | | |
| 18 | Maximum SD | 1.5 | Median Std. Error of Mean | 12 0.75 | | | | | | | |
| 19 | Coefficient of Variation | 0.122 | Skewness | 0.37 | | | | | | | |
| 20 21 | Note: Sample size is small (e.g., <10), if data a | re collected | using incremental sampling methodology (ISM) approach, | | | | | | | | |
| 22 | refer also to ITRC Tech Reg Guide of | on ISM (ITR | C 2020 and ITRC 2012) for additional guidance, | | | | | | | | |
| 23 24 | | | he Chebyshev UCL for small sample sizes (n < 7). in gross overestimates of the mean. | | | | | | | | |
| 25 | | | e for a discussion of the Chebyshev UCL. | | | | | | | | |
| 26 27 | | Normal C | POE Toet | | | | | | | | |
| 28 | Shapiro Wilk Test Statistic | 0.851 | GOF Test Shapiro Wilk GOF Test | | | | | | | | |
| 29 30 | 1% Shapiro Wilk Critical Value | 0.687 | Data appear Normal at 1% Significance Level | | | | | | | | |
| 31 | Lilliefors Test Statistic 1% Lilliefors Critical Value | 0.298 0.413 | Lilliefors GOF Test Data appear Normal at 1% Significance Level | | | | | | | | |
| 32 | Data appea | ar Normal at | 1% Significance Level | | | | | | | | |
| 33 34 | Note GOF tests | may be unre | eliable for small sample sizes | | | | | | | | |
| 35 | Assuming Normal Distribution | | | | | | | | | | |
| 36 37 | 95% Normal UCL | 95% Normal UCL 95% UCLs (Adjusted for Skewness) 95% Student's-t UCL 14.02 95% Adjusted-CLT UCL (Chen-1995) 13.63 | | | | | | | | | |
| 38 | 95% Student's-t UCL | 14.02 | 95% Adjusted-CLT UCL (Chen-1995) 95% Modified-t UCL (Johnson-1978) | 14.04 | | | | | | | |
| 39 40 | | 0 | | | | | | | | | |
| 41 | A-D Test Statistic | Gamma (0.476 | GOF Test Anderson-Darling Gamma GOF Test | | | | | | | | |
| 42 | 5% A-D Critical Value | 0.656 | Detected data appear Gamma Distributed at 5% Significance | Level | | | | | | | |
| 43 44 | K-S Test Statistic 5% K-S Critical Value | 0.333 0.394 | Kolmogorov-Smirnov Gamma GOF Test Detected data appear Gamma Distributed at 5% Significance | Level | | | | | | | |
| 45 | Detected data appear | Gamma Dis | stributed at 5% Significance Level | | | | | | | | |
| 46 47 | Note GOF tests | may be unre | eliable for small sample sizes | | | | | | | | |
| 48 | | | Statistics | | | | | | | | |
| 49 50 | k hat (MLE) Theta hat (MLE) | 89.83 0.136 | k star (bias corrected MLE) Theta star (bias corrected MLE) | 22.62 0.541 | | | | | | | |
| 51 | nu hat (MLE) | | | 181 | | | | | | | |
| 52 53 | MLE Mean (bias corrected) | 12.25 | MLE Sd (bias corrected) | 2.575 | | | | | | | |
| 54 | Adjusted Level of Significance | N/A | | 150.9 N/A | | | | | | | |
| 55 | | | | | | | | | | | |
| 56 57 | Ass 95% Approximate Gamma UCL | suming Gam 14.7 | ma Distribution 95% Adjusted Gamma UCL | N/A | | | | | | | |
| 58 | 0070 ripproximate dumina OOL | | | | | | | | | | |
| 59 60 | Shapiro Wilk Test Statistic | Lognormal 0.845 | GOF Test Shapiro Wilk Lognormal GOF Test | | | | | | | | |
| 61 | 10% Shapiro Wilk Critical Value | 0.792 | Data appear Lognormal at 10% Significance Level | | | | | | | | |
| 62 63 | Lilliefors Test Statistic | 0.299 | Lilliefors Lognormal GOF Test | | | | | | | | |
| 64 | 10% Lilliefors Critical Value Data appear | 0.346 Lognormal a | Data appear Lognormal at 10% Significance Level at 10% Significance Level | | | | | | | | |
| 65 66 | Note GOF tests | may be unre | liable for small sample sizes | | | | | | | | |
| 66 67 | | Lognorma | I Statistics | | | | | | | | |
| 68 | Minimum of Logged Data | 2.398 | Mean of logged Data | 2.5 | | | | | | | |
| 69 70 | Maximum of Logged Data | 2.639 | SD of logged Data | 0.122 | | | | | | | |
| 71 | Assı | | ormal Distribution | | | | | | | | |
| 72 73 | 95% H-UCL | 14.39 | 90% Chebyshev (MVUE) UCL | 14.48 | | | | | | | |
| 74 | 95% Chebyshev (MVUE) UCL 99% Chebyshev (MVUE) UCL | 15.49 19.66 | 97.5% Chebyshev (MVUE) UCL | 16.9 | | | | | | | |
| 75 | | | | | | | | | | | |
| 76 77 | | | tion Free UCL Statistics Discernible Distribution | | | | | | | | |
| 78 | | | | | | | | | | | |
| 79 80 | | | tribution Free UCLs | NI/A | | | | | | | |
| 81 | 95% CLT UCL 95% Standard Bootstrap UCL | 13.48 N/A | | N/A N/A | | | | | | | |
| 82 | 95% Hall's Bootstrap UCL | N/A | | N/A | | | | | | | |

| | Α | В | С | D | Е | F | G | Н | I | J | K | L | | |
|----|---------------------------|----------------------|----------------|----------------|---------------|----------------|-----------------|----------------|----------------|--------------|-----------------|-------|--|--|
| 83 | | | 90% Ch | ebyshev(Me | an, Sd) UCL | 14.5 | | | 95% Ch | ebyshev(Me | an, Sd) UCL | 15.52 | | |
| 84 | | | 97.5% Ch | ebyshev(Me | an, Sd) UCL | 16.93 | | | 99% Ch | ebyshev(Me | an, Sd) UCL | 19.71 | | |
| 85 | | | | | | | | | | | | | | |
| 86 | | Suggested UCL to Use | | | | | | | | | | | | |
| 87 | 95% Student's-t UCL 14.02 | | | | | | | | | | | | | |
| 88 | | | | Red | commended | UCL exceed | ds the maxim | num observa | tion | | | | | |
| 89 | | | | | | | | | | | | | | |
| 90 | | Note: Sugges | stions regard | ing the selec | tion of a 95% | 6 UCL are pr | ovided to hel | p the user to | select the m | ost appropri | ate 95% UCL | | | |
| 91 | | Recom | mendations | are based up | on data size | , data distrib | ution, and sk | ewness usin | g results fror | n simulation | studies. | | | |
| 92 | Но | wever, simu | lations result | s will not cov | er all Real W | orld data se | ts; for additio | nal insight th | ne user may | want to cons | ult a statistic | an. | | |
| 93 | | - | - | - | | | | | | - | | | | |

| 1 | | Statis | F tics for Unc | G H I J K L ensored Full Data Sets |
|----------------------|---|--------------------------|---------------------|---|
| 2 | | | | |
| 3 | User Selected Options | | | |
| 4 5 | Date/Time of Computation ProUCL 5.2 10/28/ | <u>/2024 3</u> | 3:43:26 PM | |
| 6 | From File WorkSheet.xls Full Precision OFF | | | |
| 7 | Confidence Coefficient 95% | | | |
| 8 | Number of Bootstrap Operations 2000 | | | |
| 9 | | | | |
| 10 | | | | |
| 12 | CM-WRC-1 | | | |
| 13 | | | General | Statistics |
| 14 | Total Number of Observa | ations | 4 | Number of Distinct Observations 3 |
| 15 | | | | Number of Missing Observations 0 |
| 16 | | imum | 60 | Mean 65.75 |
| 17 18 | Max | imum | 81 10.21 | Median 61 |
| 19 | Coefficient of Var | SD | 0.155 | Std. Error of Mean 5.105 Skewness 1.95 |
| 20 | Coefficient of Val | ilation | 0.155 | Skewiless 1.30 |
| 21 | Note: Sample size is small (e.g., <10), if | data a | re collected | using incremental sampling methodology (ISM) approach, |
| 22 | refer also to ITRC Tech Reg C | Guide o | n ISM (ITR | C 2020 and ITRC 2012) for additional guidance, |
| 23 | | | | he Chebyshev UCL for small sample sizes (n < 7). |
| 24 25 | | | | in gross overestimates of the mean. |
| 26 | Refer to the ProucL 5 | .∠ 1 <i>e</i> cl | iniicai Guide | e for a discussion of the Chebyshev UCL. |
| 27 | | | Normal C | GOF Test |
| 28 | Shapiro Wilk Test St | | 0.697 | Shapiro Wilk GOF Test |
| 29 | 1% Shapiro Wilk Critical | | 0.687 | Data appear Normal at 1% Significance Level |
| 30 31 | Lilliefors Test St | | 0.393 | Lilliefors GOF Test |
| 32 | 1% Lilliefors Critical | | 0.413 | Data appear Normal at 1% Significance Level 1% Significance Level |
| 33 | | | | liable for small sample sizes |
| 34 | 11010 401 | 100101 | nay bo anno | Madio 161 Official Carripto Gizeo |
| 35 | | Ass | suming Norr | mal Distribution |
| 36 | 95% Normal UCL | | | 95% UCLs (Adjusted for Skewness) |
| 37 38 | 95% Student's- | t UCL | 77.76 | 95% Adjusted-CLT UCL (Chen-1995) 79.47 |
| 39 | | | | 95% Modified-t UCL (Johnson-1978) 78.59 |
| 40 | | | Gamma (| GOF Test |
| 41 | A-D Test St | | 0.772 | Anderson-Darling Gamma GOF Test |
| 42 | 5% A-D Critical | | 0.656 | Data Not Gamma Distributed at 5% Significance Level |
| 43 44 | K-S Test St | | 0.409 | Kolmogorov-Smirnov Gamma GOF Test |
| 45 | 5% K-S Critical | | 0.394 | Data Not Gamma Distributed at 5% Significance Level ed at 5% Significance Level |
| 46 | Data Not | <u>. Gaiiiii</u> | | sa at 0 % Oignineance Level |
| 47 | | | Gamma | Statistics |
| 48 | k hat (| | 60.47 | k star (bias corrected MLE) 15.28 |
| 49 50 | Theta hat (| ` | 1.087 | Theta star (bias corrected MLE) 4.302 |
| 51 | nu hat (MLE Mean (bias corre | | 483.8 65.75 | nu star (bias corrected) 122.3 MLE Sd (bias corrected) 16.82 |
| 52 | MEE Mean (bias cone | ecteu) | 03.73 | Approximate Chi Square Value (0.05) 97.74 |
| 53 | Adjusted Level of Signific | cance | N/A | Adjusted Chi Square Value N/A |
| 54 | | • | | |
| 55 56 | 050/ 4 | | | ma Distribution |
| 57 | 95% Approximate Gamma | JUUL | 82.26 | 95% Adjusted Gamma UCL N/A |
| 58 | | | Lognorma | GOF Test |
| 59 | Shapiro Wilk Test St | | 0.707 | Shapiro Wilk Lognormal GOF Test |
| 60 | 10% Shapiro Wilk Critical | | 0.792 | Data Not Lognormal at 10% Significance Level |
| 61 62 | Lilliefors Test St | | 0.386 | Lilliefors Lognormal GOF Test |
| 63 | 10% Lilliefors Critical | | 0.346 | Data Not Lognormal at 10% Significance Level 10% Significance Level |
| 64 | Data | 14UL LO | gnomiai al | 1070 Organicance Level |
| 65 | | | Lognorma | I Statistics |
| 66 | Minimum of Logged | | 4.094 | Mean of logged Data 4.178 |
| 67 68 | Maximum of Logged | d Data | 4.394 | SD of logged Data 0.145 |
| 69 | | Λ | mina Lease | armal Distribution |
| 70 | 95% H | | 80.09 | ormal Distribution 90% Chebyshev (MVUE) UCL 80.04 |
| 71 | 95% Chebyshev (MVUE | | 86.52 | 97.5% Chebyshev (MVUE) UCL 95.52 |
| 72 | 99% Chebyshev (MVUE | , | 113.2 | , |
| 73 | | | | |
| 74 75 | | | | tion Free UCL Statistics |
| 76 | Data | appear | to tollow a | Discernible Distribution |
| , 0 | | lonnar | ametric Dist | tribution Free UCLs |
| 77 | | | | |
| 77 78 | 95% CLT | | 74.15 | 95% BCA Bootstrap UCL N/A |
| 77 78 79 | 95% CL1 95% Standard Bootstrap | UCL UCL | 74.15 N/A | 95% Bootstrap-t UCL N/A |
| 77 78 79 80 | 95% CL1 95% Standard Bootstrag 95% Hall's Bootstrag | UCL UCL UCL | 74.15 N/A N/A | 95% Bootstrap-t UCL N/A 95% Percentile Bootstrap UCL N/A |
| 77 78 79 | 95% CL1 95% Standard Bootstrap | UCL UCL UCL UCL | 74.15 N/A | 95% Bootstrap-t UCL N/A |

| | Α | В | С | D | E | F | G | Н | I | J | K | L | | |
|----|--|--|----------------|----------------|---------------|---------------|------------------|----------------|-------------|--------------|-----------------|-----|--|--|
| 83 | | | | | | | | | | | | | | |
| 84 | Suggested UCL to Use | | | | | | | | | | | | | |
| 85 | | 95% Student's-t UCL 77.76 | | | | | | | | | | | | |
| 86 | | | | | | | | | | | | | | |
| 87 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. | | | | | | | | | | | | | |
| 88 | | Recommendations are based upon data size, data distribution, and skewness using results from simulation studies. | | | | | | | | | | | | |
| 89 | | wever, simul | lations result | s will not cov | er all Real V | Vorld data se | ts; for addition | nal insight th | ne user may | want to cons | ult a statistic | an. | | |
| 90 | | | | | | | | | | | | | | |

| | A B C D E | F | G H I J K L | | | | | | | | | |
|----------|--|--|---|--|--|--|--|--|--|--|--|--|
| 2 | UCL Statis | stics for Unc | ensored Full Data Sets | | | | | | | | | |
| 3 | User Selected Options Date/Time of Computation ProUCL 5.2 10/28/2024 | 0:40:04 DM | | | | | | | | | | |
| 5 | Date/Time of Computation ProUCL 5.2 10/28/2024 From File WorkSheet.xls | 3:49:21 PM | | | | | | | | | | |
| 6 7 | Full Precision OFF Confidence Coefficient 95% | | | | | | | | | | | |
| 8 | Number of Bootstrap Operations 2000 | | | | | | | | | | | |
| 9 | | | | | | | | | | | | |
| 11 | CM-WRC-2 | | | | | | | | | | | |
| 12 13 | | General | Statistics | | | | | | | | | |
| 14 | Total Number of Observations | | Number of Distinct Observations 5 | | | | | | | | | |
| 15 16 | Minimum | 62 | Number of Missing Observations 0 Mean 84 | | | | | | | | | |
| 17 | Maximum | 113 | Median 84 | | | | | | | | | |
| 18 19 | SD Coefficient of Variation | | Std. Error of Mean 8.396 Skewness 0.82 | | | | | | | | | |
| 20 | | | | | | | | | | | | |
| 21 | | | I using incremental sampling methodology (ISM) approach, C 2020 and ITRC 2012) for additional guidance, | | | | | | | | | |
| 23 | but note that ITRC may recommend the | he t-UCL or t | he Chebyshev UCL for small sample sizes (n < 7). | | | | | | | | | |
| 24 25 | | | in gross overestimates of the mean. e for a discussion of the Chebyshev UCL. | | | | | | | | | |
| 26 27 | | | • | | | | | | | | | |
| 28 | Shapiro Wilk Test Statistic | | GOF Test Shapiro Wilk GOF Test | | | | | | | | | |
| 29 30 | 1% Shapiro Wilk Critical Value | 0.686 | Data appear Normal at 1% Significance Level | | | | | | | | | |
| 31 | Lilliefors Test Statistic 1% Lilliefors Critical Value | | Lilliefors GOF Test Data appear Normal at 1% Significance Level | | | | | | | | | |
| 32 33 | Data appe | ar Normal at | 1% Significance Level | | | | | | | | | |
| 34 | Note GUF tests | eliable for small sample sizes | | | | | | | | | | |
| 35 36 | Assuming Normal Distribution 95% Normal UCL 95% UCLs (Adjusted for Skewness) | | | | | | | | | | | |
| 37 | 95% Normal UCL 95% Student's-t UCL | 101.9 | 95% Adjusted for Skewness) 95% Adjusted-CLT UCL (Chen-1995) 101.1 | | | | | | | | | |
| 38 39 | | | 95% Modified-t UCL (Johnson-1978) 102.4 | | | | | | | | | |
| 40 | | Gamma | GOF Test | | | | | | | | | |
| 41 42 | A-D Test Statistic 5% A-D Critical Value | | Anderson-Darling Gamma GOF Test Detected data appear Gamma Distributed at 5% Significance Level | | | | | | | | | |
| 43 | K-S Test Statistic | 0.226 | Kolmogorov-Smirnov Gamma GOF Test | | | | | | | | | |
| 44 45 | 5% K-S Critical Value | | Detected data appear Gamma Distributed at 5% Significance Level stributed at 5% Significance Level | | | | | | | | | |
| 46 | | | eliable for small sample sizes | | | | | | | | | |
| 47 48 | | Gamma | Statistics | | | | | | | | | |
| 49 | k hat (MLE) | 25.96 | k star (bias corrected MLE) 10.52 | | | | | | | | | |
| 50 51 | Theta hat (MLE) nu hat (MLE) | | Theta star (bias corrected MLE) 7.986 nu star (bias corrected) 105.2 | | | | | | | | | |
| 52 | MLE Mean (bias corrected) | 84 | MLE Sd (bias corrected) 25.9 | | | | | | | | | |
| 53 54 | Adjusted Level of Significance | 0.0086 | Approximate Chi Square Value (0.05) 82.52 Adjusted Chi Square Value 73.77 | | | | | | | | | |
| 55 56 | | | | | | | | | | | | |
| 57 | As: 95% Approximate Gamma UCL | | ma Distribution 95% Adjusted Gamma UCL 119.8 | | | | | | | | | |
| 58 59 | | | | | | | | | | | | |
| 60 | Shapiro Wilk Test Statistic | 0.973 | GOF Test Shapiro Wilk Lognormal GOF Test | | | | | | | | | |
| 61 62 | 10% Shapiro Wilk Critical Value Lilliefors Test Statistic | | Data appear Lognormal at 10% Significance Level Lilliefors Lognormal GOF Test | | | | | | | | | |
| 63 | 10% Lilliefors Critical Value | 0.319 | Data appear Lognormal at 10% Significance Level | | | | | | | | | |
| 64 65 | | | at 10% Significance Level eliable for small sample sizes | | | | | | | | | |
| 66 | Note GOT lesis | | | | | | | | | | | |
| 67 68 | Minimum of Logged Data | | I Statistics Mean of logged Data 4.411 | | | | | | | | | |
| 69 | Maximum of Logged Data Maximum of Logged Data | | SD of logged Data 0.219 | | | | | | | | | |
| 70 71 | Δος | umina Loans | ormal Distribution | | | | | | | | | |
| 72 | 95% H-UCL | 107.8 | 90% Chebyshev (MVUE) UCL 108.6 | | | | | | | | | |
| 73 74 | 95% Chebyshev (MVUE) UCL 99% Chebyshev (MVUE) UCL | | 97.5% Chebyshev (MVUE) UCL 135.2 | | | | | | | | | |
| 75 | | | | | | | | | | | | |
| 76 77 | | Nonparametric Distribution Free UCL Statistics Data appear to follow a Discernible Distribution | | | | | | | | | | |
| 78 | | | | | | | | | | | | |
| 79 80 | Nonpal 95% CLT UCL | | tribution Free UCLs 95% BCA Bootstrap UCL 99.6 | | | | | | | | | |
| 81 | 95% Standard Bootstrap UCL | 96.73 | 95% Bootstrap-t UCL 106.1 | | | | | | | | | |
| 82 | 95% Hall's Bootstrap UCL | 117.5 | 95% Percentile Bootstrap UCL 97 | | | | | | | | | |

| | Α | В | С | D | E | F | G | Н | | J | K | L | |
|----|---------------------------|--------------|----------------|----------------|---------------|----------------|-----------------|----------------|----------------|---------------|-----------------|-------|--|
| 83 | | | 90% Ch | ebyshev(Me | an, Sd) UCL | 109.2 | | | 95% Ch | ebyshev(Me | an, Sd) UCL | 120.6 | |
| 84 | | | 97.5% Ch | ebyshev(Me | an, Sd) UCL | 136.4 | | | 99% Ch | ebyshev(Me | an, Sd) UCL | 167.5 | |
| 85 | | | | | | | | | | | | | |
| 86 | Suggested UCL to Use | | | | | | | | | | | | |
| 87 | 95% Student's-t UCL 101.9 | | | | | | | | | | | | |
| 88 | | | | | | | • | | | | | | |
| 89 | | Note: Sugges | stions regard | ing the selec | tion of a 95% | 6 UCL are pr | ovided to hel | p the user to | select the m | nost appropri | ate 95% UCI | - | |
| 90 | | Recom | mendations | are based up | on data size | , data distrib | ution, and sk | ewness usin | g results fror | m simulation | studies. | | |
| 91 | Но | wever, simu | lations result | s will not cov | er all Real W | orld data se | ts; for additio | nal insight th | ne user may | want to cons | ult a statistic | ian. | |
| 92 | | | | | | | | | | | | | |

| 4 | A B C D E | F | G H I J K | L |
|----------|--|----------------|---|----------------|
| 2 | UCL Statis | stics for Unc | ensored Full Data Sets | |
| 3 | User Selected Options | | | |
| 4 5 | Date/Time of Computation ProUCL 5.2 10/28/2024 3 From File WorkSheet.xls | 3:52:33 PM | | |
| 6 | Full Precision OFF | | | |
| 7 8 | Confidence Coefficient 95% Number of Bootstrap Operations 2000 | | | |
| 9 | Number of Bootstrap Operations 2000 | | | |
| 10 | 014 14/20 0 | | | |
| 12 | CM-WRC-3 | | | |
| 13 | | | Statistics | |
| 14 15 | Total Number of Observations | 4 | Number of Distinct Observations Number of Missing Observations | 0 |
| 16 | Minimum | 36 | Mean | 48.25 |
| 17 18 | Maximum | 63 | Median | 47 |
| 19 | SD Coefficient of Variation | 12.89 0.267 | Std. Error of Mean Skewness | 6.447 0.276 |
| 20 | | | | 0.27 |
| 21 | | | using incremental sampling methodology (ISM) approach, C 2020 and ITRC 2012) for additional guidance, | |
| 23 | | | he Chebyshev UCL for small sample sizes (n < 7). | |
| 24 25 | The Chebyshev UCL or | ften results | in gross overestimates of the mean. | |
| 26 | Refer to the ProUCL 5.2 Tec | nnical Guid | e for a discussion of the Chebyshev UCL. | |
| 27 | | | OF Test | |
| 28 29 | Shapiro Wilk Test Statistic 1% Shapiro Wilk Critical Value | 0.904 0.687 | Shapiro Wilk GOF Test | |
| 30 | 1% Snapiro Wilk Critical Value Lilliefors Test Statistic | 0.687 | Data appear Normal at 1% Significance Level Lilliefors GOF Test | |
| 31 | 1% Lilliefors Critical Value | 0.413 | Data appear Normal at 1% Significance Level | |
| 32 33 | | | t 1% Significance Level Bliable for small sample sizes | |
| 34 | | | | |
| 35 36 | | suming Nor | mal Distribution | |
| 37 | 95% Normal UCL 95% Student's-t UCL | 63.42 | 95% UCLs (Adjusted for Skewness) 95% Adjusted-CLT UCL (Chen-1995) | 59.8 |
| 38 | 30% Gladoliko (002 | 00.12 | 95% Modified-t UCL (Johnson-1978) | 63.57 |
| 39 40 | | Commo | GOF Test | |
| 41 | A-D Test Statistic | 0.372 | Anderson-Darling Gamma GOF Test | |
| 42 | 5% A-D Critical Value | 0.657 | Detected data appear Gamma Distributed at 5% Significance | Level |
| 43 44 | K-S Test Statistic 5% K-S Critical Value | 0.291 0.394 | Kolmogorov-Smirnov Gamma GOF Test Detected data appear Gamma Distributed at 5% Significance | a Lovol |
| 45 | | | stributed at 5% Significance Level | ; Level |
| 46 47 | Note GOF tests | may be unre | eliable for small sample sizes | |
| 47 | | Gamma | Statistics | |
| 49 | k hat (MLE) | 18.68 | k star (bias corrected MLE) | 4.836 |
| 50 51 | Theta hat (MLE) | 2.583 | Theta star (bias corrected MLE) | 9.977 |
| 52 | nu hat (MLE) MLE Mean (bias corrected) | | nu star (bias corrected) MLE Sd (bias corrected) | 38.69 21.94 |
| 53 | | | Approximate Chi Square Value (0.05) | 25.44 |
| 54 55 | Adjusted Level of Significance | N/A | Adjusted Chi Square Value | N/A |
| 56 | Ass | suming Gam | ma Distribution | |
| 57 58 | 95% Approximate Gamma UCL | | 95% Adjusted Gamma UCL | N/A |
| 58 | | Lognorma | GOF Test | |
| 60 | Shapiro Wilk Test Statistic | 0.903 | Shapiro Wilk Lognormal GOF Test | |
| 61 62 | 10% Shapiro Wilk Critical Value | 0.792 | Data appear Lognormal at 10% Significance Level | |
| 63 | Lilliefors Test Statistic 10% Lilliefors Critical Value | 0.255 0.346 | Lilliefors Lognormal GOF Test Data appear Lognormal at 10% Significance Level | |
| 64 | Data appear | Lognormal a | at 10% Significance Level | |
| 65 66 | Note GOF tests | may be unre | eliable for small sample sizes | |
| 67 | | Lognorma | I Statistics | |
| 68 | Minimum of Logged Data | 3.584 | Mean of logged Data | 3.849 |
| 69 70 | Maximum of Logged Data | 4.143 | SD of logged Data | 0.269 |
| 71 | Assı | | ormal Distribution | |
| 72 73 | 95% H-UCL | 73.67 | 90% Chebyshev (MVUE) UCL | 67.58 |
| 74 | 95% Chebyshev (MVUE) UCL 99% Chebyshev (MVUE) UCL | 76.34 112.4 | 97.5% Chebyshev (MVUE) UCL | 88.49 |
| 75 | | | | |
| 76 77 | | | tion Free UCL Statistics | |
| 78 | Data appea | r to follow a | Discernible Distribution | |
| 79 | | | tribution Free UCLs | |
| 80 81 | 95% CLT UCL | 58.85 | 95% BCA Bootstrap UCL | N/A |
| 82 | 95% Standard Bootstrap UCL 95% Hall's Bootstrap UCL | N/A N/A | 95% Bootstrap-t UCL 95% Percentile Bootstrap UCL | N/A N/A |
| | 33 /0 Fiall 5 DOUISII ap OCL | 1 1/ / 1 | 1 30 /0 1 GLOGHAIG DOUISHAD OCL | 11//3 |

| | Α | В | С | D | Е | F | G | Н | 1 | J | K | L | |
|----|----|---------------------------|----------------|----------------|---------------|----------------|------------------|----------------|----------------|----------------|------------------|-------|--|
| 83 | | | 90% Ch | ebyshev(Me | an, Sd) UCL | 67.59 | | | 95% Ch | ebyshev(Mea | an, Sd) UCL | 76.35 | |
| 84 | | | 97.5% Ch | ebyshev(Me | an, Sd) UCL | 88.51 | | | 99% Ch | ebyshev(Mea | an, Sd) UCL | 112.4 | |
| 85 | | | | | | | | | | | | | |
| 86 | | Suggested UCL to Use | | | | | | | | | | | |
| 87 | | 95% Student's-t UCL 63.42 | | | | | | | | | | | |
| 88 | | | | Red | commended | UCL exceed | ds the maxim | num observa | ition | | | | |
| 89 | | | | | | | | | | | | | |
| 90 | 1 | Note: Sugges | stions regard | ing the selec | tion of a 95% | UCL are pr | ovided to hel | p the user to | select the m | nost appropria | ate 95% UCL | | |
| 91 | | Recom | mendations | are based up | on data size | , data distrib | ution, and sk | ewness usin | g results fror | m simulation | studies. | | |
| 92 | Но | wever, simu | lations result | s will not cov | er all Real W | orld data se | ts; for addition | nal insight th | ne user may | want to consi | ult a statistici | an. | |
| 93 | | | | | | | | | | | | | |

| | A B C D E | F | G H I J K L | | | | | | | |
|----------|--|-----------------|---|--|--|--|--|--|--|--|
| 2 | UCL Statis | stics for Unc | ensored Full Data Sets | | | | | | | |
| 3 | User Selected Options | | | | | | | | | |
| 4 5 | Date/Time of Computation ProUCL 5.2 10/28/2024 From File WorkSheet.xls | 3:54:46 PM | | | | | | | | |
| 6 | Full Precision OFF | | | | | | | | | |
| 7 | Confidence Coefficient 95% Number of Bootstrap Operations 2000 | | | | | | | | | |
| 9 | Number of Bootstrap Operations 2000 | | | | | | | | | |
| 10 | 014 14/20 4 | | | | | | | | | |
| 12 | CM-WRC-4 | | | | | | | | | |
| 13 | | | Statistics | | | | | | | |
| 14 15 | Total Number of Observations | 4 | Number of Distinct Observations 4 Number of Missing Observations 0 | | | | | | | |
| 16 | Minimum | 309 | Mean 329.5 | | | | | | | |
| 17 18 | Maximum | | Median 317 | | | | | | | |
| 19 | SD Coefficient of Variation | 30.84 0.0936 | Std. Error of Mean 15.42 Skewness 1.814 | | | | | | | |
| 20 | | • | | | | | | | | |
| 21 | | | I using incremental sampling methodology (ISM) approach, C 2020 and ITRC 2012) for additional guidance, | | | | | | | |
| 23 | | | the Chebyshev UCL for small sample sizes (n < 7). | | | | | | | |
| 24 25 | The Chebyshev UCL o | ften results | in gross overestimates of the mean. | | | | | | | |
| 26 | Refer to the ProUCL 5.2 Tec | onnical Guid | e for a discussion of the Chebyshev UCL. | | | | | | | |
| 27 | | | GOF Test | | | | | | | |
| 28 29 | Shapiro Wilk Test Statistic 1% Shapiro Wilk Critical Value | | Shapiro Wilk GOF Test | | | | | | | |
| 30 | 1% Snapiro Wilk Critical Value Lilliefors Test Statistic | | Data appear Normal at 1% Significance Level Lilliefors GOF Test | | | | | | | |
| 31 | 1% Lilliefors Critical Value | 0.413 | Data appear Normal at 1% Significance Level | | | | | | | |
| 32 33 | | | t 1% Significance Level eliable for small sample sizes | | | | | | | |
| 34 | Note GOF tests | may be unife | Silable for Silial Satisfic Sizes | | | | | | | |
| 35 | Assuming Normal Distribution 95% Normal LICI | | | | | | | | | |
| 36 37 | 95% Normal UCL 95% Student's-t UCL | 365.8 | 95% UCLs (Adjusted for Skewness) 95% Adjusted-CLT UCL (Chen-1995) 369.8 | | | | | | | |
| 38 | 3370 Ottacht 3-1 OCE | 300.0 | 95% Modified-t UCL (Johnson-1978) 368.1 | | | | | | | |
| 39 40 | | | 005 Task | | | | | | | |
| 41 | A-D Test Statistic | 0.598 | GOF Test Anderson-Darling Gamma GOF Test | | | | | | | |
| 42 | 5% A-D Critical Value | | Detected data appear Gamma Distributed at 5% Significance Level | | | | | | | |
| 43 44 | K-S Test Statistic | | Kolmogorov-Smirnov Gamma GOF Test | | | | | | | |
| 45 | 5% K-S Critical Value Detected data appear | | Detected data appear Gamma Distributed at 5% Significance Level stributed at 5% Significance Level | | | | | | | |
| 46 | | | eliable for small sample sizes | | | | | | | |
| 47 48 | | Gamma | Statistics | | | | | | | |
| 49 | k hat (MLE) | 160.4 | k star (bias corrected MLE) 40.26 | | | | | | | |
| 50 51 | Theta hat (MLE) | | Theta star (bias corrected MLE) 8.184 | | | | | | | |
| 52 | nu hat (MLE) MLE Mean (bias corrected) | | nu star (bias corrected) 322.1 MLE Sd (bias corrected) 51.93 | | | | | | | |
| 53 | | | Approximate Chi Square Value (0.05) 281.5 | | | | | | | |
| 54 55 | Adjusted Level of Significance | N/A | Adjusted Chi Square Value N/A | | | | | | | |
| 56 | As | suming Gam | nma Distribution | | | | | | | |
| 57 50 | 95% Approximate Gamma UCL | | 95% Adjusted Gamma UCL N/A | | | | | | | |
| 58 59 | | Lognorma | I GOF Test | | | | | | | |
| 60 | Shapiro Wilk Test Statistic | 0.786 | Shapiro Wilk Lognormal GOF Test | | | | | | | |
| 61 62 | 10% Shapiro Wilk Critical Value | | Data Not Lognormal at 10% Significance Level | | | | | | | |
| 63 | Lilliefors Test Statistic 10% Lilliefors Critical Value | | Lilliefors Lognormal GOF Test Data appear Lognormal at 10% Significance Level | | | | | | | |
| 64 | Data appear Approx | ximate Logn | ormal at 10% Significance Level | | | | | | | |
| 65 66 | Note GOF tests | may be unre | eliable for small sample sizes | | | | | | | |
| 67 | | Lognorma | Il Statistics | | | | | | | |
| 68 | Minimum of Logged Data | 5.733 | Mean of logged Data 5.794 | | | | | | | |
| 69 70 | Maximum of Logged Data | 5.927 | SD of logged Data 0.09 | | | | | | | |
| 71 | Assi | uming Logno | ormal Distribution | | | | | | | |
| 72 | 95% H-UCL | N/A | 90% Chebyshev (MVUE) UCL 373.9 | | | | | | | |
| 73 74 | 95% Chebyshev (MVUE) UCL 99% Chebyshev (MVUE) UCL | 394.1 477 | 97.5% Chebyshev (MVUE) UCL 422.1 | | | | | | | |
| 75 | | | | | | | | | | |
| 76 77 | | | tion Free UCL Statistics | | | | | | | |
| 78 | Data appea | ar to follow a | Discernible Distribution | | | | | | | |
| 79 | | | tribution Free UCLs | | | | | | | |
| 80 81 | 95% CLT UCL | 354.9 | 95% BCA Bootstrap UCL N/A | | | | | | | |
| 82 | 95% Standard Bootstrap UCL 95% Hall's Bootstrap UCL | 1 | 95% Bootstrap-t UCL N/A 95% Percentile Bootstrap UCL N/A | | | | | | | |
| | 30 /0 Hall 5 DOUISHAP UCL | 1 17//3 | 35 /6 F Greening Doorshap COL) IN/A | | | | | | | |

| | Α | В | С | D | E | F | G | Н | 1 | J | K | L | |
|----|---------------------------|--------------|----------------|----------------|---------------|----------------|------------------|----------------|----------------|---------------|-----------------|-------|--|
| 83 | | | 90% Ch | ebyshev(Me | an, Sd) UCL | 375.8 | | | 95% Ch | ebyshev(Me | an, Sd) UCL | 396.7 | |
| 84 | | | 97.5% Ch | ebyshev(Me | an, Sd) UCL | 425.8 | | | 99% Ch | ebyshev(Me | an, Sd) UCL | 482.9 | |
| 85 | | | | | | | | | | | | | |
| 86 | Suggested UCL to Use | | | | | | | | | | | | |
| 87 | 95% Student's-t UCL 365.8 | | | | | | | | | | | | |
| 88 | | | | | | | • | | | | | | |
| 89 | | Note: Sugges | stions regard | ing the selec | tion of a 95% | 6 UCL are pr | ovided to hel | p the user to | select the m | nost appropri | ate 95% UCI | | |
| 90 | | Recom | mendations | are based up | on data size | , data distrib | ution, and sk | ewness usin | g results fror | n simulation | studies. | | |
| 91 | Но | wever, simu | lations result | s will not cov | er all Real W | Vorld data se | ts; for addition | nal insight th | ne user may | want to cons | ult a statistic | ian. | |
| 92 | | | | | | | | | | | | | |

| | A B C D E | F | G H I J K L | | | | | | | | | |
|----------|---|--|--|--|--|--|--|--|--|--|--|--|
| 2 | UCL Statis | stics for Unc | ensored Full Data Sets | | | | | | | | | |
| 3 | User Selected Options | 0.50.54.514 | | | | | | | | | | |
| 5 | Date/Time of Computation ProUCL 5.2 10/28/2024 3 From File WorkSheet.xls | 3:56:51 PIVI | | | | | | | | | | |
| 6 | Full Precision OFF | | | | | | | | | | | |
| 7 8 | Confidence Coefficient 95% Number of Bootstrap Operations 2000 | | | | | | | | | | | |
| 9 | Number of Booletiap Operations (2000 | | | | | | | | | | | |
| 10 11 | CM-WRC-5 | | | | | | | | | | | |
| 12 | ONI-WITO-0 | | | | | | | | | | | |
| 13 14 | Total Number of Observations | General 4 | Statistics Number of Distinct Observations 4 | | | | | | | | | |
| 15 | Total Number of Observations | 4 | Number of Missing Observations 0 | | | | | | | | | |
| 16 17 | Minimum | 77 106 | Mean 92.75 Median 94 | | | | | | | | | |
| 18 | Maximum SD | 14.93 | Median 94 Std. Error of Mean 7.465 | | | | | | | | | |
| 19 | Coefficient of Variation | 0.161 | Skewness -0.134 | | | | | | | | | |
| 20 21 | Note: Sample size is small (e.g., <10), if data a | are collected | using incremental sampling methodology (ISM) approach, | | | | | | | | | |
| 22 | refer also to ITRC Tech Reg Guide of | on ISM (ITR | C 2020 and ITRC 2012) for additional guidance, | | | | | | | | | |
| 23 24 | | | the Chebyshev UCL for small sample sizes (n < 7). in gross overestimates of the mean. | | | | | | | | | |
| 25 | | | e for a discussion of the Chebyshev UCL. | | | | | | | | | |
| 26 27 | | Normal (| GOF Test | | | | | | | | | |
| 28 | Shapiro Wilk Test Statistic | 0.834 | Shapiro Wilk GOF Test | | | | | | | | | |
| 29 30 | 1% Shapiro Wilk Critical Value | 0.687 | Data appear Normal at 1% Significance Level | | | | | | | | | |
| 31 | Lilliefors Test Statistic 1% Lilliefors Critical Value | 0.294 0.413 | Lilliefors GOF Test Data appear Normal at 1% Significance Level | | | | | | | | | |
| 32 | Data appea | ar Normal at | 1% Significance Level | | | | | | | | | |
| 33 34 | Note GOF tests | may be unre | eliable for small sample sizes | | | | | | | | | |
| 35 | Assuming Normal Distribution | | | | | | | | | | | |
| 36 37 | 95% Normal UCL | 95% Normal UCL 95% UCLs (Adjusted for Skewness) 95% Student's-t UCL 110.3 95% Adjusted-CLT UCL (Chen-1995) 104.5 | | | | | | | | | | |
| 38 | 95% Students-t UCL | 110.3 | 95% Adjusted-CLT UCL (Chen-1995) 104.5 95% Modified-t UCL (Johnson-1978) 110.2 | | | | | | | | | |
| 39 40 | | 0 | | | | | | | | | | |
| 41 | A-D Test Statistic | Gamma 0.499 | GOF Test Anderson-Darling Gamma GOF Test | | | | | | | | | |
| 42 | 5% A-D Critical Value | 0.656 | Detected data appear Gamma Distributed at 5% Significance Level | | | | | | | | | |
| 43 44 | K-S Test Statistic 5% K-S Critical Value | 0.328 0.394 | Kolmogorov-Smirnov Gamma GOF Test Detected data appear Gamma Distributed at 5% Significance Level | | | | | | | | | |
| 45 | Detected data appear | Gamma Di | stributed at 5% Significance Level | | | | | | | | | |
| 46 47 | Note GOF tests | may be unre | eliable for small sample sizes | | | | | | | | | |
| 48 | | | Statistics | | | | | | | | | |
| 49 50 | k hat (MLE) Theta hat (MLE) | 50.69 1.83 | k star (bias corrected MLE) 12.84 Theta star (bias corrected MLE) 7.224 | | | | | | | | | |
| 51 | nu hat (MLE) | 405.5 | nu star (bias corrected MLE) 7.224 | | | | | | | | | |
| 52 53 | MLE Mean (bias corrected) | 92.75 | MLE Sd (bias corrected) 25.88 | | | | | | | | | |
| 54 | Adjusted Level of Significance | N/A | Approximate Chi Square Value (0.05) 80.33 Adjusted Chi Square Value N/A | | | | | | | | | |
| 55 | | | | | | | | | | | | |
| 56 57 | Ass 95% Approximate Gamma UCL | | ma Distribution 95% Adjusted Gamma UCL N/A | | | | | | | | | |
| 58 | CONTRACTOR | | | | | | | | | | | |
| 59 60 | Shapiro Wilk Test Statistic | Lognorma 0.841 | GOF Test Shapiro Wilk Lognormal GOF Test | | | | | | | | | |
| 61 | 10% Shapiro Wilk Critical Value | 0.792 | Data appear Lognormal at 10% Significance Level | | | | | | | | | |
| 62 63 | Lilliefors Test Statistic | 0.294 0.346 | Lilliefors Lognormal GOF Test | | | | | | | | | |
| 64 | 10% Lilliefors Critical Value Data appear | | Data appear Lognormal at 10% Significance Level at 10% Significance Level | | | | | | | | | |
| 65 66 | | | eliable for small sample sizes | | | | | | | | | |
| 66 67 | | Lognorma | I Statistics | | | | | | | | | |
| 68 | Minimum of Logged Data | 4.344 | Mean of logged Data 4.52 | | | | | | | | | |
| 69 70 | Maximum of Logged Data | 4.663 | SD of logged Data 0.163 | | | | | | | | | |
| 71 | | | ormal Distribution | | | | | | | | | |
| 72 73 | 95% H-UCL | 116.3 | 90% Chebyshev (MVUE) UCL 115.4 | | | | | | | | | |
| 74 | 95% Chebyshev (MVUE) UCL 99% Chebyshev (MVUE) UCL | 125.7 167.9 | 97.5% Chebyshev (MVUE) UCL 139.9 | | | | | | | | | |
| 75 | | | 1 5 1101 0: 11 11 | | | | | | | | | |
| 76 77 | | | tion Free UCL Statistics Discernible Distribution | | | | | | | | | |
| 78 | | | | | | | | | | | | |
| 79 80 | | | tribution Free UCLs | | | | | | | | | |
| 81 | 95% CLT UCL 95% Standard Bootstrap UCL | 105 N/A | 95% BCA Bootstrap UCL N/A 95% Bootstrap-t UCL N/A | | | | | | | | | |
| 82 | 95% Hall's Bootstrap UCL | N/A | 95% Percentile Bootstrap UCL N/A | | | | | | | | | |

| | Α | В | С | D | Е | F | G | Н | I | J | K | L | | |
|----|----|---|----------------|----------------|---------------|----------------|--------------------|----------------|----------------|---------------|-----------------|-------|--|--|
| 83 | | | 90% Ch | ebyshev(Me | an, Sd) UCL | 115.1 | | | 95% Ch | ebyshev(Me | an, Sd) UCL | 125.3 | | |
| 84 | | | 97.5% Ch | ebyshev(Mea | an, Sd) UCL | 139.4 | | | 99% Ch | ebyshev(Me | an, Sd) UCL | 167 | | |
| 85 | | | | | | | | | | | | | | |
| 86 | | | | | | Suggested | UCL to Use | | | | | | | |
| 87 | | 95% Student's-t UCL 110.3 | | | | | | | | | | | | |
| 88 | | Recommended UCL exceeds the maximum observation | | | | | | | | | | | | |
| 89 | | | | | | | | | | | | | | |
| 90 | 1 | Note: Sugges | stions regard | ing the selec | tion of a 95% | UCL are pr | ovided to hel | p the user to | select the m | ost appropria | ate 95% UCL | | | |
| 91 | | Recom | mendations a | are based up | on data size | , data distrib | ution, and sk | ewness usin | g results fror | n simulation | studies. | | | |
| 92 | Ho | wever, simul | lations result | s will not cov | er all Real W | orld data se | ts; for additio | nal insight th | ne user may | want to cons | ult a statistic | ian. | | |
| 93 | | | | | | | | | | | | | | |
| 94 | | Note: For | | | | | | | | nd Gamma) r | may not be | | | |
| 95 | | | reliable. (| Chen's and J | ohnson's me | ethods provi | <u>de adjustme</u> | nts for posit | vely skewed | data sets. | | | | |
| 96 | | | | | | | | | | | | | | |

| | A B C D E | F | G H I J K | L | | | | | | |
|----------|--|----------------|---|----------------|--|--|--|--|--|--|
| 2 | UCL Statis | tics for Unc | ensored Full Data Sets | | | | | | | |
| 3 | User Selected Options | | | | | | | | | |
| 4 5 | Date/Time of Computation ProUCL 5.2 10/28/2024 4 From File WorkSheet.xls | 4:02:25 PM | | | | | | | | |
| 6 | Full Precision OFF | | | | | | | | | |
| 7 | Confidence Coefficient 95% Number of Bootstrap Operations 2000 | | | | | | | | | |
| 9 | Number of Bootstrap Operations 2000 | | | | | | | | | |
| 10 | 0000 WD4 | | | | | | | | | |
| 12 | GC03-WRA | | | | | | | | | |
| 13 | | | Statistics | | | | | | | |
| 14 15 | Total Number of Observations | 4 | Number of Distinct Observations Number of Missing Observations | 0 | | | | | | |
| 16 | Minimum | 30 | Mean | 35.5 | | | | | | |
| 17 18 | Maximum | 45 | Median | 33.5 | | | | | | |
| 19 | SD Coefficient of Variation | 6.856 0.193 | Std. Error of Mean Skewness | 3.428 1.241 | | | | | | |
| 20 | - | | | | | | | | | |
| 21 | | | using incremental sampling methodology (ISM) approach, C 2020 and ITRC 2012) for additional guidance, | | | | | | | |
| 23 | | | he Chebyshev UCL for small sample sizes (n < 7). | | | | | | | |
| 24 25 | The Chebyshev UCL of | ften results | in gross overestimates of the mean. | | | | | | | |
| 26 | Refer to the ProUCL 5.2 Tec | hnical Guid | e for a discussion of the Chebyshev UCL. | | | | | | | |
| 27 | | | OF Test | | | | | | | |
| 28 29 | Shapiro Wilk Test Statistic 1% Shapiro Wilk Critical Value | 0.881 0.687 | Shapiro Wilk GOF Test | | | | | | | |
| 30 | 1% Snapiro Wilk Critical Value Lilliefors Test Statistic | 0.687 | Data appear Normal at 1% Significance Level Lilliefors GOF Test | | | | | | | |
| 31 | 1% Lilliefors Critical Value | 0.413 | Data appear Normal at 1% Significance Level | | | | | | | |
| 32 33 | | | t 1% Significance Level | | | | | | | |
| 34 | | | | | | | | | | |
| 35 36 | | suming Nor | mal Distribution | | | | | | | |
| 37 | 95% Normal UCL 95% Student's-t UCL | 43.57 | 95% UCLs (Adjusted for Skewness) 95% Adjusted-CLT UCL (Chen-1995) | 43.41 | | | | | | |
| 38 | 30 % Stadonio 1 002 | 10.07 | 95% Modified-t UCL (Johnson-1978) | 43.92 | | | | | | |
| 39 40 | | Commo | GOF Test | | | | | | | |
| 41 | A-D Test Statistic | 0.371 | Anderson-Darling Gamma GOF Test | | | | | | | |
| 42 | 5% A-D Critical Value | 0.656 | Detected data appear Gamma Distributed at 5% Significance | Level | | | | | | |
| 43 44 | K-S Test Statistic 5% K-S Critical Value | 0.277 0.394 | Kolmogorov-Smirnov Gamma GOF Test Detected data appear Gamma Distributed at 5% Significance | a Lovol | | | | | | |
| 45 | | | stributed at 5% Significance Level | ; Level | | | | | | |
| 46 47 | Note GOF tests | may be unre | eliable for small sample sizes | | | | | | | |
| 47 | | Gamma | Statistics | | | | | | | |
| 49 | k hat (MLE) | 38.07 | k star (bias corrected MLE) | 9.684 | | | | | | |
| 50 51 | Theta hat (MLE) | 0.932 | Theta star (bias corrected MLE) | 3.666 | | | | | | |
| 52 | nu hat (MLE) MLE Mean (bias corrected) | 304.6 35.5 | nu star (bias corrected) MLE Sd (bias corrected) | 77.47 11.41 | | | | | | |
| 53 | | | Approximate Chi Square Value (0.05) | 58.2 | | | | | | |
| 54 55 | Adjusted Level of Significance | N/A | Adjusted Chi Square Value | N/A | | | | | | |
| 56 | Ass | suming Gam | ma Distribution | | | | | | | |
| 57 58 | 95% Approximate Gamma UCL | | 95% Adjusted Gamma UCL | N/A | | | | | | |
| 58 | | Lognorma | GOF Test | | | | | | | |
| 60 | Shapiro Wilk Test Statistic | 0.9 | Shapiro Wilk Lognormal GOF Test | | | | | | | |
| 61 62 | 10% Shapiro Wilk Critical Value | 0.792 | Data appear Lognormal at 10% Significance Level | | | | | | | |
| 63 | Lilliefors Test Statistic 10% Lilliefors Critical Value | 0.246 0.346 | Lilliefors Lognormal GOF Test Data appear Lognormal at 10% Significance Level | | | | | | | |
| 64 | Data appear | Lognormal a | at 10% Significance Level | | | | | | | |
| 65 66 | Note GOF tests | may be unre | eliable for small sample sizes | | | | | | | |
| 67 | | Lognorma | I Statistics | | | | | | | |
| 68 | Minimum of Logged Data | 3.401 | Mean of logged Data | 3.556 | | | | | | |
| 69 70 | Maximum of Logged Data | 3.807 | SD of logged Data | 0.185 | | | | | | |
| 71 | | ıming Logno | ormal Distribution | | | | | | | |
| 72 73 | 95% H-UCL | 46.14 | 90% Chebyshev (MVUE) UCL | 45.3 | | | | | | |
| 74 | 95% Chebyshev (MVUE) UCL 99% Chebyshev (MVUE) UCL | 49.74 68.02 | 97.5% Chebyshev (MVUE) UCL | 55.91 | | | | | | |
| 75 | | | | | | | | | | |
| 76 77 | | | tion Free UCL Statistics | | | | | | | |
| 78 | Data appea | r to tollow a | Discernible Distribution | | | | | | | |
| 79 | | | tribution Free UCLs | | | | | | | |
| 80 81 | 95% CLT UCL | 41.14 | 95% BCA Bootstrap UCL | N/A | | | | | | |
| 82 | 95% Standard Bootstrap UCL 95% Hall's Bootstrap UCL | N/A N/A | 95% Bootstrap-t UCL 95% Percentile Bootstrap UCL | N/A N/A | | | | | | |
| | 20 /0 Hall 5 DOUISHAP UCL | 1 1//-1 | 1 30 /0 L GLOGHING DOORSHAD OCK | 11//3 | | | | | | |

| | Α | В | С | D | E | F | G | Н | I | J | K | L |
|----|--|--------------|----------------|----------------|---------------|--------------|------------------|----------------|--------------|----------------|------------------|-------|
| 83 | | | 90% Ch | ebyshev(Me | an, Sd) UCL | 45.78 | | | 95% Ch | ebyshev(Me | an, Sd) UCL | 50.44 |
| 84 | 97.5% Chebyshev(Mean, Sd) UCL 56.91 99% Chebyshev(Mean, Sd) UCL | | | | | | | | | 69.61 | | |
| 85 | | | | | | | | | | | | |
| 86 | Suggested UCL to Use | | | | | | | | | | | |
| 87 | 95% Student's-t UCL 43.57 | | | | | | | | | | | |
| 88 | | | | | | • | • | | | | | |
| 89 | 1 | Note: Sugges | stions regard | ing the selec | tion of a 95% | UCL are pr | ovided to hel | p the user to | select the m | nost appropria | ate 95% UCL | |
| 90 | Recommendations are based upon data size, data distribution, and skewness using results from simulation studies. | | | | | | | | | | | |
| 91 | Но | wever, simul | lations result | s will not cov | er all Real W | orld data se | ts; for addition | nal insight th | ne user may | want to cons | ult a statistici | an. |
| 92 | | | | | | | | | | | | |

| | A B C D E | F | G H I J K L | | | | | | | | |
|----------|---|------------------|--|--|--|--|--|--|--|--|--|
| 2 | UCL Statis | stics for Unc | ensored Full Data Sets | | | | | | | | |
| 3 | User Selected Options | 4 00 40 DM | | | | | | | | | |
| 5 | Date/Time of Computation ProUCL 5.2 10/28/2024 WorkSheet.xls | 4:03:49 PM | | | | | | | | | |
| 6 | Full Precision OFF | | | | | | | | | | |
| 7 | Confidence Coefficient 95% Number of Bootstrap Operations 2000 | | | | | | | | | | |
| 9 | Number of Booletrap Operations (2000 | | | | | | | | | | |
| 10 11 | GC03-WRB | | | | | | | | | | |
| 12 | G005-W11D | | | | | | | | | | |
| 13 14 | Total Number of Observations | | Statistics Number of Distinct Observations 7 | | | | | | | | |
| 15 | Total Nulliber of Observations | 0 | Number of Missing Observations 0 | | | | | | | | |
| 16 17 | Minimum | | Mean 217.6 Median 186 | | | | | | | | |
| 18 | Maximum SD | | Median 186 Std. Error of Mean 45.41 | | | | | | | | |
| 19 20 | Coefficient of Variation | 0.59 | Skewness 1.408 | | | | | | | | |
| 21 | Note: Sample size is small (e.g., <10), if data | are collected | I using incremental sampling methodology (ISM) approach, | | | | | | | | |
| 22 | refer also to ITRC Tech Reg Guide | on ISM (ITR | C 2020 and ITRC 2012) for additional guidance, | | | | | | | | |
| 23 24 | but note that ITRC may recommend the t-UCL or the Chebyshey UCL for small sample sizes (n < 7). | | | | | | | | | | |
| 25 | | | e for a discussion of the Chebyshev UCL. | | | | | | | | |
| 26 27 | | Normal (| GOF Test | | | | | | | | |
| 28 | Shapiro Wilk Test Statistic | 0.874 | Shapiro Wilk GOF Test | | | | | | | | |
| 29 30 | 1% Shapiro Wilk Critical Value Lilliefors Test Statistic | | Data appear Normal at 1% Significance Level Lilliefors GOF Test | | | | | | | | |
| 31 | 1% Lilliefors Critical Value | 0.333 | Data appear Normal at 1% Significance Level | | | | | | | | |
| 32 33 | | | 1% Significance Level | | | | | | | | |
| 34 | 4 | | | | | | | | | | |
| 35 36 | | mal Distribution | | | | | | | | | |
| 37 | 95% Normal UCL 95% Student's-t UCL | 303.7 | 95% UCLs (Adjusted for Skewness) 95% Adjusted-CLT UCL (Chen-1995) 316.5 | | | | | | | | |
| 38 | | | 95% Modified-t UCL (Johnson-1978) 307.4 | | | | | | | | |
| 40 | 39 40 Gamma GOF Test | | | | | | | | | | |
| 41 | A-D Test Statistic | 0.296 | Anderson-Darling Gamma GOF Test | | | | | | | | |
| 42 43 | 5% A-D Critical Value K-S Test Statistic | | Detected data appear Gamma Distributed at 5% Significance Level Kolmogorov-Smirnov Gamma GOF Test | | | | | | | | |
| 44 | 5% K-S Critical Value | | Detected data appear Gamma Distributed at 5% Significance Level | | | | | | | | |
| 45 46 | | | stributed at 5% Significance Level | | | | | | | | |
| 47 | Note GOF tests | iliay be ullik | eliable for Striali Sample Sizes | | | | | | | | |
| 48 49 | L bot (MI E) | | Statistics | | | | | | | | |
| 50 | k hat (MLE) Theta hat (MLE) | | k star (bias corrected MLE) 2.409 Theta star (bias corrected MLE) 90.35 | | | | | | | | |
| 51 52 | nu hat (MLE) | | nu star (bias corrected) 38.54 | | | | | | | | |
| 53 | MLE Mean (bias corrected) | 217.6 | MLE Sd (bias corrected) 140.2 Approximate Chi Square Value (0.05) 25.32 | | | | | | | | |
| 54 | Adjusted Level of Significance | 0.0195 | Adjusted Chi Square Value 22.65 | | | | | | | | |
| 55 56 | Δς | sumina Gam | nma Distribution | | | | | | | | |
| 57 | 95% Approximate Gamma UCL | | 95% Adjusted Gamma UCL 370.3 | | | | | | | | |
| 58 59 | | Loanorma | I GOF Test | | | | | | | | |
| 60 | Shapiro Wilk Test Statistic | 0.968 | Shapiro Wilk Lognormal GOF Test | | | | | | | | |
| 61 62 | 10% Shapiro Wilk Critical Value Lilliefors Test Statistic | | Data appear Lognormal at 10% Significance Level Lilliefors Lognormal GOF Test | | | | | | | | |
| 63 | 10% Lilliefors Critical Value | 0.265 | Data appear Lognormal at 10% Significance Level | | | | | | | | |
| 64 65 | | | at 10% Significance Level | | | | | | | | |
| 66 | Note GOF tests | may be unite | eliable for small sample sizes | | | | | | | | |
| 67 68 | NO. 17 | | I Statistics | | | | | | | | |
| 69 | Minimum of Logged Data Maximum of Logged Data | | Mean of logged Data 5.242 SD of logged Data 0.566 | | | | | | | | |
| 70 | | | | | | | | | | | |
| 71 72 | | | prmal Distribution 90% Chebyshev (MVUE) UCL 349 | | | | | | | | |
| 73 | 95% Chebyshev (MVUE) UCL | 408.7 | 97.5% Chebyshev (MVUE) UCL 491.6 | | | | | | | | |
| 74 75 | 99% Chebyshev (MVUE) UCL | 654.5 | | | | | | | | | |
| 76 | | | tion Free UCL Statistics | | | | | | | | |
| 77 78 | Data appea | ar to follow a | Discernible Distribution | | | | | | | | |
| 79 | Nonpa | rametric Dis | tribution Free UCLs | | | | | | | | |
| 80 | 95% CLT UCL | 292.3 | 95% BCA Bootstrap UCL 312.8 | | | | | | | | |
| 81 82 | 95% Standard Bootstrap UCL 95% Hall's Bootstrap UCL | | 95% Bootstrap-t UCL 347.9 95% Percentile Bootstrap UCL 293.4 | | | | | | | | |
| | JO /0 I Idii S DODISII AP OCL | 000.1 | 35 /6 1 Crochine Doubling OCL 233.4 | | | | | | | | |

| | Α | В | С | D | E | F | G | Н | I | J | K | L |
|----|--|--------------|----------------|----------------|---------------|--------------|------------------|----------------|--------------|----------------|-----------------|-------|
| 83 | | | 90% Ch | ebyshev(Me | an, Sd) UCL | 353.9 | | | 95% Ch | ebyshev(Me | an, Sd) UCL | 415.6 |
| 84 | 97.5% Chebyshev(Mean, Sd) UCL 501.2 99% Chebyshev(Mean, Sd) UCL | | | | | | | | | 669.5 | | |
| 85 | | | | | | | | | | | | |
| 86 | Suggested UCL to Use | | | | | | | | | | | |
| 87 | 95% Student's-t UCL 303.7 | | | | | | | | | | | |
| 88 | | | | | | • | • | | | | | |
| 89 | 1 | Note: Sugges | stions regard | ing the selec | tion of a 95% | UCL are pr | ovided to hel | p the user to | select the m | nost appropria | ate 95% UCL | |
| 90 | Recommendations are based upon data size, data distribution, and skewness using results from simulation studies. | | | | | | | | | | | |
| 91 | Но | wever, simul | lations result | s will not cov | er all Real W | orld data se | ts; for addition | nal insight th | ne user may | want to cons | ult a statistic | an. |
| 92 | | | | | | | | | | | | |

| 1 | A B C D | E UCL Statis | F stics for Unc | G H I J K L ensored Full Data Sets |
|----------------------------|-------------------------------------|---|-----------------------------|---|
| 2 | | | | |
| 3 | User Selected Options | | | |
| 5 | | 5.2 10/31/2024 3 Input.xls | 3:44:08 PM | |
| 6 | Full Precision OFF | присла | | |
| 7 | Confidence Coefficient 95% | | | |
| 8 | Number of Bootstrap Operations 2000 | | | |
| 9 | | | | |
| | GC5-WRA-0.5-1 | | | |
| 12 | GC5-WRA-0.5-1 | | | |
| 13 | | | General | Statistics |
| 14 | Total Number | of Observations | 4 | Number of Distinct Observations 4 |
| 15 | | | 00 | Number of Missing Observations 0 |
| 16 17 | | Minimum Maximum | 86 133 | Mean 99.5 Median 89.5 |
| 18 | | SD | 22.4 | Std. Error of Mean 11.2 |
| 19 | Coeffic | cient of Variation | 0.225 | Skewness 1.965 |
| 20 | | | | |
| 21 22 | Note: Sample size is small (e.g | g., <10), if data a | are collected | using incremental sampling methodology (ISM) approach, |
| 23 | | | | C 2020 and ITRC 2012) for additional guidance, he Chebyshev UCL for small sample sizes (n < 7). |
| 24 | | | | in gross overestimates of the mean. |
| 25 | Refer to the | ProUCL 5.2 Tec | hnical Guide | e for a discussion of the Chebyshev UCL. |
| 26 | | | | - |
| 27 28 | Object 1 M | Silk Took Ok-21-21 | | GOF Test |
| 29 | | ilk Test Statistic | 0.7 0.687 | Shapiro Wilk GOF Test Data appear Normal at 1% Significance Level |
| 30 | | ors Test Statistic | 0.067 | Lilliefors GOF Test |
| 31 | 1% Lilliefo | rs Critical Value | 0.413 | Data Not Normal at 1% Significance Level |
| 32 | D | ata appear Appi | roximate No | rmal at 1% Significance Level |
| 33 34 | | Note GOF tests | may be unre | eliable for small sample sizes |
| 35 | | Λα. | ouming Norr | mal Distribution |
| 36 | 95% Normal UC | | Summy Non | mal Distribution 95% UCLs (Adjusted for Skewness) |
| 37 | | Student's-t UCL | 125.9 | 95% Adjusted-CLT UCL (Chen-1995) 129.7 |
| 38 | | | | 95% Modified-t UCL (Johnson-1978) 127.7 |
| 39 40 | | | | 0057 |
| 41 | Δ | -D Test Statistic | 0.775 | GOF Test Anderson-Darling Gamma GOF Test |
| 42 | | D Critical Value | 0.773 | Data Not Gamma Distributed at 5% Significance Level |
| 43 | | -S Test Statistic | 0.433 | Kolmogorov-Smirnov Gamma GOF Test |
| 44 | 5% K | -S Critical Value | 0.394 | Data Not Gamma Distributed at 5% Significance Level |
| 45 46 | | Data Not Gamr | na Distribute | ed at 5% Significance Level |
| 47 | | | Gamma | Statistics |
| 48 | | k hat (MLE) | 29.8 | k star (bias corrected MLE) 7.617 |
| 49 | | Theta hat (MLE) | 3.339 | Theta star (bias corrected MLE) 13.06 |
| 50 | | nu hat (MLE) | 238.4 | nu star (bias corrected) 60.93 |
| 51 52 | MLE Mean | (bias corrected) | 99.5 | MLE Sd (bias corrected) 36.05 Approximate Chi Square Value (0.05) 43.98 |
| 53 | Adjusted Leve | l of Significance | N/A | Approximate Chi Square Value (0.05) 43.98 Adjusted Chi Square Value N/A |
| 54 | Aujustou Leve | . or organicance | 1 1// 1 | / Aujustica Offi Oquato Value 19/A |
| 55 | | | | ma Distribution |
| 56 | 95% Approxima | ite Gamma UCL | 137.9 | 95% Adjusted Gamma UCL N/A |
| 57 58 | | | Lognormal | GOF Test |
| 59 | Shaniro W | ilk Test Statistic | Lognormai 0.717 | Shapiro Wilk Lognormal GOF Test |
| 60 | | ilk Critical Value | 0.792 | Data Not Lognormal at 10% Significance Level |
| 61 | Lilliefo | ors Test Statistic | 0.408 | Lilliefors Lognormal GOF Test |
| 62 63 | 10% Lilliefo | rs Critical Value | 0.346 | Data Not Lognormal at 10% Significance Level |
| 64 | | Data Not Lo | ognormal at | 10% Significance Level |
| 65 | | | Lognorma | I Statistics |
| 66 | Minimum | of Logged Data | 4.454 | Mean of logged Data 4.583 |
| 67 | | of Logged Data | 4.89 | SD of logged Data 0.206 |
| 68 69 | | A | mala e I · · · | armal Distribution |
| 70 | | 95% H-UCL | <u>ıming Logno</u> 134.1 | prmal Distribution 90% Chebyshev (MVUE) UCL 130 |
| 71 | 95% Chehysh | ev (MVUE) UCL | 143.8 | 97.5% Chebyshev (MVUE) UCL 163 |
| 72 | | ev (MVUE) UCL | 200.7 | |
| 73 | | | | |
| 74 | | | | tion Free UCL Statistics |
| | | Data appea | r to follow a | Discernible Distribution |
| 75 76 | | Nonnar | ametric Dist | tribution Free UCLs |
| 76 | | itolipal | | |
| 76 77 78 | | 95% CLT UCL | 117.9 | 95% BCA Bootstrap UCL N/A |
| 76 77 78 79 | | 95% CLT UCL Bootstrap UCL | N/A | 95% Bootstrap-t UCL N/A |
| 76 77 78 79 80 | 95% Hall's | 95% CLT UCL d Bootstrap UCL s Bootstrap UCL | N/A N/A | 95% Bootstrap-t UCL N/A 95% Percentile Bootstrap UCL N/A |
| 76 77 78 79 | | 95% CLT UCL d Bootstrap UCL s Bootstrap UCL (Mean, Sd) UCL | N/A | 95% Bootstrap-t UCL N/A |

| | Α | В | С | D | E | F | G | Н | I | J | K | L |
|----|----------------------|---------------------------|----------------|----------------|---------------|----------------|------------------|----------------|----------------|--------------|-----------------|------|
| 83 | | | | | | | | | | | | |
| 84 | Suggested UCL to Use | | | | | | | | | | | |
| 85 | | 95% Student's-t UCL 125.9 | | | | | | | | | | |
| 86 | | | | | | | | | | | | |
| 87 | | | Wher | n a data set f | ollows an app | oroximate dis | stribution pas | sing only on | e of the GOF | tests, | | |
| 88 | | | it is su | ggested to us | se a UCL bas | sed upon a d | istribution pa | ssing both C | OF tests in F | ProUCL | | |
| 89 | | | | | | | | | | | | |
| 90 | 1 | Note: Sugges | stions regard | ling the selec | tion of a 95% | 6 UCL are pr | ovided to hel | p the user to | select the m | ost appropri | ate 95% UCI | |
| 91 | | Recom | mendations | are based up | on data size | , data distrib | ution, and sk | ewness usin | g results fron | n simulation | studies. | |
| 92 | Но | wever, simu | lations result | s will not cov | er all Real V | /orld data se | ts; for addition | nal insight th | ne user may v | want to cons | ult a statistic | ian. |
| 93 | | | | | | | | | | | | |

| 4 | A B C D E | F | G H I J K | L | | | | | | |
|----------|---|----------------|--|----------------|--|--|--|--|--|--|
| 2 | UCL Statis | stics for Unc | ensored Full Data Sets | | | | | | | |
| 3 | User Selected Options | | | | | | | | | |
| 4 5 | Date/Time of Computation ProUCL 5.2 10/31/2024 3 From File ProUCL Input.xls | 3:45:38 PM | | | | | | | | |
| 6 | Full Precision OFF | | | | | | | | | |
| 7 | Confidence Coefficient 95% | | | | | | | | | |
| 8 | Number of Bootstrap Operations 2000 | | | | | | | | | |
| 10 | | | | | | | | | | |
| 11 | GC5-WRA-0.5-2 | | | | | | | | | |
| 12 13 | | General | Statistics | | | | | | | |
| 14 | Total Number of Observations | 4 | Number of Distinct Observations | 4 | | | | | | |
| 15 16 | | E 4 | Number of Missing Observations | 0 | | | | | | |
| 17 | Minimum Maximum | 54 81 | Mean Median | 69 70.5 | | | | | | |
| 18 | SD | 11.17 | Std. Error of Mean | 5.583 | | | | | | |
| 19 20 | Coefficient of Variation | 0.162 | Skewness | -0.785 | | | | | | |
| 21 | Note: Sample size is small (e.g., <10), if data ε | are collected | using incremental sampling methodology (ISM) approach, | | | | | | | |
| 22 | refer also to ITRC Tech Reg Guide of | on ISM (ITR | C 2020 and ITRC 2012) for additional guidance, | | | | | | | |
| 23 24 | | | he Chebyshev UCL for small sample sizes (n < 7). | | | | | | | |
| 25 | | | in gross overestimates of the mean. e for a discussion of the Chebyshev UCL. | | | | | | | |
| 26 | | | • | | | | | | | |
| 27 28 | Shapiro Wilk Test Statistic | | GOF Test Shapiro Wilk GOF Test | | | | | | | |
| 29 | 1% Shapiro Wilk Critical Value | | Data appear Normal at 1% Significance Level | | | | | | | |
| 30 | Lilliefors Test Statistic | 0.286 | Lilliefors GOF Test | | | | | | | |
| 31 32 | 1% Lilliefors Critical Value | | Data appear Normal at 1% Significance Level 1% Significance Level | | | | | | | |
| 33 | | | liable for small sample sizes | | | | | | | |
| 34 35 | | | | | | | | | | |
| 36 | Ass | suming Nori | nal Distribution 95% UCLs (Adjusted for Skewness) | | | | | | | |
| 37 | 95% Student's-t UCL | 82.14 | 95% Adjusted for Skewness) 95% Adjusted-CLT UCL (Chen-1995) | 75.84 | | | | | | |
| 38 | | | 95% Modified-t UCL (Johnson-1978) | 81.77 | | | | | | |
| 39 40 | | Gamma | GOF Test | | | | | | | |
| 41 | A-D Test Statistic | 0.359 | Anderson-Darling Gamma GOF Test | | | | | | | |
| 42 43 | 5% A-D Critical Value | 0.656 | Detected data appear Gamma Distributed at 5% Significance | Level | | | | | | |
| 43 | K-S Test Statistic 5% K-S Critical Value | | Kolmogorov-Smirnov Gamma GOF Test Detected data appear Gamma Distributed at 5% Significance | l evel | | | | | | |
| 45 | Detected data appear | r Gamma Di | stributed at 5% Significance Level | LOVOI | | | | | | |
| 46 47 | Note GOF tests | may be unre | eliable for small sample sizes | | | | | | | |
| 48 | | Gamma | Statistics | | | | | | | |
| 49 | k hat (MLE) | 47.99 | k star (bias corrected MLE) | 12.16 | | | | | | |
| 50 51 | Theta hat (MLE) | | Theta star (bias corrected MLE) | 5.672 | | | | | | |
| 52 | nu hat (MLE) MLE Mean (bias corrected) | | nu star (bias corrected) MLE Sd (bias corrected) | 97.32 19.78 | | | | | | |
| 53 | | | Approximate Chi Square Value (0.05) | 75.56 | | | | | | |
| 54 55 | Adjusted Level of Significance | N/A | Adjusted Chi Square Value | N/A | | | | | | |
| 56 | Ass | suming Gam | ma Distribution | | | | | | | |
| 57 | 95% Approximate Gamma UCL | | 95% Adjusted Gamma UCL | N/A | | | | | | |
| 58 59 | | Lognorma | GOF Test | | | | | | | |
| 60 | Shapiro Wilk Test Statistic | 0.914 | Shapiro Wilk Lognormal GOF Test | | | | | | | |
| 61 62 | 10% Shapiro Wilk Critical Value | 0.792 | Data appear Lognormal at 10% Significance Level | | | | | | | |
| 63 | Lilliefors Test Statistic 10% Lilliefors Critical Value | | Lilliefors Lognormal GOF Test Data appear Lognormal at 10% Significance Level | | | | | | | |
| 64 | Data appear | Lognormal a | at 10% Significance Level | | | | | | | |
| 65 66 | Note GOF tests | may be unre | eliable for small sample sizes | | | | | | | |
| 67 | | Lognorma | I Statistics | | | | | | | |
| 68 | Minimum of Logged Data | 3.989 | Mean of logged Data | 4.224 | | | | | | |
| 69 70 | Maximum of Logged Data | 4.394 | SD of logged Data | 0.17 | | | | | | |
| 71 | Assı | umina Loana | ormal Distribution | | | | | | | |
| 72 | 95% H-UCL | 87.48 | 90% Chebyshev (MVUE) UCL | 86.55 | | | | | | |
| 73 74 | 95% Chebyshev (MVUE) UCL 99% Chebyshev (MVUE) UCL | 94.49 127.2 | 97.5% Chebyshev (MVUE) UCL | 105.5 | | | | | | |
| 75 | 99% Chebysnev (MIVUE) UCL | 121.2 | <u> </u> | | | | | | | |
| 76 | | | tion Free UCL Statistics | | | | | | | |
| 77 78 | Data appea | r to follow a | Discernible Distribution | | | | | | | |
| 79 | Nonpar | rametric Dis | tribution Free UCLs | | | | | | | |
| 80 | 95% CLT UCL | 78.18 | 95% BCA Bootstrap UCL | N/A | | | | | | |
| 81 | 95% Standard Bootstrap UCL 95% Hall's Bootstrap UCL | N/A N/A | 95% Bootstrap-t UCL 95% Percentile Bootstrap UCL | N/A N/A | | | | | | |
| 82 | | IN/A | 95% Percentile Bootstran UCL | IN/A | | | | | | |

| | Α | В | С | D | E | F | G | Н | I | J | K | L |
|----|----------------------|---------------------------|----------------|----------------|---------------|----------------|--------------------|--------------------|----------------|--------------|-----------------|-------|
| 83 | | | 90% Ch | ebyshev(Mea | an, Sd) UCL | 85.75 | | | 95% Ch | ebyshev(Me | an, Sd) UCL | 93.33 |
| 84 | | | 97.5% Ch | ebyshev(Mea | an, Sd) UCL | 103.9 | | | 99% Ch | ebyshev(Me | an, Sd) UCL | 124.5 |
| 85 | | | | | | | | | | | | |
| 86 | Suggested UCL to Use | | | | | | | | | | | |
| 87 | | 95% Student's-t UCL 82.14 | | | | | | | | | | |
| 88 | | | | Red | commended | UCL exceed | is the maxim | <u>num observa</u> | ition | | | |
| 89 | | | | | | | | | | | | |
| 90 | 1 | Note: Sugges | stions regard | ing the selec | tion of a 95% | UCL are pr | ovided to hel | p the user to | select the m | ost appropri | ate 95% UCL | |
| 91 | | Recom | mendations | are based up | on data size | , data distrib | ution, and sk | ewness usin | g results fror | n simulation | studies. | |
| 92 | Ho | wever, simu | lations result | s will not cov | er all Real W | orld data se | ts; for addition | nal insight th | ne user may | want to cons | ult a statistic | ian. |
| 93 | | | | | | | | | | | | |
| 94 | | Note: For | highly negat | ively-skewe | d data, confi | dence limits | (e.g., Chen, | Johnson, Lo | ognormal, ar | nd Gamma) ı | may not be | |
| 95 | | | reliable. | Chen's and J | ohnson's m | ethods provi | <u>de adjustme</u> | nts for posit | vely skewed | data sets. | | |
| 96 | | | | | | | | | | | | |

| 1 | A B C D E | F tics for Unc | G H I J K L |
|----------|---|-------------------|---|
| 2 | | uco ioi one | iconsored Full Data Octo |
| 3 | User Selected Options |), 47, 47 DN4 | |
| 5 | Date/Time of Computation ProUCL 5.2 10/31/2024 3 From File ProUCL Input.xls | 3:47:17 PIVI | <u> </u> |
| 6 | Full Precision OFF | | |
| 7 | Confidence Coefficient 95% | | |
| 9 | Number of Bootstrap Operations 2000 | | |
| 10 | | | |
| 11 | GC5-WRA-0.5-3 | | |
| 13 | | General | al Statistics |
| 14 | Total Number of Observations | 10 | Number of Distinct Observations 10 |
| 15 16 | Minimum | 253 | Number of Missing Observations 0 Mean 347.6 |
| 17 | Maximum | 446 | Median 351 |
| 18 19 | SD | 62.31 | Std. Error of Mean 19.71 |
| 20 | Coefficient of Variation | 0.179 | Skewness 0.00327 |
| 21 | | Normal (| GOF Test |
| 22 | Shapiro Wilk Test Statistic | 0.977 | Shapiro Wilk GOF Test |
| 23 24 | 1% Shapiro Wilk Critical Value Lilliefors Test Statistic | 0.781 0.0962 | Data appear Normal at 1% Significance Level Lilliefors GOF Test |
| 25 | 1% Lilliefors Critical Value | 0.304 | Data appear Normal at 1% Significance Level |
| 26 27 | Data appea | ar Normal a | at 1% Significance Level |
| 28 | Δος | sumina Nor | ormal Distribution |
| 29 | 95% Normal UCL | | 95% UCLs (Adjusted for Skewness) |
| 30 31 | 95% Student's-t UCL | 383.7 | 95% Adjusted-CLT UCL (Chen-1995) 380 95% Modified-t UCL (Johnson-1978) 383.7 |
| 32 | | | 1 33% Woullieu-t OCL (301118011-1976)] 383.7 |
| 33 | | | GOF Test |
| 34 35 | A-D Test Statistic 5% A-D Critical Value | 0.173 0.724 | Anderson-Darling Gamma GOF Test Detected data appear Gamma Distributed at 5% Significance Level |
| 36 | K-S Test Statistic | 0.724 | Kolmogorov-Smirnov Gamma GOF Test |
| 37 | 5% K-S Critical Value | 0.266 | Detected data appear Gamma Distributed at 5% Significance Level |
| 38 39 | Detected data appear | Gamma Di | Distributed at 5% Significance Level |
| 40 | | | a Statistics |
| 41 | k hat (MLE) | 33.76 | k star (bias corrected MLE) 23.7 |
| 42 43 | Theta hat (MLE) nu hat (MLE) | 10.3 675.1 | Theta star (bias corrected MLE) 14.67 nu star (bias corrected) 473.9 |
| 44 | MLE Mean (bias corrected) | 347.6 | MLE Sd (bias corrected) 71.41 |
| 45 46 | Adjusted Lovel of Cignificance | 0.0267 | Approximate Chi Square Value (0.05) 424.4 |
| 47 | Adjusted Level of Significance | 0.0267 | Adjusted Chi Square Value 416.3 |
| 48 | | | mma Distribution |
| 49 50 | 95% Approximate Gamma UCL | 388.1 | 95% Adjusted Gamma UCL 395.7 |
| 51 | | Lognorma | al GOF Test |
| 52 | Shapiro Wilk Test Statistic | 0.971 | Shapiro Wilk Lognormal GOF Test |
| 53 54 | 10% Shapiro Wilk Critical Value Lilliefors Test Statistic | 0.869 0.122 | Data appear Lognormal at 10% Significance Level Lilliefors Lognormal GOF Test |
| 55 | 10% Lilliefors Critical Value | 0.241 | Data appear Lognormal at 10% Significance Level |
| 56 57 | Data appear | Lognormal | l at 10% Significance Level |
| 58 | | Lognorma | nal Statistics |
| 59 | Minimum of Logged Data | 5.533 | Mean of logged Data 5.836 |
| 60 61 | Maximum of Logged Data | 6.1 | SD of logged Data 0.183 |
| 62 | Assu | ıming Logno | normal Distribution |
| 63 | 95% H-UCL | 390.4 | 90% Chebyshev (MVUE) UCL 408.3 |
| 64 65 | 95% Chebyshev (MVUE) UCL 99% Chebyshev (MVUE) UCL | 435.8 548.9 | 97.5% Chebyshev (MVUE) UCL 474 |
| 66 | 99 /0 Griebysnev (NIVOE) UCL | J-U.J | |
| 67 68 | | | oution Free UCL Statistics |
| 69 | Data appea | r to tollow a | a Discernible Distribution |
| 70 | | ametric Dis | istribution Free UCLs |
| 71 72 | 95% CLT UCL | 380 | 95% BCA Bootstrap UCL 376.1 |
| 73 | 95% Standard Bootstrap UCL 95% Hall's Bootstrap UCL | 377.9 379.6 | 95% Bootstrap-t UCL 383.9 95% Percentile Bootstrap UCL 376.8 |
| 74 | 90% Chebyshev(Mean, Sd) UCL | 406.7 | 95% Chebyshev(Mean, Sd) UCL 433.5 |
| 75 76 | 97.5% Chebyshev(Mean, Sd) UCL | 470.7 | 99% Chebyshev(Mean, Sd) UCL 543.7 |
| 76 | | Suggested | d UCL to Use |
| 78 | 95% Student's-t UCL | 383.7 | |
| 79 80 | Nets Corrections and the desired of the Correction | 1101 - | annidad to hale the years and other was to see the second of the second |
| 81 | | | provided to help the user to select the most appropriate 95% UCL. ibution, and skewness using results from simulation studies. |
| 82 | | | sets; for additional insight the user may want to consult a statistician. |
| | | | |

83 B C D E F G H I J K L

| 1 | A B C D E | F tics for Unc | G H I J K L censored Full Data Sets | |
|----------|---|-------------------|---|-----------|
| 2 | | 101 0110 | cerisored i dii bata ees | |
| 3 | User Selected Options |). 40.E0 DN4 | | |
| 5 | Date/Time of Computation ProUCL 5.2 10/31/2024 3 From File ProUCL Input.xls | 3:48:52 PIVI | | |
| 6 | Full Precision OFF | | | |
| 7 | Confidence Coefficient 95% | | | |
| 9 | Number of Bootstrap Operations 2000 | | | |
| 10 | | | | |
| 11 | GC5-WRA-0.5-4 | | | |
| 13 | | General | I Statistics | |
| 14 | Total Number of Observations | 10 | Number of Distinct Observations 10 | |
| 15 16 | Minimum | 81 | Number of Missing Observations 0 Mean 149.7 | , |
| 17 | Maximum | 302 | Median 124 | |
| 18 19 | SD | 69.36 | Std. Error of Mean 21.9 | |
| 20 | Coefficient of Variation | 0.463 | Skewness 1.3 | 94 |
| 21 | | Normal (| GOF Test | |
| 22 | Shapiro Wilk Test Statistic | 0.851 | Shapiro Wilk GOF Test | |
| 23 24 | 1% Shapiro Wilk Critical Value Lilliefors Test Statistic | 0.781 0.207 | Data appear Normal at 1% Significance Level Lilliefors GOF Test | |
| 25 | 1% Lilliefors Critical Value | 0.304 | Data appear Normal at 1% Significance Level | |
| 26 27 | Data appea | ar Normal a | at 1% Significance Level | |
| 28 | Δος | sumina Nor | rmal Distribution | |
| 29 | 95% Normal UCL | | 95% UCLs (Adjusted for Skewness) | |
| 30 31 | 95% Student's-t UCL | 189.9 | 95% Adjusted-CLT UCL (Chen-1995) 196.1 95% Modified-t UCL (Johnson-1978) 191.5 | |
| 32 | | | 95 % Modified-t OCE (301115011-1978) 191.5 | , |
| 33 | | | GOF Test | |
| 34 35 | A-D Test Statistic 5% A-D Critical Value | 0.443 0.728 | Anderson-Darling Gamma GOF Test Detected data appear Gamma Distributed at 5% Significance Leve | اد |
| 36 | K-S Test Statistic | 0.728 | Kolmogorov-Smirnov Gamma GOF Test | 51 |
| 37 | 5% K-S Critical Value | 0.267 | Detected data appear Gamma Distributed at 5% Significance Leve | el |
| 38 39 | Detected data appear | Gamma Di | istributed at 5% Significance Level | |
| 40 | | | Statistics | |
| 41 | k hat (MLE) | 6.209 | k star (bias corrected MLE) 4.4 | |
| 42 43 | Theta hat (MLE) nu hat (MLE) | 24.11 124.2 | Theta star (bias corrected MLE) 33.9 nu star (bias corrected) 88.2 | |
| 44 | MLE Mean (bias corrected) | 149.7 | MLE Sd (bias corrected) 71.2 | 26 |
| 45 46 | Adjusted Level of Cignificance | 0.0267 | Approximate Chi Square Value (0.05) 67.6 Adjusted Chi Square Value 64.4 | |
| 47 | Adjusted Level of Significance | 0.0267 | Adjusted Chi Square Value 64.4 | + / |
| 48 | | | mma Distribution | |
| 49 50 | 95% Approximate Gamma UCL | 195.4 | 95% Adjusted Gamma UCL 205 | |
| 51 | | Lognorma | al GOF Test | |
| 52 53 | Shapiro Wilk Test Statistic | 0.934 | Shapiro Wilk Lognormal GOF Test | |
| 54 | 10% Shapiro Wilk Critical Value Lilliefors Test Statistic | 0.869 0.192 | Data appear Lognormal at 10% Significance Level Lilliefors Lognormal GOF Test | |
| 55 | 10% Lilliefors Critical Value | 0.241 | Data appear Lognormal at 10% Significance Level | |
| 56 57 | Data appear l | Lognormal a | at 10% Significance Level | |
| 58 | | Lognorma | al Statistics | |
| 59 | Minimum of Logged Data | 4.394 | Mean of logged Data 4.9 | |
| 60 61 | Maximum of Logged Data | 5.71 | SD of logged Data 0.4 | 14 |
| 62 | | | ormal Distribution | |
| 63 64 | 95% H-UCL | 200.8 | 90% Chebyshev (MVUE) UCL 208 |] |
| 65 | 95% Chebyshev (MVUE) UCL 99% Chebyshev (MVUE) UCL | 234.8 345.2 | 97.5% Chebyshev (MVUE) UCL 272 | |
| 66 | | | | |
| 67 68 | | | ution Free UCL Statistics | |
| 69 | Data appea | i to follow a | a Discernible Distribution | |
| 70 | | | stribution Free UCLs | |
| 71 72 | 95% CLT UCL 95% Standard Bootstrap UCL | 185.8 183.3 | 95% BCA Bootstrap UCL 192.6 95% Bootstrap-t UCL 222.5 | |
| 73 | 95% Standard Bootstrap UCL 95% Hall's Bootstrap UCL | 343.6 | 95% Bootstrap t UCL 222.s | |
| 74 | 90% Chebyshev(Mean, Sd) UCL | 215.5 | 95% Chebyshev(Mean, Sd) UCL 245.3 | 3 |
| 75 76 | 97.5% Chebyshev(Mean, Sd) UCL | 286.7 | 99% Chebyshev(Mean, Sd) UCL 367.9 |) |
| 77 | | Suggested | i UCL to Use | |
| 78 | 95% Student's-t UCL | 189.9 | | |
| 79 80 | Note: Suggestions regarding the selection of a 0E9/ | LICL aro pr | provided to help the user to select the most appropriate 95% UCL. | |
| 81 | | | bution, and skewness using results from simulation studies. | |
| 82 | | | ets; for additional insight the user may want to consult a statistician. | |
| | | | | |

83 B C D E F G H I J K L

| 4 | A B C D E | F | G H I J K | L |
|----------|--|----------------|--|----------------|
| 2 | UCL Statis | stics for Unc | ensored Full Data Sets | |
| 3 | User Selected Options | | | , |
| 4 5 | Date/Time of Computation ProUCL 5.2 10/31/2024 3 | 3:50:46 PM | | |
| 6 | Full Precision OFF | | | |
| 7 | Confidence Coefficient 95% | | | |
| 8 | Number of Bootstrap Operations 2000 | | | |
| 10 | | | | |
| 11 | GC5-WRA-0.5-4-DS | | | |
| 12 13 | | General | Statistics | |
| 14 | Total Number of Observations | 4 | Number of Distinct Observations | 4 |
| 15 16 | Minimum | F.C. | Number of Missing Observations | 0 |
| 17 | Minimum Maximum | 56 76 | Mean Median | 67.75 69.5 |
| 18 | SD | 9.179 | Std. Error of Mean | 4.589 |
| 19 20 | Coefficient of Variation | 0.135 | Skewness | -0.722 |
| 21 | Note: Sample size is small (e.g., <10), if data a | are collected | using incremental sampling methodology (ISM) approach, | |
| 22 | refer also to ITRC Tech Reg Guide of | on ISM (ITR | C 2020 and ITRC 2012) for additional guidance, | |
| 23 24 | | | he Chebyshev UCL for small sample sizes (n < 7). | |
| 25 | | | in gross overestimates of the mean. e for a discussion of the Chebyshev UCL. | |
| 26 | | | • | |
| 27 28 | Shapiro Wilk Test Statistic | | GOF Test Shapiro Wilk GOF Test | |
| 29 | 1% Shapiro Wilk Critical Value | | Data appear Normal at 1% Significance Level | |
| 30 | Lilliefors Test Statistic | 0.252 | Lilliefors GOF Test | |
| 31 32 | 1% Lilliefors Critical Value | | Data appear Normal at 1% Significance Level 1 1% Significance Level | |
| 33 | | | eliable for small sample sizes | |
| 34 35 | | | | |
| 36 | As: 95% Normal UCL | suming Nor | mal Distribution 95% UCLs (Adjusted for Skewness) | |
| 37 | 95% Student's-t UCL | 78.55 | 95% Adjusted-CLT UCL (Chen-1995) | 73.53 |
| 38 | | | 95% Modified-t UCL (Johnson-1978) | 78.27 |
| 39 40 | | Gamma | GOF Test | |
| 41 | A-D Test Statistic | 0.336 | Anderson-Darling Gamma GOF Test | |
| 42 43 | 5% A-D Critical Value | | Detected data appear Gamma Distributed at 5% Significance | Level |
| 43 | K-S Test Statistic 5% K-S Critical Value | | Kolmogorov-Smirnov Gamma GOF Test Detected data appear Gamma Distributed at 5% Significance | Level |
| 45 | Detected data appear | r Gamma Di | stributed at 5% Significance Level | LOVOI |
| 46 47 | Note GOF tests | may be unre | eliable for small sample sizes | |
| 48 | | Gamma | Statistics | |
| 49 | k hat (MLE) | 69.71 | k star (bias corrected MLE) | 17.59 |
| 50 51 | Theta hat (MLE) | | Theta star (bias corrected MLE) nu star (bias corrected) | 3.851 140.7 |
| 52 | nu hat (MLE) MLE Mean (bias corrected) | | MLE Sd (bias corrected) | 16.15 |
| 53 | | | Approximate Chi Square Value (0.05) | 114.3 |
| 54 55 | Adjusted Level of Significance | N/A | Adjusted Chi Square Value | N/A |
| 56 | Ass | suming Gam | ma Distribution | |
| 57 50 | 95% Approximate Gamma UCL | | | N/A |
| 58 59 | | Lonnorma | GOF Test | |
| 60 | Shapiro Wilk Test Statistic | 0.913 | Shapiro Wilk Lognormal GOF Test | |
| 61 62 | 10% Shapiro Wilk Critical Value | | Data appear Lognormal at 10% Significance Level | |
| 63 | Lilliefors Test Statistic 10% Lilliefors Critical Value | | Lilliefors Lognormal GOF Test Data appear Lognormal at 10% Significance Level | |
| 64 | Data appear | Lognormal a | at 10% Significance Level | |
| 65 66 | Note GOF tests | may be unre | eliable for small sample sizes | |
| 67 | | Lognorma | I Statistics | |
| 68 | Minimum of Logged Data | 4.025 | Mean of logged Data | 4.209 |
| 69 70 | Maximum of Logged Data | 4.331 | SD of logged Data | 0.14 |
| 71 | Assı | uming Loand | ormal Distribution | |
| 72 | 95% H-UCL | 81.87 | 90% Chebyshev (MVUE) UCL | 81.97 |
| 73 74 | 95% Chebyshev (MVUE) UCL 99% Chebyshev (MVUE) UCL | 88.4 114.9 | 97.5% Chebyshev (MVUE) UCL | 97.33 |
| 75 | 99% Criebysnev (MVUE) UCL | 114.9 | <u> </u> | |
| 76 | | | tion Free UCL Statistics | |
| 77 78 | Data appea | ar to follow a | Discernible Distribution | |
| 79 | Nonpar | rametric Dis | tribution Free UCLs | |
| 80 | 95% CLT UCL | 75.3 | 95% BCA Bootstrap UCL | N/A |
| 81 82 | 95% Standard Bootstrap UCL | N/A | | N/A |
| UZ | 95% Hall's Bootstrap UCL | N/A | 95% Percentile Bootstrap UCL | N/A |

| | A B C D E F G H I J | | | | | | | | | | K | L |
|----|----------------------|--------------|----------------|----------------|---------------|----------------|------------------|----------------|----------------|---------------|-----------------|-------|
| 83 | | - | 90% Ch | ebyshev(Me | an, Sd) UCL | 81.52 | | | 95% Ch | ebyshev(Me | an, Sd) UCL | 87.75 |
| 84 | | | 97.5% Ch | ebyshev(Me | an, Sd) UCL | 96.41 | | | 99% Ch | ebyshev(Me | an, Sd) UCL | 113.4 |
| 85 | | | | | | | | | | | | |
| 86 | Cuggottou CCL to CCC | | | | | | | | | | | |
| 87 | | | | 95% Stu | dent's-t UCL | 78.55 | | | | | | |
| 88 | | | | | | | | | | | | |
| 89 | | | | | | | | | | | | |
| 90 | l | Note: Sugges | stions regard | ing the selec | tion of a 95% | 6 UCL are pr | ovided to hel | p the user to | select the m | nost appropri | ate 95% UCL | |
| 91 | | Recom | mendations | are based up | on data size | , data distrib | ution, and sk | ewness usin | g results fror | m simulation | studies. | |
| 92 | Ho | wever, simu | lations result | s will not cov | er all Real V | Vorld data se | ts; for addition | nal insight th | ne user may | want to cons | ult a statistic | ian. |
| 93 | | | | | | | | | | | | |
| 94 | | Note: For | highly negat | ively-skewe | d data, confi | dence limits | (e.g., Chen, | Johnson, Lo | ognormal, ar | nd Gamma) ı | may not be | |
| 95 | | | reliable. | Chen's and J | lohnson's m | ethods provi | de adjustme | nts for posit | vely skewed | data sets. | | |
| 96 | | | | | | | | | | | | |

| 1 | A B C D E UCL Statis | F stics for Unc | G H I J K L ensored Full Data Sets |
|----------|---|--------------------|--|
| 2 | , | | |
| 3 | User Selected Options | 0.E4.00 D15 | |
| 5 | Date/Time of Computation ProUCL 5.2 10/31/2024 3 | 3:54:03 PM | |
| 6 | Full Precision OFF | | |
| 7 | Confidence Coefficient 95% | | |
| 8 | Number of Bootstrap Operations 2000 | | |
| 9 | | | |
| | GC5-WRB-0.5-1 | | |
| 12 | GC3-WRD-0.3-1 | | |
| 13 | | General | Statistics |
| 14 | Total Number of Observations | 4 | Number of Distinct Observations 4 |
| 15 16 | N. Alianiana | 100 | Number of Missing Observations 0 |
| 17 | Minimum Maximum | | Mean 139 Median 132.5 |
| 18 | SD | _ | Std. Error of Mean 7.714 |
| 19 | Coefficient of Variation | | Skewness 1.926 |
| 20 | | | |
| 21 22 | | | d using incremental sampling methodology (ISM) approach, |
| 23 | | | C 2020 and ITRC 2012) for additional guidance, the Chebyshev UCL for small sample sizes (n < 7). |
| 24 | | | in gross overestimates of the mean. |
| 25 | | | e for a discussion of the Chebyshev UCL. |
| 26 27 | | | |
| 28 | Shapiro Wilk Test Statistic | | GOF Test Shapira Wilk GOF Test |
| 29 | Snapiro Wilk Test Statistic 1% Shapiro Wilk Critical Value | | Shapiro Wilk GOF Test Data appear Normal at 1% Significance Level |
| 30 | Lilliefors Test Statistic | | Lilliefors GOF Test |
| 31 | 1% Lilliefors Critical Value | 0.413 | Data appear Normal at 1% Significance Level |
| 32 | | | t 1% Significance Level |
| 33 34 | Note GOF tests | may be unre | eliable for small sample sizes |
| 35 | Δο | suming Nor | mal Distribution |
| 36 | 95% Normal UCL | Summy Non | 95% UCLs (Adjusted for Skewness) |
| 37 | 95% Student's-t UCL | 157.2 | 95% Adjusted-CLT UCL (Chen-1995) 159.6 |
| 38 39 | | | 95% Modified-t UCL (Johnson-1978) 158.4 |
| 40 | | Gommo | GOF Test |
| 41 | A-D Test Statistic | | Anderson-Darling Gamma GOF Test |
| 42 | 5% A-D Critical Value | | Data Not Gamma Distributed at 5% Significance Level |
| 43 | K-S Test Statistic | _ | Kolmogorov-Smirnov Gamma GOF Test |
| 44 45 | 5% K-S Critical Value | | Data Not Gamma Distributed at 5% Significance Level |
| 46 | Data Not Gamir | ma Distribut | ed at 5% Significance Level |
| 47 | | Gamma | Statistics |
| 48 | k hat (MLE) | 115.5 | k star (bias corrected MLE) 29.05 |
| 49 50 | Theta hat (MLE) | 1.203 | Theta star (bias corrected MLE) 4.785 |
| 51 | nu hat (MLE) MLE Mean (bias corrected) | | nu star (bias corrected) 232.4 MLE Sd (bias corrected) 25.79 |
| 52 | MLE Medil (bias correcteu) | 139 | Approximate Chi Square Value (0.05) 198.1 |
| 53 | Adjusted Level of Significance | N/A | Adjusted Chi Square Value N/A |
| 54 | | | |
| 55 56 | | | nma Distribution |
| 57 | 95% Approximate Gamma UCL | 103.1 | 95% Adjusted Gamma UCL N/A |
| 58 | | Lognorma | I GOF Test |
| 59 | Shapiro Wilk Test Statistic | 0.742 | Shapiro Wilk Lognormal GOF Test |
| 60 | 10% Shapiro Wilk Critical Value | | Data Not Lognormal at 10% Significance Level |
| 61 62 | Lilliefors Test Statistic | | Lilliefors Lognormal GOF Test |
| 63 | 10% Lilliefors Critical Value | | Data Not Lognormal at 10% Significance Level 10% Significance Level |
| 64 | | ognormar at | 1070 eiginiodiido Edfoi |
| 65 | | | Statistics |
| 66 67 | Minimum of Logged Data | | Mean of logged Data 4.93 |
| 67 68 | Maximum of Logged Data | 5.088 | SD of logged Data 0.106 |
| 69 | Δοοι | umina Loana | ormal Distribution |
| 70 | 95% H-UCL | | 90% Chebyshev (MVUE) UCL 161 |
| 71 | 95% Chebyshev (MVUE) UCL | 171 | 97.5% Chebyshev (MVUE) UCL 184.8 |
| 72 73 | 99% Chebyshev (MVUE) UCL | 212.1 | |
| 74 | Monnorome | atric Dietribu | tion Free UCL Statistics |
| 75 | | | Discernible Distribution |
| 76 | | | |
| 77 | | | tribution Free UCLs |
| 78 79 | 95% CLT UCL | | 95% BCA Bootstrap UCL N/A |
| 79 80 | 95% Standard Bootstrap UCL 95% Hall's Bootstrap UCL | N/A N/A | 95% Bootstrap-t UCL N/A 95% Percentile Bootstrap UCL N/A |
| 81 | 95% Hall's Bootstrap OCL 90% Chebyshev(Mean, Sd) UCL | 162.1 | 95% Percentile Bootstrap UCL N/A 95% Chebyshev(Mean, Sd) UCL 172.6 |
| | 97.5% Chebyshev(Mean, Sd) UCL | 187.2 | 99% Chebyshev(Mean, Sd) UCL 215.7 |
| 82 | | | , |

| | Α | В | С | D | E | F | G | Н | I | J | K | L |
|----|---|----------------------|----------------|----------------|---------------|----------------|-----------------|----------------|----------------|---------------|-----------------|-----|
| 83 | | | | | | | | | | | | |
| 84 | | Suggested UCL to Use | | | | | | | | | | |
| 85 | | | | 95% Stu | dent's-t UCL | 157.2 | | | | | | |
| 86 | | | | | | | • | | | | | |
| 87 | 1 | Note: Sugges | stions regard | ling the selec | tion of a 95% | 6 UCL are pr | ovided to hel | p the user to | select the m | ost appropria | ate 95% UCL | |
| 88 | | Recom | mendations | are based up | on data size | , data distrib | ution, and sk | ewness usin | g results fror | n simulation | studies. | |
| 89 | | wever, simul | lations result | s will not cov | er all Real V | Vorld data se | ts; for additio | nal insight th | ne user may | want to consi | ult a statistic | an. |
| 90 | | | | | | | | | | | | |

| 4 | A B C D E | F | G H I J K | L |
|----------|---|-----------------------|---|-----------------------|
| 2 | UCL Statis | stics for Unc | ensored Full Data Sets | |
| 3 | User Selected Options | | | |
| 4 5 | Date/Time of Computation ProUCL 5.2 10/31/2024 3 | 3:55:47 PM | | |
| 6 | Full Precision OFF | | | |
| 7 | Confidence Coefficient 95% Number of Bootstrap Operations 2000 | | | |
| 9 | Number of Bootstrap Operations 2000 | | | |
| 10 | 005 W/DD 0 5 0 | | | |
| 12 | GC5-WRB-0.5-2 | | | |
| 13 | | | Statistics | |
| 14 15 | Total Number of Observations | 4 | Number of Distinct Observations Number of Missing Observations | 0 |
| 16 | Minimum | 52 | Mean | 85 |
| 17 18 | Maximum | | Median | 84 |
| 19 | SD Coefficient of Variation | | Std. Error of Mean Skewness | 13.92 0.214 |
| 20 | | | | |
| 21 22 | | | l using incremental sampling methodology (ISM) approach, C 2020 and ITRC 2012) for additional guidance, | |
| 23 | | | he Chebyshev UCL for small sample sizes (n < 7). | |
| 24 25 | The Chebyshev UCL o | often results | in gross overestimates of the mean. | |
| 26 | Refer to the ProUCL 5.2 Tec | nnical Guide | e for a discussion of the Chebyshev UCL. | |
| 27 | | | OF Test | |
| 28 29 | Shapiro Wilk Test Statistic 1% Shapiro Wilk Critical Value | | Shapiro Wilk GOF Test Data appear Normal at 1% Significance Level | |
| 30 | 1% Snapiro Wilk Critical Value Lilliefors Test Statistic | | Lilliefors GOF Test | |
| 31 | 1% Lilliefors Critical Value | 0.413 | Data appear Normal at 1% Significance Level | |
| 32 33 | | | t 1% Significance Level Bliable for small sample sizes | |
| 34 | | | | |
| 35 36 | | suming Norr | mal Distribution | |
| 37 | 95% Normal UCL 95% Student's-t UCL | 117.8 | 95% UCLs (Adjusted for Skewness) 95% Adjusted-CLT UCL (Chen-1995) 1 | 109.5 |
| 38 | 30% Cladonic (002 | 117.0 | | 118 |
| 39 40 | | 0 | 005 T4 | |
| 41 | A-D Test Statistic | | GOF Test Anderson-Darling Gamma GOF Test | |
| 42 | 5% A-D Critical Value | 0.657 | Detected data appear Gamma Distributed at 5% Significance | Level |
| 43 44 | K-S Test Statistic 5% K-S Critical Value | | Kolmogorov-Smirnov Gamma GOF Test Detected data appear Gamma Distributed at 5% Significance | Lovel |
| 45 | | | stributed at 5% Significance Level | Level |
| 46 47 | | | eliable for small sample sizes | |
| 47 | | Gamma | Statistics | |
| 49 | k hat (MLE) | | k star (bias corrected MLE) | 3.135 |
| 50 51 | Theta hat (MLE) | | | 27.11 |
| 52 | nu hat (MLE) MLE Mean (bias corrected) | | | <u>25.08</u> 48.01 |
| 53 | | | Approximate Chi Square Value (0.05) | 14.67 |
| 54 55 | Adjusted Level of Significance | N/A | Adjusted Chi Square Value | N/A |
| 56 | Ass | suming Garr | ma Distribution | |
| 57 58 | 95% Approximate Gamma UCL | | | N/A |
| 58 | | Lognorma | GOF Test | |
| 60 | Shapiro Wilk Test Statistic | 0.958 | Shapiro Wilk Lognormal GOF Test | |
| 61 62 | 10% Shapiro Wilk Critical Value | | Data appear Lognormal at 10% Significance Level | |
| 63 | Lilliefors Test Statistic 10% Lilliefors Critical Value | | Lilliefors Lognormal GOF Test Data appear Lognormal at 10% Significance Level | |
| 64 | Data appear | Lognormal a | at 10% Significance Level | |
| 65 66 | Note GOF tests | may be unre | eliable for small sample sizes | |
| 67 | | Lognorma | I Statistics | |
| 68 | Minimum of Logged Data | 3.951 | Mean of logged Data | 4.4 |
| 69 70 | Maximum of Logged Data | 4.787 | SD of logged Data | 0.344 |
| 71 | | | ormal Distribution | |
| 72 73 | 95% H-UCL | 154.9 | 90% Chebyshev (MVUE) UCL 1 | 128.6 |
| 74 | 95% Chebyshev (MVUE) UCL 99% Chebyshev (MVUE) UCL | | 97.5% Chebyshev (MVUE) UCL 1 | 175.7 |
| 75 | | | | |
| 76 77 | | | tion Free UCL Statistics | |
| 78 | Data appea | <u>ir to follow a</u> | Discernible Distribution | |
| 79 | | | tribution Free UCLs | |
| 80 81 | 95% CLT UCL | 107.9 | 95% BCA Bootstrap UCL | N/A |
| 82 | 95% Standard Bootstrap UCL 95% Hall's Bootstrap UCL | | | N/A N/A |
| | 20 /0 Hall 5 DOUISHAP UCL | 1.1//-1 | 1 20 /0 L GLOGHING DOORSHAP OOF | 14// 1 |

| | Α | В | С | D | Е | F | G | Н | I | J | K | L |
|----|--|--------------|----------------|----------------|---------------|--------------|------------------|----------------|--------------|----------------|-----------------|-------|
| 83 | | | 90% Ch | ebyshev(Me | an, Sd) UCL | 126.7 | | | 95% Ch | ebyshev(Me | an, Sd) UCL | 145.7 |
| 84 | | | 97.5% Ch | ebyshev(Me | an, Sd) UCL | 171.9 | | | 99% Ch | ebyshev(Me | an, Sd) UCL | 223.5 |
| 85 | | | | | | | | | | | | |
| 86 | Suggested UCL to Use | | | | | | | | | | | |
| 87 | 95% Student's-t UCL 117.8 | | | | | | | | | | | |
| 88 | | | | | | • | • | | | | | |
| 89 | 1 | Note: Sugges | stions regard | ing the selec | tion of a 95% | UCL are pr | ovided to hel | p the user to | select the m | nost appropria | ate 95% UCL | |
| 90 | Recommendations are based upon data size, data distribution, and skewness using results from simulation studies. | | | | | | | | | | | |
| 91 | Но | wever, simul | lations result | s will not cov | er all Real W | orld data se | ts; for addition | nal insight th | ne user may | want to cons | ult a statistic | ian. |
| 92 | | | | | | | | | | | | |

| 1 | A B C D E | F | G H I J K L |
|----------|--|----------------------|---|
| 2 | UCL Statis | stics for Unc | ensored Full Data Sets |
| 3 | User Selected Options | | |
| 4 5 | Date/Time of Computation ProUCL 5.2 10/31/2024 : From File ProUCL Input.xls | 2:13:25 PM | |
| 6 | Full Precision OFF | | |
| 7 | Confidence Coefficient 95% Number of Bootstrap Operations 2000 | | |
| 9 | Number of Bootstrap Operations 2000 | | |
| 10 | 000 WD4 0.5.4 | | |
| 12 | GC6-WRA-0.5-1 | | |
| 13 | | | Statistics |
| 14 15 | Total Number of Observations | 5 | Number of Distinct Observations 5 Number of Missing Observations 0 |
| 16 | Minimum | 172 | Mean 194.4 |
| 17 18 | Maximum SD | 239 26.26 | Median 189 Std. Error of Mean 11.75 |
| 19 | Coefficient of Variation | | Sta. Error of Mean 11.75 Skewness 1.694 |
| 20 | | | |
| 21 22 | | | I using incremental sampling methodology (ISM) approach, C 2020 and ITRC 2012) for additional guidance, |
| 23 | but note that ITRC may recommend the | ne t-UCL or t | he Chebyshev UCL for small sample sizes (n < 7). |
| 24 25 | | | in gross overestimates of the mean. |
| 26 | Refer to the Prouct 5.2 Tec | milical Guid | e for a discussion of the Chebyshev UCL. |
| 27 | 0 | | GOF Test |
| 28 29 | Shapiro Wilk Test Statistic 1% Shapiro Wilk Critical Value | | Shapiro Wilk GOF Test Data appear Normal at 1% Significance Level |
| 30 | Lilliefors Test Statistic | 0.321 | Lilliefors GOF Test |
| 31 32 | 1% Lilliefors Critical Value | | Data appear Normal at 1% Significance Level |
| 33 | | | t 1% Significance Level eliable for small sample sizes |
| 34 | | | |
| 35 36 | As 95% Normal UCL | suming Nor | mal Distribution 95% UCLs (Adjusted for Skewness) |
| 37 | 95% Student's-t UCL | 219.4 | 95% Adjusted-CLT UCL (Chen-1995) 223.2 |
| 38 | | | 95% Modified-t UCL (Johnson-1978) 220.9 |
| 39 40 | | Gamma | GOF Test |
| 41 | A-D Test Statistic | 0.483 | Anderson-Darling Gamma GOF Test |
| 42 43 | 5% A-D Critical Value | 0.678 | Detected data appear Gamma Distributed at 5% Significance Level |
| 44 | K-S Test Statistic 5% K-S Critical Value | | Kolmogorov-Smirnov Gamma GOF Test Detected data appear Gamma Distributed at 5% Significance Level |
| 45 | Detected data appear | r Gamma Di | stributed at 5% Significance Level |
| 46 47 | Note GOF tests | may be unre | eliable for small sample sizes |
| 48 | | Gamma | Statistics |
| 49 50 | k hat (MLE) | 74.11 | k star (bias corrected MLE) 29.78 |
| 51 | Theta hat (MLE) nu hat (MLE) | | Theta star (bias corrected MLE) 6.528 nu star (bias corrected) 297.8 |
| 52 | MLE Mean (bias corrected) | | MLE Sd (bias corrected) 35.62 |
| 53 54 | Adjusted Level of Significance | 0.0086 | Approximate Chi Square Value (0.05) 258.8 Adjusted Chi Square Value 242.8 |
| 55 | Aujusteu Level of Significative | 0.0000 | Aujusteu Otti Squate Value 242.8 |
| 56 57 | | | nma Distribution |
| 58 | 95% Approximate Gamma UCL | 223.1 | 95% Adjusted Gamma UCL 238.5 |
| 59 | | | GOF Test |
| 60 61 | Shapiro Wilk Test Statistic 10% Shapiro Wilk Critical Value | 0.862 0.806 | Shapiro Wilk Lognormal GOF Test Data appear Lognormal at 10% Significance Level |
| 62 | Lilliefors Test Statistic | | Lilliefors Lognormal GOF Test |
| 63 64 | 10% Lilliefors Critical Value | | Data appear Lognormal at 10% Significance Level |
| 64 65 | | | at 10% Significance Level Bliable for small sample sizes |
| 66 | note don tests | | |
| 67 68 | Minimum all and 15 | | I Statistics Mean of legged Date F 262 |
| 69 | Minimum of Logged Data Maximum of Logged Data | | Mean of logged Data 5.263 SD of logged Data 0.128 |
| 70 | | | |
| 71 72 | Assi 95% H-UCL | uming Logno 222.2 | prmal Distribution 90% Chebyshev (MVUE) UCL 227.6 |
| 73 | 95% Chebyshev (MVUE) UCL | 242.6 | 97.5% Chebyshev (MVUE) UCL 263.5 |
| 74 | 99% Chebyshev (MVUE) UCL | 304.6 | , |
| 75 76 | Nonnarame | tric Distribu | tion Free UCL Statistics |
| 77 | | | Discernible Distribution |
| 78 79 | | | |
| 79 80 | Nonpal 95% CLT UCL | | tribution Free UCLs 95% BCA Bootstrap UCL 217.8 |
| | 95% Standard Bootstrap UCL | | 95% Bootstrap-t UCL 242.4 |
| 81 82 | 95% Hall's Bootstrap UCL | | 95% Percentile Bootstrap UCL 215.6 |

| | Α | В | С | D | E | F | G | Н | I | J | K | L |
|----|--|--------------|----------------|----------------|---------------|---------------|------------------|----------------|--------------|---------------|------------------|-------|
| 83 | | | 90% Ch | ebyshev(Me | an, Sd) UCL | 229.6 | | | 95% Ch | ebyshev(Me | an, Sd) UCL | 245.6 |
| 84 | | | 97.5% Ch | ebyshev(Me | an, Sd) UCL | 267.8 | | | 99% Ch | ebyshev(Me | an, Sd) UCL | 311.3 |
| 85 | | | | | | | | | | | | |
| 86 | Suggested UCL to Use | | | | | | | | | | | |
| 87 | | | | 95% Stu | dent's-t UCL | 219.4 | | | | | | |
| 88 | | | | | | • | • | | | | | - |
| 89 | 1 | Note: Sugges | stions regard | ing the selec | tion of a 95% | 6 UCL are pr | ovided to hel | p the user to | select the m | ost appropria | ate 95% UCL | |
| 90 | Recommendations are based upon data size, data distribution, and skewness using results from simulation studies. | | | | | | | | | | | |
| 91 | Но | wever, simul | lations result | s will not cov | er all Real W | Vorld data se | ts; for addition | nal insight th | ne user may | want to cons | ult a statistici | ian. |
| 92 | | | | | | | | | | | | |

| 4 | A B C D E | F | G H I J K | L |
|----------|---|----------------|--|----------------|
| 2 | UCL Stati | stics for Unc | ensored Full Data Sets | |
| 3 | User Selected Options | | | |
| 4 5 | Date/Time of Computation ProUCL 5.2 10/31/2024 From File ProUCL Input.xls | 2:15:50 PM | | |
| 6 | Full Precision OFF | | | |
| 7 8 | Confidence Coefficient 95% Number of Bootstrap Operations 2000 | | | |
| 9 | Number of Bootstrap Operations 2000 | | | |
| 10 | 000 W/D4 0 5 0 | | | |
| 12 | GC6-WRA-0.5-2 | | | |
| 13 | | | Statistics | |
| 14 15 | Total Number of Observations | 10 | Number of Distinct Observations Number of Missing Observations | 10 0 |
| 16 | Minimum | | Mean | 241.1 |
| 17 18 | Maximum SD | | Median Std. Error of Mean | 218 29.94 |
| 19 | Coefficient of Variation | | Skewness | 1 |
| 20 | | NI I (| OCT | |
| 21 | Shapiro Wilk Test Statistic | | GOF Test Shapiro Wilk GOF Test | |
| 23 | 1% Shapiro Wilk Critical Value | 0.781 | Data appear Normal at 1% Significance Level | |
| 24 25 | Lilliefors Test Statistic 1% Lilliefors Critical Value | | Lilliefors GOF Test Data appear Normal at 1% Significance Level | |
| 26 | | | : 1% Significance Level | |
| 27 28 | | aumina Na | nol Distribution | |
| 29 | 95% Normal UCL | ssuming Nori | nal Distribution 95% UCLs (Adjusted for Skewness) | |
| 30 | 95% Student's-t UCL | . 296 | 95% Adjusted-CLT UCL (Chen-1995) | 300.5 |
| 31 32 | | | 95% Modified-t UCL (Johnson-1978) | 297.6 |
| 33 | | | GOF Test | |
| 34 35 | A-D Test Statistic 5% A-D Critical Value | | Anderson-Darling Gamma GOF Test Detected data appear Gamma Distributed at 5% Significanc | o Lovol |
| 36 | K-S Test Statistic | | Kolmogorov-Smirnov Gamma GOF Test | e reaei |
| 37 38 | 5% K-S Critical Value | | Detected data appear Gamma Distributed at 5% Significance | e Level |
| 39 | Detected data appea | r Gamma Di | stributed at 5% Significance Level | |
| 40 | | | Statistics | |
| 41 | k hat (MLE) Theta hat (MLE) | | k star (bias corrected MLE) Theta star (bias corrected MLE) | 5.645 42.71 |
| 43 | nu hat (MLE) | 159.4 | nu star (bias corrected) | 112.9 |
| 44 45 | MLE Mean (bias corrected) | 241.1 | MLE Sd (bias corrected) Approximate Chi Square Value (0.05) | 101.5 89.38 |
| 46 | Adjusted Level of Significance | 0.0267 | Approximate Citi Square Value (0.03) Adjusted Chi Square Value | 85.74 |
| 47 48 | | in Oom | man Distribution | |
| 49 | 95% Approximate Gamma UCL | | ma Distribution 95% Adjusted Gamma UCL | 317.5 |
| 50 | | <u> </u> | | |
| 51 52 | Shapiro Wilk Test Statistic | | GOF Test Shapiro Wilk Lognormal GOF Test | |
| 53 | 10% Shapiro Wilk Critical Value | 0.869 | Data appear Lognormal at 10% Significance Level | |
| 54 55 | Lilliefors Test Statistic 10% Lilliefors Critical Value | | Lilliefors Lognormal GOF Test Data appear Lognormal at 10% Significance Level | |
| 56 | | | at 10% Significance Level | |
| 57 58 | | Lognorma | I Statistics | |
| 59 | Minimum of Logged Data | | Mean of logged Data | 5.421 |
| 60 61 | Maximum of Logged Data | | SD of logged Data | 0.371 |
| 62 | | umina Loana | ormal Distribution | |
| 63 | 95% H-UCL | 312.4 | 90% Chebyshev (MVUE) UCL | 326.1 |
| 64 65 | 95% Chebyshev (MVUE) UCL 99% Chebyshev (MVUE) UCL | | 97.5% Chebyshev (MVUE) UCL | 418.7 |
| 66 | | | | |
| 67 68 | | | tion Free UCL Statistics | |
| 69 | Data appea | ar to rollow a | Discernible Distribution | |
| 70 71 | | | tribution Free UCLs | 200 |
| 71 72 | 95% CLT UCL 95% Standard Bootstrap UCL | | 95% BCA Bootstrap UCL 95% Bootstrap-t UCL | 298 332.3 |
| 73 | 95% Hall's Bootstrap UCL | 364.7 | 95% Percentile Bootstrap UCL | 289.2 |
| 74 75 | 90% Chebyshev(Mean, Sd) UCL 97.5% Chebyshev(Mean, Sd) UCL | | 95% Chebyshev(Mean, Sd) UCL 99% Chebyshev(Mean, Sd) UCL | 371.6 539 |
| 76 | 27.570 Chebyshev(Mean, 30) UCL | | | 333 |
| 77 78 | 0E0/ Childonal a 1101 | | UCL to Use | |
| 79 | 95% Student's-t UCL | . 290 | <u> </u> | |
| 80 | | | ovided to help the user to select the most appropriate 95% UCL. | |
| 81 82 | | | ution, and skewness using results from simulation studies. ts; for additional insight the user may want to consult a statisticia | ın l |
| _~_ | However, Simulations results will not cover all Real V | voria data se | io, for additional moight the doct may want to consult a statisticia | 11. |

83 B C D E F G H I J K L

| 4 | A B C D E | F | G H I J K | L |
|----------|---|----------------|---|----------------|
| 2 | UCL Statis | stics for Unc | ensored Full Data Sets | |
| 3 | User Selected Options | | | |
| 4 5 | Date/Time of Computation ProUCL 5.2 10/31/2024 2 From File ProUCL Input.xls | 2:19:41 PM | | |
| 6 | Full Precision OFF | | | |
| 7 | Confidence Coefficient 95% | | | |
| 8 | Number of Bootstrap Operations 2000 | | | |
| 10 | | | | |
| 11 | GC6-WTP-0.5-1 | | | |
| 12 13 | | General | Statistics | |
| 14 | Total Number of Observations | 4 | Number of Distinct Observations | 3 |
| 15 16 | Marian | F | Number of Missing Observations | 0 |
| 17 | Minimum Maximum | 5 10 | Mean Median | 7.25 7 |
| 18 | SD | 2.062 | Std. Error of Mean | 1.031 |
| 19 20 | Coefficient of Variation | 0.284 | Skewness | 0.713 |
| 21 | Note: Sample size is small (e.g., <10), if data a | are collected | using incremental sampling methodology (ISM) approach, | |
| 22 | refer also to ITRC Tech Reg Guide of | on ISM (ITR | C 2020 and ITRC 2012) for additional guidance, | |
| 23 24 | | | he Chebyshev UCL for small sample sizes (n < 7). | |
| 25 | | | in gross overestimates of the mean. e for a discussion of the Chebyshev UCL. | |
| 26 | 110.01 to the 11000£ 0.2 160 | | • | |
| 27 28 | Objection MPD To a Control | | GOF Test | |
| 28 | Shapiro Wilk Test Statistic 1% Shapiro Wilk Critical Value | | Shapiro Wilk GOF Test Data appear Normal at 1% Significance Level | |
| 30 | Lilliefors Test Statistic | 0.298 | Lilliefors GOF Test | |
| 31 32 | 1% Lilliefors Critical Value | | Data appear Normal at 1% Significance Level | |
| 33 | | | t 1% Significance Level Bliable for small sample sizes | |
| 34 | | | | |
| 35 36 | | suming Nor | mal Distribution | |
| 37 | 95% Normal UCL 95% Student's-t UCL | 9.676 | 95% UCLs (Adjusted for Skewness) 95% Adjusted-CLT UCL (Chen-1995) | 9.338 |
| 38 | 35% Gludents-t GGE | 3.070 | 95% Modified-t UCL (Johnson-1978) | 9.737 |
| 39 | | | | |
| 40 41 | A-D Test Statistic | 0.337 | GOF Test Anderson-Darling Gamma GOF Test | |
| 42 | 5% A-D Critical Value | | Detected data appear Gamma Distributed at 5% Significance | Level |
| 43 | K-S Test Statistic | | Kolmogorov-Smirnov Gamma GOF Test | |
| 44 45 | 5% K-S Critical Value | | Detected data appear Gamma Distributed at 5% Significance stributed at 5% Significance Level | Level |
| 46 | Note GOF tests | may be unre | eliable for small sample sizes | |
| 47 48 | | • | Orani da . | |
| 48 | k hat (MLE) | 16.81 | Statistics k star (bias corrected MLE) | 4.369 |
| 50 | Theta hat (MLE) | | Theta star (bias corrected MLE) | 1.659 |
| 51 52 | nu hat (MLE) | | nu star (bias corrected) | 34.95 |
| 53 | MLE Mean (bias corrected) | 7.25 | MLE Sd (bias corrected) Approximate Chi Square Value (0.05) | 3.469 22.43 |
| 54 | Adjusted Level of Significance | N/A | Approximate Chi Square Value (0.03) Adjusted Chi Square Value | N/A |
| 55 56 | | | | |
| 56 | Ass 95% Approximate Gamma UCL | | ma Distribution 95% Adjusted Gamma UCL | N/A |
| 58 | 90 / о друголинате Gamina OCL | 11.0 | 3570 Aujusteu Gainind UCL | 1 11/7 |
| 59 60 | 01 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 | | GOF Test | |
| 60 61 | Shapiro Wilk Test Statistic 10% Shapiro Wilk Critical Value | | Shapiro Wilk Lognormal GOF Test Data appear Lognormal at 10% Significance Level | |
| 62 | Lilliefors Test Statistic | 0.257 | Lilliefors Lognormal GOF Test | |
| 63 64 | 10% Lilliefors Critical Value | | Data appear Lognormal at 10% Significance Level | |
| 65 | | | at 10% Significance Level Bliable for small sample sizes | |
| 66 | Note GOF lests | ay De Ulile | madio for official outriple 31263 | |
| 67 68 | | | I Statistics | 4.05. |
| 68 | Minimum of Logged Data Maximum of Logged Data | | Mean of logged Data SD of logged Data | 1.951 0.283 |
| 70 | wiaxiiiluiii oi Logged Data | | JD 01 logged Data | 0.200 |
| 71 | | | ormal Distribution | 10.01 |
| 72 73 | 95% H-UCL 95% Chebyshev (MVUE) UCL | 11.42 11.69 | 90% Chebyshev (MVUE) UCL 97.5% Chebyshev (MVUE) UCL | 10.31 13.62 |
| 74 | 99% Chebyshev (MVUE) UCL | | 37.370 Gliebyshev (NIVOL) UCL | 10.02 |
| 75 76 | | | the Fee HOLOught | |
| 76 77 | | | tion Free UCL Statistics Discernible Distribution | |
| 78 | | ar to lollow a | | |
| 79 | | | tribution Free UCLs | NI/C |
| 80 81 | 95% CLT UCL 95% Standard Bootstrap UCL | | 95% BCA Bootstrap UCL 95% Bootstrap-t UCL | N/A N/A |
| 82 | 95% Standard Bootstrap OCL 95% Hall's Bootstrap UCL | 1 | 95% Percentile Bootstrap UCL | N/A N/A |
| | | _ | | |

| | Α | В | С | D | E | F | G | Н | I | J | K | L |
|----|--|--------------|----------------|----------------|---------------|---------------|------------------|----------------|--------------|---------------|-----------------|-------|
| 83 | | | 90% Ch | ebyshev(Me | an, Sd) UCL | 10.34 | | | 95% Ch | ebyshev(Me | an, Sd) UCL | 11.74 |
| 84 | | | 97.5% Ch | ebyshev(Me | an, Sd) UCL | 13.69 | | | 99% Ch | ebyshev(Me | an, Sd) UCL | 17.51 |
| 85 | 35 | | | | | | | | | | | |
| 86 | Suggested UCL to Use | | | | | | | | | | | |
| 87 | | | | 95% Stu | dent's-t UCL | 9.676 | | | | | | |
| 88 | | | | | | | • | | | | | • |
| 89 | 1 | Note: Sugges | stions regard | ing the selec | tion of a 95% | 6 UCL are pr | ovided to hel | p the user to | select the m | ost appropria | ate 95% UCL | |
| 90 | Recommendations are based upon data size, data distribution, and skewness using results from simulation studies. | | | | | | | | | | | |
| 91 | Но | wever, simul | lations result | s will not cov | er all Real W | /orld data se | ts; for addition | nal insight th | ne user may | want to cons | ult a statistic | ian. |
| 92 | | | | | | | | | | | | |

| 4 | A B C D E | F | G H I J K | L |
|----------|---|-----------------|--|----------------|
| 2 | UCL Stat | tistics for Unc | ensored Full Data Sets | |
| 3 | User Selected Options | | | |
| 4 5 | Date/Time of Computation ProUCL 5.2 10/31/2024 From File ProUCL Input.xls | 4 2:22:06 PM | | |
| 6 | Full Precision OFF | | | |
| 7 | Confidence Coefficient 95% | | | |
| 8 | Number of Bootstrap Operations 2000 | | | |
| 10 | | | | |
| 11 | GC6-WTP-0.5-2 | | | |
| 12 13 | | General | Statistics | |
| 14 | Total Number of Observation | | Number of Distinct Observations | 3 |
| 15 16 | Minimum | . 11 | Number of Missing Observations | 13 |
| 17 | Minimun Maximun | | Mean Median | 12.5 |
| 18 | SI | 2.449 | Std. Error of Mean | 1.225 |
| 19 20 | Coefficient of Variation | n 0.188 | Skewness | 0.544 |
| 21 | Note: Sample size is small (e.g., <10), if data | are collected | using incremental sampling methodology (ISM) approach, | |
| 22 | refer also to ITRC Tech Reg Guide | on ISM (ITR | C 2020 and ITRC 2012) for additional guidance, | |
| 23 24 | | | he Chebyshev UCL for small sample sizes (n < 7). | |
| 25 | | | in gross overestimates of the mean. e for a discussion of the Chebyshev UCL. | |
| 26 | | | • | |
| 27 28 | Shapiro Wilk Test Statisti | | GOF Test Shapiro Wilk GOF Test | |
| 29 | 1% Shapiro Wilk Critical Value | | Data appear Normal at 1% Significance Level | |
| 30 | Lilliefors Test Statisti | c 0.293 | Lilliefors GOF Test | |
| 31 32 | 1% Lilliefors Critical Value | | Data appear Normal at 1% Significance Level 1 1% Significance Level | |
| 33 | | | eliable for small sample sizes | |
| 34 | | | | |
| 35 36 | 95% Normal UCL | ssuming Nor | mal Distribution 95% UCLs (Adjusted for Skewness) | |
| 37 | 95% Student's-t UC | L 15.88 | 95% Adjusted-CLT UCL (Chen-1995) | 15.37 |
| 38 | | | 95% Modified-t UCL (Johnson-1978) | 15.94 |
| 39 40 | | Gamma | GOF Test | |
| 41 | A-D Test Statisti | | Anderson-Darling Gamma GOF Test | |
| 42 43 | 5% A-D Critical Value | _ | Detected data appear Gamma Distributed at 5% Significance | Level |
| 43 | K-S Test Statisti 5% K-S Critical Value | | Kolmogorov-Smirnov Gamma GOF Test Detected data appear Gamma Distributed at 5% Significance | l evel |
| 45 | Detected data appe | ar Gamma Di | stributed at 5% Significance Level | 20101 |
| 46 47 | Note GOF tests | s may be unre | eliable for small sample sizes | |
| 48 | | Gamma | Statistics | |
| 49 | k hat (MLE | | k star (bias corrected MLE) | 9.757 |
| 50 51 | Theta hat (MLE | | Theta star (bias corrected MLE) | 1.332 |
| 52 | nu hat (MLE MLE Mean (bias corrected | | nu star (bias corrected) MLE Sd (bias corrected) | 78.06 4.162 |
| 53 | MEE Modif (blue corrected | | Approximate Chi Square Value (0.05) | 58.7 |
| 54 55 | Adjusted Level of Significance | e N/A | Adjusted Chi Square Value | N/A |
| 56 | Α | ssuming Gam | nma Distribution | |
| 57 | 95% Approximate Gamma UC | | | N/A |
| 58 59 | | Lognorma | GOF Test | |
| 60 | Shapiro Wilk Test Statisti | | Shapiro Wilk Lognormal GOF Test | |
| 61 | 10% Shapiro Wilk Critical Value | e 0.792 | Data appear Lognormal at 10% Significance Level | |
| 62 63 | Lilliefors Test Statisti 10% Lilliefors Critical Value | | Lilliefors Lognormal GOF Test Data appear Lognormal at 10% Significance Level | |
| 64 | Data appea | r Lognormal a | at 10% Significance Level | |
| 65 66 | Note GOF test | s may be unre | eliable for small sample sizes | |
| 66 67 | | Lognorma | I Statistics | |
| 68 | Minimum of Logged Date | a 2.398 | Mean of logged Data | 2.552 |
| 69 70 | Maximum of Logged Date | | SD of logged Data | 0.186 |
| 70 | Δε | sumina I oana | ormal Distribution | |
| 72 | 95% H-UC | L 16.94 | 90% Chebyshev (MVUE) UCL | 16.61 |
| 73 74 | 95% Chebyshev (MVUE) UC | | 97.5% Chebyshev (MVUE) UCL | 20.53 |
| 74 75 | 99% Chebyshev (MVUE) UC | L 24.99 | | |
| 76 | | | tion Free UCL Statistics | |
| 77 78 | Data appe | ear to follow a | Discernible Distribution | |
| 78 79 | Nonn | arametric Die | tribution Free UCLs | |
| 80 | 95% CLT UC | L 15.01 | 95% BCA Bootstrap UCL | N/A |
| | OFO/ Chandand Backetian LIC | L N/A | 95% Bootstrap-t UCL | N/A |
| 81 82 | 95% Standard Bootstrap UC 95% Hall's Bootstrap UC | | 95% Percentile Bootstrap UCL | N/A |

| | Α | В | С | D | E | F | G | Н | | J | K | L | 1 | |
|----|-----------------------------|--|----------------|----------------|---------------|--------------|-----------------|----------------|--------------|-----------------------------------|-----------------|-------|---|--|
| 83 | | | 90% Ch | ebyshev(Me | an, Sd) UCL | 16.67 | | | 95% Ch | 95% Chebyshev(Mean, Sd) UCL 18.34 | | | | |
| 84 | | | 97.5% Ch | ebyshev(Me | an, Sd) UCL | 20.65 | | | 99% Ch | ebyshev(Me | an, Sd) UCL | 25.19 | l | |
| 85 | | | | | | | | | | | | | ı | |
| 86 | | | | | | Suggested | UCL to Use | | | | | | ı | |
| 87 | 95% Student's-t UCL 15.88 | | | | | | | | | | | ı | | |
| 88 | | | | | | | • | | | | | | l | |
| 89 | 1 | Note: Sugges | stions regard | ing the selec | tion of a 95% | UCL are pr | ovided to hel | p the user to | select the m | nost appropri | ate 95% UCL | | ı | |
| 90 | | Recommendations are based upon data size, data distribution, and skewness using results from simulation studies. | | | | | | | | | | | | |
| 91 | Но | wever, simul | lations result | s will not cov | er all Real W | orld data se | ts; for additio | nal insight th | ne user may | want to cons | ult a statistic | an. | l | |
| 92 | | | | | | | | | | | | | | |

| 4 | A B C D E | F | G H I J K | L |
|----------|--|--------------------|---|----------------|
| 2 | UCL Statis | stics for Unc | ensored Full Data Sets | |
| 3 | User Selected Options | | | |
| 4 5 | Date/Time of Computation ProUCL 5.2 10/31/2024 2 | 2:27:32 PM | | |
| 6 | Full Precision OFF | | | |
| 7 | Confidence Coefficient 95% Number of Bootstrap Operations 2000 | | | |
| 9 | Number of bootstrap Operations 2000 | | | |
| 10 | OCC WITH O F 2 | | | |
| 12 | GC6-WTP-0.5-3 | | | |
| 13 | | | Statistics | |
| 14 15 | Total Number of Observations | 4 | Number of Distinct Observations Number of Missing Observations | 0 |
| 16 | Minimum | 6 | Mean | 6.5 |
| 17 18 | Maximum SD | 7 0.577 | Median Std. Error of Mean | 6.5 0.289 |
| 19 | Coefficient of Variation | | Std. Error or Mean Skewness | 0.289 |
| 20 21 | Nata Cample de la cuell (e e ed 0) 1/ 1 : | ana aalla -t- | using ingremental gameling mathedalage (IOM) | |
| 22 | | | using incremental sampling methodology (ISM) approach, C 2020 and ITRC 2012) for additional guidance, | |
| 23 | but note that ITRC may recommend the | ne t-UCL or t | he Chebyshev UCL for small sample sizes (n < 7). | |
| 24 25 | | | in gross overestimates of the mean. e for a discussion of the Chebyshev UCL. | |
| 26 | 110101 to the 1 1000£ 3.2 Tec | | • | |
| 27 28 | Shapiro Wilk Test Statistic | | GOF Test Shapiro Wilk GOF Test | |
| 29 | 1% Shapiro Wilk Test Statistic | | Data appear Normal at 1% Significance Level | |
| 30 31 | Lilliefors Test Statistic | 0.307 | Lilliefors GOF Test | |
| 32 | 1% Lilliefors Critical Value Data appe | | Data appear Normal at 1% Significance Level 1% Significance Level | |
| 33 | | | liable for small sample sizes | |
| 34 35 | Δο | sumina Nor | mal Distribution | |
| 36 | 95% Normal UCL | | 95% UCLs (Adjusted for Skewness) | |
| 37 38 | 95% Student's-t UCL | 7.179 | 95% Adjusted-CLT UCL (Chen-1995) 95% Modified-t UCL (Johnson-1978) | 6.975 7.179 |
| 39 | | | 95% Modified-t UCL (Johnson-1978) | 7.179 |
| 40 | | | GOF Test | |
| 41 42 | A-D Test Statistic 5% A-D Critical Value | 0.719 0.657 | Anderson-Darling Gamma GOF Test Data Not Gamma Distributed at 5% Significance Level | |
| 43 | K-S Test Statistic | 0.341 | Kolmogorov-Smirnov Gamma GOF Test | |
| 44 45 | 5% K-S Critical Value Detected data follow Ap | | Detected data appear Gamma Distributed at 5% Significance Distribution at 5% Significance Level | Level |
| 46 | | | eliable for small sample sizes | |
| 47 48 | | Cammo | Statistics | |
| 49 | k hat (MLE) | 168.7 | k star (bias corrected MLE) | 42.33 |
| 50 51 | Theta hat (MLE) | | Theta star (bias corrected MLE) | 0.154 |
| 52 | nu hat (MLE) MLE Mean (bias corrected) | | nu star (bias corrected) 3 MLE Sd (bias corrected) | 338.7 0.999 |
| 53 | | | Approximate Chi Square Value (0.05) 2 | 297 |
| 54 55 | Adjusted Level of Significance | N/A | Adjusted Chi Square Value | N/A |
| 56 | | | ma Distribution | |
| 57 58 | 95% Approximate Gamma UCL | 7.411 | 95% Adjusted Gamma UCL | N/A |
| 59 | | | GOF Test | |
| 60 61 | Shapiro Wilk Test Statistic | 0.731 | Shapiro Wilk Lognormal GOF Test | |
| 62 | 10% Shapiro Wilk Critical Value Lilliefors Test Statistic | | Data Not Lognormal at 10% Significance Level Lilliefors Lognormal GOF Test | |
| 63 | 10% Lilliefors Critical Value | 0.346 | Data appear Lognormal at 10% Significance Level | |
| 64 65 | | | ormal at 10% Significance Level Bliable for small sample sizes | |
| 66 | Note GOF tests | may be unit | MIGNIO IVI SIIIGII SGIIIPIG SIZGS | |
| 67 68 | Minimum of Lange 1 Date | | I Statistics Mean of legged Date | 1 000 |
| 69 | Minimum of Logged Data Maximum of Logged Data | | Mean of logged Data SD of logged Data | 1.869 0.089 |
| 70 71 | | • | | |
| 71 72 | | uming Logno N/A | ormal Distribution 90% Chebyshev (MVUE) UCL | 7.367 |
| 73 | 95% Chebyshev (MVUE) UCL | 7.76 | 97.5% Chebyshev (MVUE) UCL | 8.305 |
| 74 75 | 99% Chebyshev (MVUE) UCL | 9.376 | | |
| 76 | Nonparame | etric Distribu | tion Free UCL Statistics | |
| 77 | | | Discernible Distribution | |
| 78 79 | Nonna | rametric Die | tribution Free UCLs | |
| 80 | 95% CLT UCL | 6.975 | 95% BCA Bootstrap UCL | N/A |
| 81 82 | 95% Standard Bootstrap UCL | 1 | | N/A |
| UΖ | 95% Hall's Bootstrap UCL | N/A | 95% Percentile Bootstrap UCL | N/A |

| | Α | В | С | D | E | F | G | Н | I | J | K | L | |
|----|----|--|----------------|----------------|---------------|---------------|------------------|----------------|--------------|--------------|------------------|-------|---|
| 83 | | | 90% Ch | ebyshev(Me | an, Sd) UCL | 7.366 | | | 95% Ch | ebyshev(Me | an, Sd) UCL | 7.758 | 1 |
| 84 | | | 97.5% Ch | ebyshev(Me | an, Sd) UCL | 8.303 | | | 99% Ch | ebyshev(Me | an, Sd) UCL | 9.372 |] |
| 85 | | | | | | | | | | | | |] |
| 86 | | | | | | Suggested | UCL to Use | | | | | | 1 |
| 87 | | 95% Student's-t UCL 7.179 | | | | | | | | | | | |
| 88 | | | | Red | commended | UCL exceed | ds the maxim | num observa | ition | | | | 1 |
| 89 | | | | | | | | | | | | |] |
| 90 | 1 | Note: Sugge: | stions regard | ing the selec | tion of a 95% | 6 UCL are pr | ovided to hel | p the user to | select the m | ost appropri | ate 95% UCL | | 1 |
| 91 | | Recommendations are based upon data size, data distribution, and skewness using results from simulation studies. | | | | | | | | | | | |
| 92 | Но | wever, simu | lations result | s will not cov | er all Real W | /orld data se | ts; for addition | nal insight th | ne user may | want to cons | ult a statistici | an. | |
| 93 | | | | | | | | | | | | | 1 |

| 4 | A B C D E | F | G H I J K | L |
|----------|---|----------------|---|----------------|
| 2 | UCL Statis | stics for Unc | ensored Full Data Sets | |
| 3 | User Selected Options | 2.20.01 DM | | |
| 5 | Date/Time of Computation ProUCL 5.2 10/31/2024 2 From File ProUCL Input.xls | 2:30:01 PW | | |
| 6 7 | Full Precision OFF | | | |
| 8 | Confidence Coefficient 95% Number of Bootstrap Operations 2000 | | | |
| 9 | | | | |
| 10 11 | GC7-WRA-0.5-1 | | | |
| 12 | GO7 711 (1 C.C.) | | | |
| 13 14 | Total Number of Observations | General 4 | Statistics Number of Distinct Observations | 3 |
| 15 | Total Number of Observations | 7 | Number of Missing Observations | 0 |
| 16 17 | Minimum Maximum | 13 17 | Mean Median | 15 15 |
| 18 | SD SD | 1.633 | Std. Error of Mean | 0.816 |
| 19 20 | Coefficient of Variation | 0.109 | Skewness | 0 |
| 21 | Note: Sample size is small (e.g., <10), if data a | are collected | using incremental sampling methodology (ISM) approach, | |
| 22 | refer also to ITRC Tech Reg Guide | on ISM (ITR | C 2020 and ITRC 2012) for additional guidance, | |
| 23 24 | | | he Chebyshev UCL for small sample sizes (n < 7). in gross overestimates of the mean. | |
| 25 | | | e for a discussion of the Chebyshev UCL. | |
| 26 27 | | Normal (| GOF Test | |
| 28 | Shapiro Wilk Test Statistic | 0.944 | Shapiro Wilk GOF Test | |
| 29 30 | 1% Shapiro Wilk Critical Value Lilliefors Test Statistic | | Data appear Normal at 1% Significance Level Lilliefors GOF Test | |
| 31 | 1% Lilliefors Critical Value | | Data appear Normal at 1% Significance Level | |
| 32 33 | Data appe | ar Normal at | 1% Significance Level | |
| 34 | Note GOF tests | may be unre | liable for small sample sizes | |
| 35 | | suming Nor | nal Distribution | |
| 36 37 | 95% Normal UCL 95% Student's-t UCL | 16.92 | 95% UCLs (Adjusted for Skewness) 95% Adjusted-CLT UCL (Chen-1995) | 16.34 |
| 38 | 33 % Students-t OCL | 10.32 | 95% Adjusted-CET OCE (Chen-1995) 95% Modified-t UCL (Johnson-1978) | 16.92 |
| 39 40 | | 0 | COE Took | |
| 41 | A-D Test Statistic | 0.332 | GOF Test Anderson-Darling Gamma GOF Test | |
| 42 43 | 5% A-D Critical Value | 0.657 | Detected data appear Gamma Distributed at 5% Significance | Level |
| 44 | K-S Test Statistic 5% K-S Critical Value | | Kolmogorov-Smirnov Gamma GOF Test Detected data appear Gamma Distributed at 5% Significance | Level |
| 45 | Detected data appear | r Gamma Di | stributed at 5% Significance Level | |
| 46 47 | Note GOF tests | may be unre | eliable for small sample sizes | |
| 48 | | | Statistics | |
| 49 50 | k hat (MLE) Theta hat (MLE) | 111.7 0.134 | k star (bias corrected MLE) Theta star (bias corrected MLE) | 28.08 0.534 |
| 51 | nu hat (MLE) | 893.3 | nu star (bias corrected) | 224.7 |
| 52 53 | MLE Mean (bias corrected) | 15 | MLE Sd (bias corrected) | 2.831 |
| 54 | Adjusted Level of Significance | N/A | | 191 N/A |
| 55 56 | | | | |
| 57 | Ast 95% Approximate Gamma UCL | | ma Distribution 95% Adjusted Gamma UCL | N/A |
| 58 | 22.2 | | | |
| 59 60 | Shapiro Wilk Test Statistic | | GOF Test Shapiro Wilk Lognormal GOF Test | |
| 61 | 10% Shapiro Wilk Critical Value | 0.792 | Data appear Lognormal at 10% Significance Level | |
| 62 63 | Lilliefors Test Statistic 10% Lilliefors Critical Value | | Lilliefors Lognormal GOF Test Data appear Lognormal at 10% Significance Level | |
| 64 | Data appear | Lognormal a | at 10% Significance Level | |
| 65 66 | Note GOF tests | may be unre | eliable for small sample sizes | |
| 67 | | Lognorma | I Statistics | |
| 68 | Minimum of Logged Data | 2.565 | Mean of logged Data | 2.704 |
| 69 70 | Maximum of Logged Data | 2.833 | SD of logged Data | 0.11 |
| 71 | Assı | uming Logno | rmal Distribution | , |
| 72 73 | 95% H-UCL 95% Chebyshev (MVUE) UCL | 17.31 18.58 | 90% Chebyshev (MVUE) UCL 97.5% Chebyshev (MVUE) UCL | 17.47 20.13 |
| 74 | 99% Chebyshev (MVUE) UCL | 23.17 | 97.3% Chebyshev (WVOE) UCL | ۷.۱۵ |
| 75 76 | | | tion Eron LICI Statistics | |
| 77 | | | tion Free UCL Statistics Discernible Distribution | |
| 78 | | | | |
| 79 80 | Nonpai 95% CLT UCL | | tribution Free UCLs 95% BCA Bootstrap UCL | N/A |
| 81 | 95% Standard Bootstrap UCL | N/A | 95% Bootstrap-t UCL | N/A |
| 82 | 95% Hall's Bootstrap UCL | N/A | 95% Percentile Bootstrap UCL | N/A |

| | Α | В | С | D | E | F | G | Н | 1 | J | K | L |
|----|---|--------------|---------------|---------------|---------------|--------------|---------------|---------------|--------------|--------------|-------------|-------|
| 83 | | | 90% Ch | ebyshev(Me | an, Sd) UCL | 17.45 | | | 95% Ch | ebyshev(Me | an, Sd) UCL | 18.56 |
| 84 | | | 97.5% Ch | ebyshev(Me | an, Sd) UCL | 20.1 | | | 99% Ch | ebyshev(Me | an, Sd) UCL | 23.12 |
| 85 | | | | | | | | | | | | |
| 86 | | | | | | Suggested | UCL to Use | | | | | |
| 87 | | | | 95% Stu | dent's-t UCL | 16.92 | | | | | | |
| 88 | | | | | | | • | | | | | |
| 89 | 1 | Note: Sugges | stions regard | ing the selec | tion of a 95% | 6 UCL are pr | ovided to hel | p the user to | select the m | ost appropri | ate 95% UCL | |
| 90 | | | | | | | | | | | | |
| 91 | However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician. | | | | | | | | | | | |
| 92 | | | | | | | | | | | | |

| 4 | A B C D E | F | G H I J K | L |
|----------|---|----------------|---|----------------|
| 2 | UCL Statis | Sucs for Unc | ensored Full Data Sets | |
| 3 | User Selected Options | | | |
| 4 5 | Date/Time of Computation ProUCL 5.2 10/31/2024 2 From File ProUCL Input.xls | 2:31:34 PM | | |
| 6 | Full Precision OFF | | | |
| 7 8 | Confidence Coefficient 95% Number of Bootstrap Operations 2000 | | | |
| 9 | Number of Bootstrap Operations 2000 | | | |
| 10 | GC7-WRA-0.5-2 | | | |
| 12 | GC/-WKA-0.5-2 | | | |
| 13 | | | Statistics | |
| 14 15 | Total Number of Observations | 4 | Number of Distinct Observations Number of Missing Observations | 0 |
| 16 | Minimum | 10 | Mean | 12.5 |
| 17 18 | Maximum | | Median Std. Error of Mean | 12.5 1.19 |
| 19 | SD Coefficient of Variation | 2.38 0.19 | Std. Error of Weari Skewness | 0 |
| 20 | | • | | |
| 21 22 | | | l using incremental sampling methodology (ISM) approach, C 2020 and ITRC 2012) for additional guidance, | |
| 23 | but note that ITRC may recommend th | ne t-UCL or t | he Chebyshev UCL for small sample sizes (n < 7). | |
| 24 25 | | | in gross overestimates of the mean. | |
| 26 | Refer to the Prouch 5.2 Tec | anneal Guid | e for a discussion of the Chebyshev UCL. | |
| 27 | | | OF Test | |
| 28 29 | Shapiro Wilk Test Statistic 1% Shapiro Wilk Critical Value | | Shapiro Wilk GOF Test Data appear Normal at 1% Significance Level | |
| 30 | Lilliefors Test Statistic | | Lilliefors GOF Test | |
| 31 32 | 1% Lilliefors Critical Value | 0.413 | Data appear Normal at 1% Significance Level | |
| 33 | | | t 1% Significance Level Bliable for small sample sizes | |
| 34 | | | | |
| 35 36 | As: 95% Normal UCL | suming Nor | mal Distribution 95% UCLs (Adjusted for Skewness) | |
| 37 | 95% Normal OCL 95% Student's-t UCL | 15.3 | 95% OCLS (Adjusted for Skewness) 95% Adjusted-CLT UCL (Chen-1995) | 14.46 |
| 38 | | | 95% Modified-t UCL (Johnson-1978) | 15.3 |
| 39 40 | | Gamma | GOF Test | |
| 41 | A-D Test Statistic | 0.355 | Anderson-Darling Gamma GOF Test | |
| 42 43 | 5% A-D Critical Value | 0.656 | Detected data appear Gamma Distributed at 5% Significance | e Level |
| 43 | K-S Test Statistic 5% K-S Critical Value | | Kolmogorov-Smirnov Gamma GOF Test Detected data appear Gamma Distributed at 5% Significance | e Level |
| 45 | Detected data appear | r Gamma Di | stributed at 5% Significance Level | |
| 46 47 | Note GOF tests | may be unre | eliable for small sample sizes | |
| 48 | | Gamma | Statistics | |
| 49 | k hat (MLE) | 36.31 | k star (bias corrected MLE) | 9.245 |
| 50 51 | Theta hat (MLE) nu hat (MLE) | | Theta star (bias corrected MLE) nu star (bias corrected) | 1.352 73.96 |
| 52 | MLE Mean (bias corrected) | 12.5 | MLE Sd (bias corrected) | 4.111 |
| 53 54 | Adimate all arrel of Otion 10 | NI/A | Approximate Chi Square Value (0.05) | 55.16 |
| 55 | Adjusted Level of Significance | N/A | Adjusted Chi Square Value | N/A |
| 56 | | | ma Distribution | |
| 57 58 | 95% Approximate Gamma UCL | 16.76 | 95% Adjusted Gamma UCL | N/A |
| 59 | | | GOF Test | |
| 60 61 | Shapiro Wilk Test Statistic | 0.913 | Shapiro Wilk Lognormal GOF Test | |
| 62 | 10% Shapiro Wilk Critical Value Lilliefors Test Statistic | | Data appear Lognormal at 10% Significance Level Lilliefors Lognormal GOF Test | |
| 63 | 10% Lilliefors Critical Value | 0.346 | Data appear Lognormal at 10% Significance Level | |
| 64 65 | | | at 10% Significance Level | |
| 66 | Note GOF tests | may be unre | eliable for small sample sizes | |
| 67 | | | Statistics | |
| 68 69 | Minimum of Logged Data | | Mean of logged Data | 2.512 |
| 70 | Maximum of Logged Data | 2.708 | SD of logged Data | 0.193 |
| 71 | Assu | | ormal Distribution | |
| 72 73 | 95% H-UCL 95% Chebyshev (MVUE) UCL | 16.48 17.74 | 90% Chebyshev (MVUE) UCL 97.5% Chebyshev (MVUE) UCL | 16.1 20 |
| 74 | 99% Chebyshev (MVUE) UCL | 24.45 | 37.370 Chebyshev (WVOL) UCL | |
| 75 76 | | atala Distrib | tion Front IICI Chabinting | |
| 77 | | | tion Free UCL Statistics Discernible Distribution | |
| 78 | | | | - |
| 79 80 | | | tribution Free UCLs | NI/A |
| 80 | 95% CLT UCL 95% Standard Bootstrap UCL | | 95% BCA Bootstrap UCL 95% Bootstrap-t UCL | N/A N/A |
| 82 | 95% Hall's Bootstrap UCL | 1 | 95% Percentile Bootstrap UCL | N/A |
| | | | | |

| | Α | В | С | D | Е | F | G | Н | | J | K | L |
|----|---------------------|--|----------------|----------------|---------------|--------------|-----------------|----------------|--------------|--------------|-----------------|-------|
| 83 | | | 90% Ch | ebyshev(Me | an, Sd) UCL | 16.07 | | | 95% Ch | ebyshev(Me | an, Sd) UCL | 17.69 |
| 84 | | | 97.5% Ch | ebyshev(Me | an, Sd) UCL | 19.93 | | | 99% Ch | ebyshev(Me | an, Sd) UCL | 24.34 |
| 85 | | | | | | | | | | | | |
| 86 | | | | | | Suggested | UCL to Use | | | | | |
| 87 | 95% Student's-t UCL | | | | | | | | | | | |
| 88 | | | | Red | commended | UCL exceed | ds the maxim | num observa | tion | | | |
| 89 | | | | | | | | | | | | |
| 90 | | Note: Sugges | stions regard | ing the selec | tion of a 95% | UCL are pr | ovided to hel | p the user to | select the m | ost appropri | ate 95% UCL | |
| 91 | | Recommendations are based upon data size, data distribution, and skewness using results from simulation studies. | | | | | | | | | | |
| 92 | Но | wever, simu | lations result | s will not cov | er all Real W | orld data se | ts; for additio | nal insight th | ne user may | want to cons | ult a statistic | an. |
| 93 | | - | - | - | | | | | | - | | |

| | A B C D E | F | G H I J K | L |
|----------|---|----------------|---|----------------|
| 2 | UCL Statis | stics for Unc | ensored Full Data Sets | |
| 3 | User Selected Options | 0.00.14.514 | | |
| 5 | Date/Time of Computation ProUCL 5.2 10/31/2024 ProUCL Input.xls | 2:33:14 PIVI | | |
| 6 | Full Precision OFF | | | |
| 7 | Confidence Coefficient 95% Number of Bootstrap Operations 2000 | | | |
| 9 | Number of Bootstrap Operations (2000) | | | |
| 10 | GC7-WRA-0.5-3 | | | |
| 12 | GC/-WRA-0.5-3 | | | |
| 13 14 | T. IN 1 (0) | | Statistics | 4 |
| 15 | Total Number of Observations | 4 | Number of Distinct Observations Number of Missing Observations | 0 |
| 16 | Minimum | | Mean | 26.75 |
| 17 18 | Maximum SD | | Median Std. Error of Mean | 28.5 2.72 |
| 19 | Coefficient of Variation | | Skewness | -1.468 |
| 20 21 | Note: Comple size is small (a.g. <10) if data | ara callactas | veing ingreportal compling mathedaless: (ICM) approach | |
| 22 | | | using incremental sampling methodology (ISM) approach, C 2020 and ITRC 2012) for additional guidance, | |
| 23 | but note that ITRC may recommend the | ne t-UCL or t | he Chebyshev UCL for small sample sizes (n < 7). | |
| 24 25 | | | in gross overestimates of the mean. e for a discussion of the Chebyshev UCL. | |
| 26 | Neigh to the Floods 3.2 let | | • | |
| 27 28 | Shapiro Wilk Test Statistic | | GOF Test Shapiro Wilk GOF Test | |
| 29 | Snapiro Wilk Test Statistic 1% Shapiro Wilk Critical Value | | Data appear Normal at 1% Significance Level | |
| 30 31 | Lilliefors Test Statistic | 0.268 | Lilliefors GOF Test | |
| 32 | 1% Lilliefors Critical Value Data appe | | Data appear Normal at 1% Significance Level 1% Significance Level | |
| 33 | | | eliable for small sample sizes | |
| 34 35 | ٨٥ | eumina Non | mal Distribution | |
| 36 | 95% Normal UCL | Sulling Non | 95% UCLs (Adjusted for Skewness) | |
| 37 38 | 95% Student's-t UCL | 33.15 | 95% Adjusted-CLT UCL (Chen-1995) | 29.09 |
| 39 | | | 95% Modified-t UCL (Johnson-1978) | 32.82 |
| 40 | | | GOF Test | |
| 41 42 | A-D Test Statistic 5% A-D Critical Value | | Anderson-Darling Gamma GOF Test Detected data appear Gamma Distributed at 5% Significance | a Level |
| 43 | K-S Test Statistic | | Kolmogorov-Smirnov Gamma GOF Test | |
| 44 45 | 5% K-S Critical Value | | Detected data appear Gamma Distributed at 5% Significance | Level |
| 46 | Note GOF tests | may be unre | stributed at 5% Significance Level | |
| 47 | | | · | |
| 48 49 | k hat (MLE) | | Statistics k star (bias corrected MLE) | 7.282 |
| 50 | Theta hat (MLE) | 0.94 | Theta star (bias corrected MLE) | 3.673 |
| 51 52 | nu hat (MLE) MLE Mean (bias corrected) | | nu star (bias corrected) MLE Sd (bias corrected) | 58.26 9.913 |
| 53 | MLE Mean (bias corrected) | 20.75 | Approximate Chi Square Value (0.05) | 41.71 |
| 54 55 | Adjusted Level of Significance | N/A | Adjusted Chi Square Value | N/A |
| 56 | As | sumina Gam | ma Distribution | |
| 57 | 95% Approximate Gamma UCL | | 95% Adjusted Gamma UCL | N/A |
| 58 59 | | Loanorma | GOF Test | |
| 60 | Shapiro Wilk Test Statistic | 0.832 | Shapiro Wilk Lognormal GOF Test | |
| 61 62 | 10% Shapiro Wilk Critical Value Lilliefors Test Statistic | | Data appear Lognormal at 10% Significance Level Lilliefors Lognormal GOF Test | |
| 63 | 10% Lilliefors Critical Value | | Data appear Lognormal at 10% Significance Level | |
| 64 65 | Data appear | Lognormal a | at 10% Significance Level | |
| 66 | Note GOF tests | may be unre | eliable for small sample sizes | |
| 67 | | | I Statistics | |
| 68 69 | Minimum of Logged Data Maximum of Logged Data | | Mean of logged Data | 3.269 0.224 |
| 70 | wiaximum or Logged Data | J.434 | SD of logged Data | 0.224 |
| 71 72 | Ass | uming Logno | ormal Distribution | 25.75 |
| 73 | 95% H-UCL 95% Chebyshev (MVUE) UCL | 37.4 39.81 | 90% Chebyshev (MVUE) UCL 97.5% Chebyshev (MVUE) UCL | 35.75 45.45 |
| 74 | 99% Chebyshev (MVUE) UCL | | 2.13.13 2.130/JOHOT (INTOL) OOL | |
| 75 76 | Mannatam | atric Distribu | tion Free UCL Statistics | |
| 77 | | | Discernible Distribution | |
| 78 79 | | | | |
| 80 | Nonpa 95% CLT UCL | | tribution Free UCLs 95% BCA Bootstrap UCL | N/A |
| 81 | 95% Standard Bootstrap UCL | N/A | 95% Bootstrap-t UCL | N/A |
| 82 | 95% Hall's Bootstrap UCL | N/A | 95% Percentile Bootstrap UCL | N/A |

| | Α | В | С | D | Е | F | G | Н | I | J | K | L | |
|----|---|--------------|----------------|----------------|---------------|----------------|--------------------|----------------|----------------|---------------|-----------------|-------|---|
| 83 | | | 90% Ch | ebyshev(Me | an, Sd) UCL | 34.91 | | | 95% Ch | ebyshev(Me | an, Sd) UCL | 38.6 | 1 |
| 84 | | | 97.5% Ch | ebyshev(Me | an, Sd) UCL | 43.73 | | | 99% Ch | ebyshev(Me | an, Sd) UCL | 53.81 |] |
| 85 | | | | | | | | | | | | | 1 |
| 86 | | | | | | Suggested | UCL to Use | | | | | | |
| 87 | | | | 95% Stu | dent's-t UCL | 33.15 | | | | | | | |
| 88 | Recommended UCL exceeds the maximum observation | | | | | | | | | | | | |
| 89 | | | | | | | | | | | | | |
| 90 | 1 | Note: Sugges | stions regard | ing the selec | tion of a 95% | UCL are pr | ovided to hel | p the user to | select the m | ost appropria | ate 95% UCL | | |
| 91 | | Recom | mendations a | are based up | on data size | , data distrib | ution, and sk | ewness usin | g results fror | m simulation | studies. | | |
| 92 | Ho | wever, simu | lations result | s will not cov | er all Real W | orld data se | ts; for additio | nal insight th | ne user may | want to cons | ult a statistic | ian. | |
| 93 | | | | | | | | | | | | | |
| 94 | | Note: For | highly negat | ively-skewe | d data, confi | dence limits | (e.g., Chen, | Johnson, Lo | ognormal, ar | nd Gamma) r | may not be | | |
| 95 | | | reliable. (| Chen's and J | ohnson's me | ethods provi | <u>de adjustme</u> | nts for posit | vely skewed | data sets. | | | |
| 96 | | | | | | | | | | | | | 1 |

| 1 | A B C D E | F | G H I J K | L |
|----------|--|------------------|--|----------------|
| 2 | UCL Stati | stics for Unc | ensored Full Data Sets | |
| 3 | User Selected Options | | | |
| 4 5 | Date/Time of Computation ProUCL 5.2 10/31/2024 From File ProUCL Input.xls | 2:35:27 PM | | |
| 6 | Full Precision OFF | | | |
| 7 8 | Confidence Coefficient 95% Number of Bootstrap Operations 2000 | | | |
| 9 | Number of Bootstrap Operations 2000 | | | |
| 10 | 007 W/DD 0.5.4 | | | |
| 12 | GC7-WRB-0.5-1 | | | |
| 13 | | | Statistics | |
| 14 15 | Total Number of Observations | 4 | Number of Distinct Observations Number of Missing Observations | 0 |
| 16 | Minimum | | Mean | 11.75 |
| 17 18 | Maximum SD | | Median Std. Error of Mean | 10.5 1.436 |
| 19 | Coefficient of Variation | _ | Std. Error of Mean Skewness | 1.436 |
| 20 | | • | | |
| 21 22 | | | using incremental sampling methodology (ISM) approach, C 2020 and ITRC 2012) for additional guidance, | |
| 23 | but note that ITRC may recommend t | he t-UCL or t | he Chebyshev UCL for small sample sizes (n < 7). | |
| 24 25 | | | in gross overestimates of the mean. | |
| 26 | Refer to the Prouce 5.2 Te | CHINCAL GUID | e for a discussion of the Chebyshev UCL. | |
| 27 | <u></u> | | GOF Test | |
| 28 29 | Shapiro Wilk Test Statistic 1% Shapiro Wilk Critical Value | | Shapiro Wilk GOF Test Data appear Normal at 1% Significance Level | |
| 30 | Lilliefors Test Statistic | | Lilliefors GOF Test | |
| 31 32 | 1% Lilliefors Critical Value | | Data appear Normal at 1% Significance Level | |
| 33 | | | : 1% Significance Level sliable for small sample sizes | |
| 34 | | | | |
| 35 36 | 95% Normal UCL | ssuming Nor | nal Distribution 95% UCLs (Adjusted for Skewness) | |
| 37 | 95% Student's-t UCL | . 15.13 | 95% Adjusted for Skewness) 95% Adjusted-CLT UCL (Chen-1995) | 15.53 |
| 38 39 | | | 95% Modified-t UCL (Johnson-1978) | 15.35 |
| 40 | | Gamma | GOF Test | |
| 41 | A-D Test Statistic | 0.643 | Anderson-Darling Gamma GOF Test | |
| 42 43 | 5% A-D Critical Value | | Detected data appear Gamma Distributed at 5% Significance | Level |
| 44 | K-S Test Statistic 5% K-S Critical Value | | Kolmogorov-Smirnov Gamma GOF Test Detected data appear Gamma Distributed at 5% Significance | Level |
| 45 | Detected data appea | r Gamma Di | stributed at 5% Significance Level | |
| 46 47 | Note GOF tests | may be unre | eliable for small sample sizes | |
| 48 | | | Statistics | |
| 49 50 | k hat (MLE) | | k star (bias corrected MLE) | 6.477 |
| 51 | Theta hat (MLE) nu hat (MLE) | | Theta star (bias corrected MLE) nu star (bias corrected) | 1.814 51.82 |
| 52 | MLE Mean (bias corrected) | | MLE Sd (bias corrected) | 4.617 |
| 53 54 | Adjusted Level of Significance | N/A | Approximate Chi Square Value (0.05) Adjusted Chi Square Value | 36.28 N/A |
| 55 | Aujusteu Level of Signification | , IN/ <i>F</i> \ | Aujusteu Cili Squale Value | 111/7 |
| 56 57 | | | ma Distribution | NI/A |
| 58 | 95% Approximate Gamma UCL | . 16.78 | 95% Adjusted Gamma UCL | N/A |
| 59 | <u> </u> | | GOF Test | |
| 60 61 | Shapiro Wilk Test Statistic 10% Shapiro Wilk Critical Value | | Shapiro Wilk Lognormal GOF Test Data Not Lognormal at 10% Significance Level | |
| 62 | Lilliefors Test Statistic | 0.332 | Lilliefors Lognormal GOF Test | |
| 63 64 | 10% Lilliefors Critical Value | | Data appear Lognormal at 10% Significance Level | |
| 65 | | | ormal at 10% Significance Level | |
| 66 | 11000 401 1000 | <u>-</u> | · | |
| 67 68 | Minimum of Laura d Data | | I Statistics Moan of logged Data | 2 444 |
| 69 | Minimum of Logged Data Maximum of Logged Data | | Mean of logged Data SD of logged Data | 2.444 0.224 |
| 70 | | • | | |
| 71 72 | | | ormal Distribution 90% Chebyshev (MVUE) UCL | 15.66 |
| 73 | 95% Chebyshev (MVUE) UCL | | 97.5% Chebyshev (MVUE) UCL | 19.9 |
| 74 75 | 99% Chebyshev (MVUE) UCL | | | |
| 75 76 | Nonnaram | etric Distribu | tion Free UCL Statistics | |
| 77 | | | Discernible Distribution | |
| | | | | |
| 78 | • • | | | |
| | | | tribution Free UCLs 95% BCA Bootstrap UCL | N/A |
| 78 79 | Nonpa 95% CLT UCL 95% Standard Bootstrap UCL 95% Hall's Bootstrap UCL | 14.11 N/A | ribution Free UCLs 95% BCA Bootstrap UCL 95% Bootstrap-t UCL 95% Percentile Bootstrap UCL | N/A N/A |

| | Α | В | С | D | E | F | G | Н | I | J | K | L | | |
|----|-----------------------------|--|----------------|----------------|---------------|--------------|------------------|----------------|--------------|-----------------------------------|------------------|-------|--|--|
| 83 | | | 90% Ch | ebyshev(Me | an, Sd) UCL | 16.06 | | | 95% Ch | 95% Chebyshev(Mean, Sd) UCL 18.01 | | | | |
| 84 | | | 97.5% Ch | ebyshev(Me | an, Sd) UCL | 20.72 | | | 99% Ch | ebyshev(Me | an, Sd) UCL | 26.04 | | |
| 85 | | | | | | | | | | | | | | |
| 86 | | | | | | Suggested | UCL to Use | | | | | | | |
| 87 | 95% Student's-t UCL 15.13 | | | | | | | | | | | | | |
| 88 | | | | | | | • | | | | | | | |
| 89 | 1 | Note: Sugges | stions regard | ing the selec | tion of a 95% | UCL are pr | ovided to hel | p the user to | select the m | nost appropria | ate 95% UCL | | | |
| 90 | | Recommendations are based upon data size, data distribution, and skewness using results from simulation studies. | | | | | | | | | | | | |
| 91 | Но | wever, simul | lations result | s will not cov | er all Real W | orld data se | ts; for addition | nal insight th | ne user may | want to cons | ult a statistici | an. | | |
| 92 | | | | | | | | | | | | | | |

| 4 | A B C D E | F | G H I J K | L |
|----------|---|-----------------|--|----------------|
| 2 | UCL Statis | stics for Unc | ensored Full Data Sets | |
| 3 | User Selected Options | | | |
| 4 5 | Date/Time of Computation ProUCL 5.2 10/31/2024 2 From File ProUCL Input.xls | 2:37:11 PM | | |
| 6 | Full Precision OFF | | | |
| 7 8 | Confidence Coefficient 95% Number of Bootstrap Operations 2000 | | | |
| 9 | Number of Bootstrap Operations 2000 | | | |
| 10 | 007 WDD 0.5.0 | | | |
| 12 | GC7-WRB-0.5-2 | | | |
| 13 | | | Statistics | |
| 14 15 | Total Number of Observations | 4 | Number of Distinct Observations Number of Missing Observations | 0 |
| 16 | Minimum | 10 | Mean | 11 |
| 17 18 | Maximum | | Median | 11 |
| 19 | SD Coefficient of Variation | 0.816 0.0742 | Std. Error of Mean Skewness | 0.408 |
| 20 | | | | |
| 21 22 | | | l using incremental sampling methodology (ISM) approach, C 2020 and ITRC 2012) for additional guidance, | |
| 23 | | | he Chebyshev UCL for small sample sizes (n < 7). | |
| 24 25 | The Chebyshev UCL o | ften results | in gross overestimates of the mean. | |
| 26 | Refer to the ProUCL 5.2 Tec | chnical Guid | e for a discussion of the Chebyshev UCL. | |
| 27 | | | OF Test | |
| 28 29 | Shapiro Wilk Test Statistic 1% Shapiro Wilk Critical Value | | Shapiro Wilk GOF Test Data appear Normal at 1% Significance Level | |
| 30 | 1% Snapiro Wilk Critical Value Lilliefors Test Statistic | | Lilliefors GOF Test | |
| 31 | 1% Lilliefors Critical Value | 0.413 | Data appear Normal at 1% Significance Level | |
| 32 33 | | | t 1% Significance Level Bliable for small sample sizes | |
| 34 | | | | |
| 35 36 | | suming Nor | mal Distribution | |
| 37 | 95% Normal UCL 95% Student's-t UCL | 11.96 | 95% UCLs (Adjusted for Skewness) 95% Adjusted-CLT UCL (Chen-1995) | 11.67 |
| 38 | 30% Cladoliko (002 | 11.00 | 95% Modified-t UCL (Johnson-1978) | 11.96 |
| 39 40 | | Commo | COT Test | |
| 41 | A-D Test Statistic | 0.331 | GOF Test Anderson-Darling Gamma GOF Test | |
| 42 | 5% A-D Critical Value | 0.657 | Detected data appear Gamma Distributed at 5% Significance | Level |
| 43 44 | K-S Test Statistic 5% K-S Critical Value | | Kolmogorov-Smirnov Gamma GOF Test Detected data appear Gamma Distributed at 5% Significance | l evel |
| 45 | Detected data appear | r Gamma Di | stributed at 5% Significance Level | Level |
| 46 47 | Note GOF tests | may be unre | eliable for small sample sizes | |
| 48 | | Gamma | Statistics | |
| 49 | k hat (MLE) | 241.2 | k star (bias corrected MLE) | 60.46 |
| 50 51 | Theta hat (MLE) nu hat (MLE) | | Theta star (bias corrected MLE) nu star (bias corrected) | 0.182 483.7 |
| 52 | MLE Mean (bias corrected) | | MLE Sd (bias corrected) | 1.415 |
| 53 | | | | 433.7 |
| 54 55 | Adjusted Level of Significance | N/A | Adjusted Chi Square Value | N/A |
| 56 | As: | suming Gam | ma Distribution | |
| 57 58 | 95% Approximate Gamma UCL | | | N/A |
| 59 | | Lognorma | GOF Test | |
| 60 | Shapiro Wilk Test Statistic | 0.944 | Shapiro Wilk Lognormal GOF Test | |
| 61 62 | 10% Shapiro Wilk Critical Value Lilliefors Test Statistic | | Data appear Lognormal at 10% Significance Level Lilliefors Lognormal GOF Test | |
| 63 | Lillefors Test Statistic 10% Lilliefors Critical Value | | Data appear Lognormal at 10% Significance Level | |
| 64 | Data appear | Lognormal a | at 10% Significance Level | |
| 65 66 | Note GOF tests | may be unre | eliable for small sample sizes | |
| 67 | | | I Statistics | |
| 68 69 | Minimum of Logged Data | 2.303 | Mean of logged Data | 2.396 |
| 70 | Maximum of Logged Data | 2.485 | SD of logged Data | 0.0745 |
| 71 | Assı | uming Logno | rmal Distribution | |
| 72 73 | 95% H-UCL | | 90% Chebyshev (MVUE) UCL | 12.23 |
| 74 | 95% Chebyshev (MVUE) UCL 99% Chebyshev (MVUE) UCL | 12.78 15.07 | 97.5% Chebyshev (MVUE) UCL | 13.56 |
| 75 | | | · | |
| 76 77 | | | tion Free UCL Statistics | |
| 78 | Data appea | ii to follow a | Discernible Distribution | |
| 79 | | | tribution Free UCLs | |
| 80 81 | 95% CLT UCL | | | N/A |
| 82 | 95% Standard Bootstrap UCL 95% Hall's Bootstrap UCL | | | N/A N/A |
| | CO /o Fiding Doolstrap CCL | | , commo bootstap ool | |

| | Α | В | С | D | E | F | G | Н | | J | K | L | |
|----|----------------------|--|----------------|----------------|---------------|---------------|-----------------------------------|----------------|--------------|--------------|-----------------|-------|---|
| 83 | | | 90% Ch | ebyshev(Me | an, Sd) UCL | 12.22 | 95% Chebyshev(Mean, Sd) UCL 12.78 | | | | | | 1 |
| 84 | | | 97.5% Ch | ebyshev(Me | an, Sd) UCL | 13.55 | | | 99% Ch | ebyshev(Me | an, Sd) UCL | 15.06 | |
| 85 | | | | | | | | | | | | | |
| 86 | Suggested UCL to Use | | | | | | | | | | | | |
| 87 | | | | 95% Stu | dent's-t UCL | 11.96 | | | | | | | 1 |
| 88 | | | | | | • | • | | | | | | |
| 89 | ľ | Note: Sugges | stions regard | ling the selec | tion of a 95% | 6 UCL are pr | ovided to hel | p the user to | select the m | ost appropri | ate 95% UCL | | |
| 90 | | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. Recommendations are based upon data size, data distribution, and skewness using results from simulation studies. | | | | | | | | | | | |
| 91 | Но | wever, simu | lations result | s will not cov | er all Real W | Vorld data se | ts; for addition | nal insight th | ne user may | want to cons | ult a statistic | an. | l |
| 92 | | | | | | | | | | | | | 1 |

| | A B C D E | F | G H I J K | L | | | | | | | | |
|----------|---|----------------|--|----------------|--|--|--|--|--|--|--|--|
| 2 | UCL Statis | stics for Unc | ensored Full Data Sets | | | | | | | | | |
| 3 | User Selected Options | | | | | | | | | | | |
| 4 5 | Date/Time of Computation ProUCL 5.2 10/31/2024 5 From File ProUCL Input.xls | 5:04:24 PM | | | | | | | | | | |
| 6 | Full Precision OFF | | | | | | | | | | | |
| 7 | Confidence Coefficient 95% Number of Bootstrap Operations 2000 | | | | | | | | | | | |
| 9 | Number of bootstrap Operations 2000 | | | | | | | | | | | |
| 10 | GF-DR-0.5-1 | | | | | | | | | | | |
| 12 | <u>3F-DR-0.3-1</u> | | | | | | | | | | | |
| 13 14 | T. IN 1 (0) | | Statistics | | | | | | | | | |
| 15 | Total Number of Observations | 4 | Number of Distinct Observations Number of Missing Observations | 0 | | | | | | | | |
| 16 | Minimum | 39 | Mean | 57.5 | | | | | | | | |
| 17 18 | Maximum SD | 83 18.57 | Median Std. Error of Mean | 54 9.287 | | | | | | | | |
| 19 | Coefficient of Variation | | Skewness | 1.038 | | | | | | | | |
| 20 | Notes Commission in small (see 440) 15 date | | I walle a lea are was a lea are alle a rea alle a rea (IOM) a serve a le | | | | | | | | | |
| 21 | | | l using incremental sampling methodology (ISM) approach, C 2020 and ITRC 2012) for additional guidance, | | | | | | | | | |
| 23 | but note that ITRC may recommend th | ne t-UCL or t | he Chebyshev UCL for small sample sizes (n < 7). | | | | | | | | | |
| 24 25 | | | in gross overestimates of the mean. e for a discussion of the Chebyshev UCL. | | | | | | | | | |
| 26 | Neiei to the Floods 5.2 Ted | Jimilicai Guiù | e ioi a discussion oi die Chebyshev CCL. | | | | | | | | | |
| 27 28 | Objective MEDI Total Co. C. C. | | GOF Test | | | | | | | | | |
| 28 | Shapiro Wilk Test Statistic 1% Shapiro Wilk Critical Value | | Shapiro Wilk GOF Test Data appear Normal at 1% Significance Level | | | | | | | | | |
| 30 | Lilliefors Test Statistic | 0.261 | Lilliefors GOF Test | | | | | | | | | |
| 31 32 | 1% Lilliefors Critical Value | | Data appear Normal at 1% Significance Level 1% Significance Level | | | | | | | | | |
| 33 | | | eliable for small sample sizes | | | | | | | | | |
| 34 35 | Assuming Normal Distribution | | | | | | | | | | | |
| 36 | As: 95% Normal UCL | suming Nor | mal Distribution 95% UCLs (Adjusted for Skewness) | | | | | | | | | |
| 37 | 95% Student's-t UCL | 79.36 | 95% Adjusted-CLT UCL (Chen-1995) | 77.92 | | | | | | | | |
| 38 39 | | | 95% Modified-t UCL (Johnson-1978) | 80.16 | | | | | | | | |
| 40 | | Gamma | GOF Test | | | | | | | | | |
| 41 | A-D Test Statistic | 0.249 | Anderson-Darling Gamma GOF Test | | | | | | | | | |
| 42 43 | 5% A-D Critical Value K-S Test Statistic | | Detected data appear Gamma Distributed at 5% Significance Kolmogorov-Smirnov Gamma GOF Test | e Level | | | | | | | | |
| 44 | 5% K-S Critical Value | 0.395 | Detected data appear Gamma Distributed at 5% Significance | e Level | | | | | | | | |
| 45 46 | Detected data appear | r Gamma Di | stributed at 5% Significance Level liable for small sample sizes | | | | | | | | | |
| 47 | Note GOT tests | iliay be ullie | silable for Small Sample Sizes | | | | | | | | | |
| 48 49 | 11.4405 | | Statistics | 0.544 | | | | | | | | |
| 50 | k hat (MLE) Theta hat (MLE) | 13.51 4.256 | k star (bias corrected MLE) Theta star (bias corrected MLE) | 3.544 16.22 | | | | | | | | |
| 51 | nu hat (MLE) | 108.1 | nu star (bias corrected) | 28.35 | | | | | | | | |
| 52 53 | MLE Mean (bias corrected) | 57.5 | MLE Sd (bias corrected) Approximate Chi Square Value (0.05) | 30.54 17.2 | | | | | | | | |
| 54 | Adjusted Level of Significance | N/A | Approximate Crit Square Value (0.05) Adjusted Chi Square Value | N/A | | | | | | | | |
| 55 56 | | | | | | | | | | | | |
| 57 | Ass 95% Approximate Gamma UCL | | ma Distribution 95% Adjusted Gamma UCL | N/A | | | | | | | | |
| 58 | | | | | | | | | | | | |
| 59 60 | Shapiro Wilk Test Statistic | | GOF Test Shapiro Wilk Lognormal GOF Test | | | | | | | | | |
| 61 | 10% Shapiro Wilk Critical Value | 0.792 | Data appear Lognormal at 10% Significance Level | | | | | | | | | |
| 62 63 | Lilliefors Test Statistic | | Lilliefors Lognormal GOF Test | | | | | | | | | |
| 64 | 10% Lilliefors Critical Value Data appear | | Data appear Lognormal at 10% Significance Level at 10% Significance Level | | | | | | | | | |
| 65 | | | eliable for small sample sizes | | | | | | | | | |
| 66 67 | | Lognorma | I Statistics | | | | | | | | | |
| 68 | Minimum of Logged Data | | Mean of logged Data | 4.014 | | | | | | | | |
| 69 70 | Maximum of Logged Data | | SD of logged Data | 0.313 | | | | | | | | |
| 71 | Δεοι | umina Loana | ormal Distribution | | | | | | | | | |
| 72 | 95% H-UCL | 96.95 | 90% Chebyshev (MVUE) UCL | 84.24 | | | | | | | | |
| 73 74 | 95% Chebyshev (MVUE) UCL 99% Chebyshev (MVUE) UCL | 96.37 146.3 | 97.5% Chebyshev (MVUE) UCL | 113.2 | | | | | | | | |
| 75 | | 170.0 | | | | | | | | | | |
| 76 | | | tion Free UCL Statistics | | | | | | | | | |
| 77 78 | Data appea | ar to follow a | Discernible Distribution | | | | | | | | | |
| 79 | | | tribution Free UCLs | | | | | | | | | |
| 80 81 | 95% CLT UCL | 72.78 | 95% BCA Bootstrap UCL 95% Bootstrap-t UCL | N/A | | | | | | | | |
| 82 | 95% Standard Bootstrap UCL 95% Hall's Bootstrap UCL | 1 | 95% Bootstrap-t UCL 95% Percentile Bootstrap UCL | N/A N/A | | | | | | | | |
| 0∠ | | | | | | | | | | | | |

| | Α | В | С | D | E | F | G | Н | ı | J | K | L | |
|----|----------------------|--|----------------|----------------|---------------|--------------|-----------------------------------|----------------|--------------|---------------|-----------------|------|--|
| 83 | | | 90% Ch | ebyshev(Me | an, Sd) UCL | 85.36 | 95% Chebyshev(Mean, Sd) UCL 97. | | | | | | |
| 84 | | | 97.5% Ch | ebyshev(Me | an, Sd) UCL | 115.5 | 99% Chebyshev(Mean, Sd) UCL 149.9 | | | | | | |
| 85 | | | | | | | | | | | | | |
| 86 | Suggested UCL to Use | | | | | | | | | | | | |
| 87 | | | | 95% Stu | dent's-t UCL | 79.36 | | | | | | | |
| 88 | | | | | | • | • | | | | | | |
| 89 | 1 | Note: Sugges | stions regard | ing the selec | tion of a 95% | UCL are pr | ovided to hel | p the user to | select the m | nost appropri | ate 95% UCL | | |
| 90 | | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. Recommendations are based upon data size, data distribution, and skewness using results from simulation studies. | | | | | | | | | | | |
| 91 | Но | wever, simul | lations result | s will not cov | er all Real W | orld data se | ts; for addition | nal insight th | ne user may | want to cons | ult a statistic | ian. | |
| 92 | | | | | | | | | | | | | |

| -1 | Α | В | С | D | E LIOL Oberia | F | G | H | I | J | K | L | |
|----------|---|---------------------------|--------------------------|---------------------------------|--------------------------------|-------------------|---|------------------------|--------------------------------|-----------------------------|----------------------------------|-----------------|--|
| 2 | | | | | UCL Statis | Stics for Unc | ensored Full D | Jata Sets | | | | | |
| 3 | Date | User Sele e/Time of Ce | cted Options | ProUCL 5.2 | 10/21/2024 | 1.26.21 DM | | | | | | | |
| 5 | Date | | From File | ProUCL Inpu | | 4.20.21 F IVI | | | | | | | |
| 6 7 | (| | Il Precision Coefficient | OFF 95% | | | | | | | | | |
| 8 | | f Bootstrap | | 2000 | | | | | | | | | |
| 9 10 | | | | | | | | | | | | | |
| 11 | GF-WRA-0. | 5-1 | | | | | | | | | | | |
| 12 13 | | | | | | General | Statistics | | | | | | |
| 14 | | | Total | Number of O | bservations | 10 | | | | | Observations | 9 | |
| 15 16 | | | | | Minimum | 170 | | | Number | r of Missing | Observations Mean | 0 348.3 | |
| 17 18 | | | | | Maximum | 491 | | | | 0.1.1 | Median | 338 | |
| 19 | | | | Coefficient | SD of Variation | 92.04 0.264 | | | | Sta. I | Error of Mean Skewness | 29.11 -0.313 | |
| 20 21 | | | | | | Normal (| COE Took | | | | | | |
| 22 | | | S | Shapiro Wilk To | est Statistic | 0.965 | GOF Test | | Shapiro Wi | ilk GOF Tes | st | | |
| 23 24 | | | | hapiro Wilk Cı | ritical Value | 0.781 | | Data appear | | | cance Level | | |
| 25 | | | 1 | % Lilliefors Ci | est Statistic ritical Value | 0.188 0.304 | | Data appear | | GOF Test at 1% Signific | cance Level | | |
| 26 27 | Data appear Normal at 1% Significance Level | | | | | | | | | | | | |
| 28 | | | | | As | suming Nori | nal Distributio | | | | | | |
| 29 30 | | | 95% No | ormal UCL | dent's-t UCL | 401.7 | | 95% U | | sted for Sk | ewness) . (Chen-1995) | 393.1 | |
| 31 | | | | 95% Stud | Jenis-i ocl | 401.7 | | 95 | 5% Modifi | ed-t UCL (Jo | ohnson-1978) | 401.2 | |
| 32 | | | | | | Gommo | GOF Test | | | | | | |
| 34 | | | | A-D T | est Statistic | 0.342 | | | | Gamma Go | | | |
| 35 36 | | | | | ritical Value est Statistic | 0.725 0.222 | Detected of | | | istributed at ov Gamma (| 5% Significan | ce Level | |
| 37 | | | | 5% K-S Cı | ritical Value | 0.266 | | data appear (| Gamma D | | 5% Significan | ce Level | |
| 38 39 | | | | Detected | data appeai | r Gamma Di | stributed at 5% | 6 Significano | e Level | | | | |
| 40 | | | | | | | Statistics | | | | | | |
| 41 | | | | | k hat (MLE) a hat (MLE) | 13.82 25.2 | | | orrected MLE) orrected MLE) | 9.741 35.75 | | | |
| 43 | | | | nı | u hat (MLE) | 276.4 | | ias corrected) | 194.8 | | | | |
| 44 45 | | | M | LE Mean (bias | s corrected) | 348.3 | | Ar | oproximate | | ias corrected) e Value (0.05) | 111.6 163.5 | |
| 46 47 | | | Adjus | sted Level of S | Significance | 0.0267 | | | A | djusted Chi | Square Value | 158.6 | |
| 48 | | | | | Ass | suming Gam | ıma Distributio | | | | | | |
| 49 50 | | | 95% A | pproximate G | | | | | 95 | % Adjusted | Gamma UCL | 428 | |
| 51 | | | | | | Lognorma | GOF Test | | | | | | |
| 52 53 | | | | Shapiro Wilk To | | 0.904 | | | | normal GO | | | |
| 54 | | | 10% 5 | hapiro Wilk Cı Lilliefors To | est Statistic | 0.869 0.244 | D | | | ormal GOF | nificance Level Test | | |
| 55 56 | | | 10 | % Lilliefors Cı | | | ormal at 10% s | Data Not Log | | : 10% Signifi | icance Level | | |
| 57 | | | | vala ap | урсаі Друго) | - | | <u>orginilical ICB</u> | F0101 | | | | |
| 58 59 | | | | Minimum of Lo | onned Data | Lognorma 5.136 | l Statistics | | | Mean o | f logged Data | 5.816 | |
| 60 | | | | Maximum of L | | 6.196 | | | | | f logged Data | 0.299 | |
| 61 62 | | | | | Δοοι | ımina I oana | ormal Distributi | ion | | | | | |
| 63 | | | | | 95% H-UCL | 427.6 | a. Diodibat | | | | (MVUE) UCL | 449.4 | |
| 64 65 | | | | Chebyshev (N Chebyshev (N | | | | | 97.5% | Chebyshev | (MVUE) UCL | 557.4 | |
| 66 | | | 33 /0 | | | | | | | | | | |
| 67 68 | | | | | | | tion Free UCL Discernible D | | | | | | |
| 69 | | | | | | | | | | | | | |
| 70 71 | | | | 950 | Nonpai % CLT UCL | | c Distribution Free UCLs 2 95% BCA Bootstrap UCL 39 | | | | | | |
| 72 | | | | Standard Boo | otstrap UCL | 393.7 | .7 95% Bootstrap-t UCI | | | | otstrap-t UCL | 396.7 | |
| 73 74 | | | | 95% Hall's Boo nebyshev(Mea | | | | | | | ootstrap UCL ean, Sd) UCL | 393.4 475.2 | |
| 75 | | | | nebyshev(Mea | | 530.1 | | | | | ean, Sd) UCL | 637.9 | |
| 76 77 | | | | | | Suggested | UCL to Use | | | | | | |
| 78 79 | | | | 95% Stud | dent's-t UCL | | | | | | | | |
| 80 | N | lote: Sugge | stions regard | ling the select | tion of a 95% | UCL are pr | ovided to help | the user to s | elect the n | nost appropi | riate 95% UCL | | |
| 81 | | Recom | nmendations | are based upo | on data size, | , data distrib | ution, and skev | wness using | results fro | m simulatior | n studies. | | |
| 82 | <u>Hov</u> | wever, simu | <u>ıatıons result</u> | is will not cove | er all Real W | orid data se | ts; for additiona | ai insight the | user may | want to con | sult a statistici | an. | |

| | Α | В | С | D | E | F | G | Н | | J | K | L |
|----|---|-----------|--------------|--------------|---------------|--------------|--------------|----------------|--------------|-------------|------------|---|
| 83 | | | | | | | | | | | | |
| 84 | | Note: For | highly negat | ively-skewe | d data, confi | dence limits | (e.g., Chen, | Johnson, Lo | ognormal, an | id Gamma) r | nay not be | |
| 85 | | | reliable. (| Chen's and J | lohnson's me | ethods provi | de adjustme | nts for posity | vely skewed | data sets. | | |
| 86 | | | | | | | | | | | | |
| | | | | | | | | | | | | |

| 1 | A B C D | E | F | G H I J K | L | | | | | | | |
|----------|---|-------------------------|----------------------|--|----------------|--|--|--|--|--|--|--|
| 2 | | UCL Statis | Stics for Unc | ensored Full Data Sets | | | | | | | | |
| 3 | User Selected Options | 0/04/0004 | 4 0 4 0 0 D1 4 | | | | | | | | | |
| 5 | Date/Time of Computation ProUCL 5.2 10 From File ProUCL Input. | | 4:31:28 PIVI | | | | | | | | | |
| 6 | Full Precision OFF | | | | | | | | | | | |
| 7 8 | Confidence Coefficient 95% Number of Bootstrap Operations 2000 | | | | | | | | | | | |
| 9 | | | | | | | | | | | | |
| 10 11 | GF-WRA-0.5-2 | | | | | | | | | | | |
| 12 | | | | | | | | | | | | |
| 13 14 | Total Niveshay of Oh | | General | | | | | | | | | |
| 15 | Total Number of Ob | servations | 5 | Number of Distinct Observations Number of Missing Observations | 0 | | | | | | | |
| 16 17 | | Minimum | | Mean | 241.4 | | | | | | | |
| 18 | | Maximum SD | | Median Std. Error of Mean | 237 15.67 | | | | | | | |
| 19 | Coefficient o | | | Skewness | -0.818 | | | | | | | |
| 20 21 | Note: Sample size is small (e.g. <1) | n) if data s | are collected | using incremental sampling methodology (ISM) approach, | | | | | | | | |
| 22 | refer also to ITRC Tech R | eg Guide | on ISM (ITR | C 2020 and ITRC 2012) for additional guidance, | | | | | | | | |
| 23 24 | | | | he Chebyshev UCL for small sample sizes (n < 7). | | | | | | | | |
| 25 | | | | in gross overestimates of the mean. e for a discussion of the Chebyshev UCL. | | | | | | | | |
| 26 | | | | • | | | | | | | | |
| 27 28 | Shapiro Wilk Te | st Statistic | Normal C 0.927 | GOF Test Shapiro Wilk GOF Test | | | | | | | | |
| 29 | 1% Shapiro Wilk Crit | tical Value | 0.686 | Data appear Normal at 1% Significance Level | | | | | | | | |
| 30 31 | Lilliefors Te: 1% Lilliefors Crit | | | Lilliefors GOF Test Data appear Normal at 1% Significance Level | | | | | | | | |
| 32 | | Data appe | ar Normal at | 1% Significance Level | | | | | | | | |
| 33 34 | Note GOF tests may be unreliable for small sample sizes | | | | | | | | | | | |
| 35 | Assuming Normal Distribution | | | | | | | | | | | |
| 36 | 95% Normal UCL | | | 95% UCLs (Adjusted for Skewness) | | | | | | | | |
| 37 38 | 95% Stude | nt's-t UCL | 274.8 | 95% Adjusted-CLT UCL (Chen-1995) 95% Modified-t UCL (Johnson-1978) | 261 273.8 | | | | | | | |
| 39 | | | | , a | 270.0 | | | | | | | |
| 40 41 | A D T- | -4 ()4-4:-4:- | | GOF Test | | | | | | | | |
| 42 | A-D Te: 5% A-D Crit | st Statistic | 0.355 0.678 | Anderson-Darling Gamma GOF Test Detected data appear Gamma Distributed at 5% Significanc | e Level | | | | | | | |
| 43 | K-S Te | st Statistic | 0.263 | Kolmogorov-Smirnov Gamma GOF Test | | | | | | | | |
| 44 45 | 5% K-S Crit Detected d | | | Detected data appear Gamma Distributed at 5% Significanc stributed at 5% Significance Level | e Level | | | | | | | |
| 46 | | | | liable for small sample sizes | | | | | | | | |
| 47 48 | | | Gamma | Statistics | | | | | | | | |
| 49 | k | hat (MLE) | | k star (bias corrected MLE) | 22.42 | | | | | | | |
| 50 51 | | hat (MLE) | | Theta star (bias corrected MLE) | 10.77 | | | | | | | |
| 52 | nu MLE Mean (bias | hat (MLE) corrected) | | nu star (bias corrected) MLE Sd (bias corrected) | 224.2 50.98 | | | | | | | |
| 53 | | | | Approximate Chi Square Value (0.05) | 190.5 | | | | | | | |
| 54 55 | Adjusted Level of Si | gnificance | 0.0086 | Adjusted Chi Square Value | 176.9 | | | | | | | |
| 56 | | | | ma Distribution | | | | | | | | |
| 57 58 | 95% Approximate Ga | mma UCL | 284 | 95% Adjusted Gamma UCL | 306 | | | | | | | |
| 59 | | | Lognorma | GOF Test | | | | | | | | |
| 60 61 | | | 0.904 | Shapiro Wilk Lognormal GOF Test | | | | | | | | |
| 62 | 10% Shapiro Wilk Crit Lilliefors Te | | | Data appear Lognormal at 10% Significance Level Lilliefors Lognormal GOF Test | | | | | | | | |
| 63 | 10% Lilliefors Crit | tical Value | 0.319 | Data appear Lognormal at 10% Significance Level | | | | | | | | |
| 64 65 | | | | at 10% Significance Level Hiable for small sample sizes | | | | | | | | |
| 66 | Note | JOI (CSIS | may be unit | niuno ivi siliali sallipie sikes | | | | | | | | |
| 67 68 | Maining - £1 - | agod Dete | | I Statistics | E 477 | | | | | | | |
| 69 | Minimum of Lo Maximum of Lo | | | Mean of logged Data SD of logged Data | 5.477 0.153 | | | | | | | |
| 70 71 | | | | | | | | | | | | |
| 71 72 | Qr | Assı 5% H-UCL | uming Logno 284.4 | rmal Distribution 90% Chebyshev (MVUE) UCL | 290.9 | | | | | | | |
| 73 | 95% Chebyshev (M) | VUE) UCL | 313.2 | 97.5% Chebyshev (MVUE) UCL | 344.3 | | | | | | | |
| 74 75 | 99% Chebyshev (M) | VUE) UCL | 405.3 | | | | | | | | | |
| 76 | | lonparame | etric Distribu | tion Free UCL Statistics | | | | | | | | |
| 77 | | | | Discernible Distribution | | | | | | | | |
| 78 79 | | Nonna | rametric Dist | tribution Free UCLs | | | | | | | | |
| 80 | | CLT UCL | 267.2 | 95% BCA Bootstrap UCL | N/A | | | | | | | |
| 81 82 | | | | 95% Bootstrap-t UCL | N/A | | | | | | | |
| UΖ | 95% Hall's Boot | strap UCL | N/A | 95% Percentile Bootstrap UCL | N/A | | | | | | | |

| | Α | В | С | D | E | F | G | Н | I | J | K | L | |
|----|----|-------------|----------------|----------------|---------------|----------------|-----------------------------------|----------------|----------------|--------------|-----------------|-------|--|
| 83 | | | 90% Ch | ebyshev(Mea | an, Sd) UCL | 288.4 | 95% Chebyshev(Mean, Sd) UCL 309.7 | | | | | | |
| 84 | | | 97.5% Ch | ebyshev(Mea | an, Sd) UCL | 339.2 | | | 99% Ch | ebyshev(Me | an, Sd) UCL | 397.3 | |
| 85 | | | | | | | | | | | | | |
| 86 | | | | | | Suggested | UCL to Use | | | | | | |
| 87 | | | | 95% Stu | dent's-t UCL | 274.8 | | | | | | | |
| 88 | | | | | | | | | | | | | |
| 89 | | Note: Sugge | stions regard | ing the selec | tion of a 95% | 6 UCL are pr | ovided to hel | p the user to | select the m | ost appropri | ate 95% UCL | | |
| 90 | | Recom | mendations | are based up | on data size | , data distrib | ution, and sk | ewness usin | g results fror | m simulation | studies. | | |
| 91 | Ho | wever, simu | lations result | s will not cov | er all Real W | Vorld data se | ts; for addition | nal insight th | ne user may | want to cons | ult a statistic | ian. | |
| 92 | | | | | | | | | | | | | |
| 93 | | Note: For | highly negat | ively-skewed | d data, confi | dence limits | (e.g., Chen, | Johnson, Lo | ognormal, ar | nd Gamma) i | may not be | · | |
| 94 | | | reliable. | Chen's and J | ohnson's m | ethods provi | de adjustme | nts for posit | vely skewed | data sets. | | | |
| 95 | | | | | | | | | | | | | |

| 1 | Α | В | С | D | E UCL Statio | F | G ensored Full D | H Data Sata | I | J | K | L |
|----------|-----------|---|--------------------------|---------------------------------|--------------------------------|-------------------|--|----------------------|--------------|---------------------------|------------------------------------|----------------|
| 2 | | | | | UCL Statis | Stics for Unc | ensorea Full L | Jata Sets | | | | |
| 3 | Date | User Sele e/Time of C | cted Options | ProUCL 5.2 | 10/31/2024 | 1.33.35 DM | | | | | | |
| 5 | Date | | From File | ProUCL Inpu | | +.33.23 F IVI | | | | | | |
| 6 7 | | | Il Precision Coefficient | OFF 95% | | | | | | | | |
| 8 | | f Bootstrap | | 2000 | | | | | | | | |
| 9 10 | | | | | | | | | | | | |
| 11 | GF-WRA-0. | 5-3 | | | | | | | | | | |
| 12 13 | | | | | | General | Statistics | | | | | |
| 14 | | | Total | Number of O | bservations | 10 | | | | | t Observations | 9 |
| 15 16 | | | | | Minimum | 224 | | | Numbe | er of Missing | g Observations Mean | 292.4 |
| 17 18 | | | | | Maximum | | | | | 0.1 | Median | 272 |
| 19 | | | | Coefficient | SD of Variation | 60.1 0.206 | | | | Sta | . Error of Mean Skewness | 19 1.28 |
| 20 21 | | | | | | Normal (| COE Took | | | | | |
| 22 | | | S | Shapiro Wilk T | est Statistic | 0.858 | GOF Test | | Shapiro W | /ilk GOF Te | est | |
| 23 24 | | | 1% S | hapiro Wilk C | ritical Value est Statistic | 0.781 | | Data appe | | | ficance Level | |
| 25 | | | 1 | % Lilliefors C | | 0.256 0.304 | | Data appe | | s GOF Test at 1% Signi | ficance Level | |
| 26 27 | | Data appear Normal at 1% Significance Level | | | | | | | | | | |
| 28 | | | | | As | suming Nori | mal Distributio | | | | | |
| 29 30 | | | 95% No | ormal UCL | dent's-t UCL | 327.2 | | 95% | | usted for S | kewness) CL (Chen-1995) | 331.9 |
| 31 | | | | 30 /o Siu(| Jenis-i UCL | JZ1.Z | | | 95% Modif | ied-t UCL (| Johnson-1978) | |
| 32 33 | | | | | | Gamma | GOF Test | | | | | |
| 34 | | | | A-D T | est Statistic | 0.573 | | | | g Gamma C | | |
| 35 36 | | | | | ritical Value est Statistic | 0.725 0.228 | Detected of | | | | at 5% Significan a GOF Test | ce Level |
| 37 | | | | 5% K-S C | ritical Value | 0.266 | | data appear | r Gamma D | | at 5% Significan | ce Level |
| 38 39 | | | | Detected | data appeai | r Gamma Di | stributed at 5% | <u> 6 Significan</u> | nce Level | | | |
| 40 | | | | | | | Statistics | | | | | |
| 41 42 | | | | | k hat (MLE) ta hat (MLE) | 29.22 10.01 | 29.22 k star (bias 10.01 Theta star (bias | | | | | 20.52 14.25 |
| 43 | | | | n | u hat (MLE) | 584.3 | nu star (bias corre | | | | | 410.4 |
| 44 45 | | | M | LE Mean (bia | s corrected) | 292.4 | | | Approximat | | bias corrected) re Value (0.05) | 64.55 364.4 |
| 46 47 | | | Adjus | sted Level of | Significance | 0.0267 | | | А | djusted Ch | i Square Value | |
| 48 | | | | | Ass | suming Gam | nma Distributio | on | | | | |
| 49 50 | | | 95% A | pproximate G | amma UCL | 329.3 | | | 95 | 5% Adjuste | d Gamma UCL | 336.2 |
| 51 | | | | | | Lognorma | GOF Test | | | | | |
| 52 53 | | | | Shapiro Wilk T hapiro Wilk C | | 0.904 0.869 | D | | | gnormal G | OF Test gnificance Level | |
| 54 | | | | Lilliefors T | est Statistic | 0.218 | | Lilli | iefors Logr | normal GOF | F Test | |
| 55 56 | | | 10 | % Lilliefors C | | | D: at 10% Signific | | | at 10% Sig | gnificance Level | |
| 57 | | | | | , ака арреа <u>і</u> | | | Janoe Leve | ra | | | |
| 58 59 | | | | Minimum of L | ogged Data | Lognorma 5.412 | l Statistics | | | Mean | of logged Data | 5.661 |
| 60 | | | | Maximum of L | | 6.031 | | | | | of logged Data | 0.191 |
| 61 62 | | | | | Assı | ıming Loand | ormal Distributi | tion | | | | |
| 63 64 | | | 050/ | | 95% H-UCL | 329.8 | | | | | v (MVUE) UCL | 345.2 |
| 65 | | | | Chebyshev (I Chebyshev (I | | 369.3 468.2 | | | 97.5% | Cnebyshe | v (MVUE) UCL | 402.7 |
| 66 67 | | | | , (. | | | tion Fron UC | Chatlati | | | | |
| 68 | | | | | | | tion Free UCL Discernible D | | | | | |
| 69 70 | | | | | | | | | | | | |
| 71 | | | | | % CLT UCL | 323.7 | tribution Free | UCLS | | | Bootstrap UCL | |
| 72 73 | | | | Standard Bo | | 322.5 544.2 | | | 0.50/ | | Bootstrap-t UCL Bootstrap UCL | 363.7 324.4 |
| 74 | | | 90% Ch | nebyshev(Mea | an, Sd) UCL | 349.4 | | | 95% C | hebyshev(N | Mean, Sd) UCL | 375.2 |
| 75 76 | | | 97.5% Ch | nebyshev(Mea | an, Sd) UCL | 411.1 | | | 99% C | hebyshev(N | Mean, Sd) UCL | 481.5 |
| 77 | | | | | | | UCL to Use | | | | | |
| 78 79 | | | | 95% Stud | dent's-t UCL | 327.2 | | | | | | |
| 80 | N | | | | | | | | | | priate 95% UCL | |
| 81 82 | Ца | | | | | | ution, and skey | | | | on studies. Insult a statistici | an |
| IJΖ | <u> </u> | wever, Simu | nations result | S WIII HOL COV | ei ali Keal W | ronu uata se | ര, ioi auditiona | ar msiyrit th | e usei IIIdy | wani io co | nisuit a Statistici | all. |

83 B C D E F G H I J K L

| | A B C D E | F | G H I J K | L | | | | | | | | |
|----------|---|-----------------------|---|----------------|--|--|--|--|--|--|--|--|
| 2 | UCL Statis | stics for Unc | ensored Full Data Sets | | | | | | | | | |
| 3 | User Selected Options | | | | | | | | | | | |
| 4 5 | Date/Time of Computation ProUCL 5.2 10/31/2024 | 4:34:59 PM | | | | | | | | | | |
| 6 | Full Precision OFF | | | | | | | | | | | |
| 7 | Confidence Coefficient 95% Number of Bootstrap Operations 2000 | | | | | | | | | | | |
| 9 | Number of Bootstrap Operations 2000 | | | | | | | | | | | |
| 10 | OF WDD 0.5.4 | | | | | | | | | | | |
| 12 | GF-WRB-0.5-1 | | | | | | | | | | | |
| 13 | | | Statistics | | | | | | | | | |
| 14 15 | Total Number of Observations | 4 | Number of Distinct Observations Number of Missing Observations | 0 | | | | | | | | |
| 16 | Minimum | 103 | | 119 | | | | | | | | |
| 17 18 | Maximum | | | 114.5 | | | | | | | | |
| 19 | SD Coefficient of Variation | | Std. Error of Mean Skewness | 8.822 1.357 | | | | | | | | |
| 20 | | , | | | | | | | | | | |
| 21 | | | I using incremental sampling methodology (ISM) approach, C 2020 and ITRC 2012) for additional guidance, | | | | | | | | | |
| 23 | | | the Chebyshev UCL for small sample sizes (n < 7). | | | | | | | | | |
| 24 25 | The Chebyshev UCL o | often results | in gross overestimates of the mean. | | | | | | | | | |
| 26 | Refer to the ProUCL 5.2 Tec | nnical Guide | e for a discussion of the Chebyshev UCL. | —— | | | | | | | | |
| 27 | | | GOF Test | | | | | | | | | |
| 28 29 | Shapiro Wilk Test Statistic 1% Shapiro Wilk Critical Value | | Shapiro Wilk GOF Test Data appear Normal at 1% Significance Level | | | | | | | | | |
| 30 | 1% Snapiro Wilk Critical Value Lilliefors Test Statistic | | Lilliefors GOF Test | | | | | | | | | |
| 31 | 1% Lilliefors Critical Value | 0.413 | Data appear Normal at 1% Significance Level | | | | | | | | | |
| 32 33 | | | t 1% Significance Level | | | | | | | | | |
| 34 | Note GOF tests may be unreliable for small sample sizes | | | | | | | | | | | |
| 35 36 | | suming Norr | mal Distribution | | | | | | | | | |
| 37 | 95% Normal UCL 95% Student's-t UCL | 139.8 | 95% UCLs (Adjusted for Skewness) 95% Adjusted-CLT UCL (Chen-1995) 1 | 139.9 | | | | | | | | |
| 38 | 50% StadSht 8 1 002 | 100.0 | | 140.8 | | | | | | | | |
| 39 40 | | | COF Test | | | | | | | | | |
| 41 | A-D Test Statistic | | GOF Test Anderson-Darling Gamma GOF Test | | | | | | | | | |
| 42 | 5% A-D Critical Value | 0.656 | Detected data appear Gamma Distributed at 5% Significance | Level | | | | | | | | |
| 43 44 | K-S Test Statistic 5% K-S Critical Value | | Kolmogorov-Smirnov Gamma GOF Test Detected data appear Gamma Distributed at 5% Significance | Lovol | | | | | | | | |
| 45 | | | stributed at 5% Significance Level | Level | | | | | | | | |
| 46 47 | | | eliable for small sample sizes | | | | | | | | | |
| 47 | | Gamma | Statistics | | | | | | | | | |
| 49 | k hat (MLE) | 64.11 | k star (bias corrected MLE) | 16.19 | | | | | | | | |
| 50 51 | Theta hat (MLE) | | Theta star (bias corrected MLE) | 7.349 | | | | | | | | |
| 52 | nu hat (MLE) MLE Mean (bias corrected) | | | 129.5 29.57 | | | | | | | | |
| 53 | | | Approximate Chi Square Value (0.05) 1 | 104.3 | | | | | | | | |
| 54 55 | Adjusted Level of Significance | N/A | Adjusted Chi Square Value | N/A | | | | | | | | |
| 56 | As | suming Garr | nma Distribution | | | | | | | | | |
| 57 58 | 95% Approximate Gamma UCL | | | N/A | | | | | | | | |
| 58 | | Lognorma | I GOF Test | | | | | | | | | |
| 60 | Shapiro Wilk Test Statistic | 0.926 | Shapiro Wilk Lognormal GOF Test | | | | | | | | | |
| 61 62 | 10% Shapiro Wilk Critical Value | | Data appear Lognormal at 10% Significance Level | | | | | | | | | |
| 63 | Lilliefors Test Statistic 10% Lilliefors Critical Value | | Lilliefors Lognormal GOF Test Data appear Lognormal at 10% Significance Level | | | | | | | | | |
| 64 | Data appear | Lognormal a | at 10% Significance Level | | | | | | | | | |
| 65 66 | Note GOF tests | may be unre | eliable for small sample sizes | | | | | | | | | |
| 67 | | Lognorma | I Statistics | | | | | | | | | |
| 68 | Minimum of Logged Data | 4.635 | Mean of logged Data | 4.771 | | | | | | | | |
| 69 70 | Maximum of Logged Data | 4.97 | SD of logged Data | 0.143 | | | | | | | | |
| 71 | | | ormal Distribution | | | | | | | | | |
| 72 73 | 95% H-UCL | 144.3 | 90% Chebyshev (MVUE) UCL 1 | 144.4 | | | | | | | | |
| 74 | 95% Chebyshev (MVUE) UCL 99% Chebyshev (MVUE) UCL | | 97.5% Chebyshev (MVUE) UCL 1 | 171.8 | | | | | | | | |
| 75 | | | · · · · · · · · · · · · · · · · · · · | | | | | | | | | |
| 76 77 | | | tion Free UCL Statistics | | | | | | | | | |
| 78 | Data appea | <u>ir to follow a</u> | Discernible Distribution | | | | | | | | | |
| 79 | | | tribution Free UCLs | | | | | | | | | |
| 80 81 | 95% CLT UCL | 133.5 | 95% BCA Bootstrap UCL | N/A | | | | | | | | |
| 82 | 95% Standard Bootstrap UCL 95% Hall's Bootstrap UCL | | • | N/A N/A | | | | | | | | |
| | 30 /0 Hall 3 DOUISHAP UCL | 1.11/7.1 | 1 20 /0 1 GLOGHUIG DOOLSHAP OCL | 7// \ | | | | | | | | |

| | Α | В | С | D | E | F | G | Н | I | J | K | L | |
|----|----------------------|--|----------------|----------------|---------------|--------------|-----------------------------------|----------------|--------------|---------------|------------------|-------|--|
| 83 | | | 90% Ch | ebyshev(Me | an, Sd) UCL | 145.5 | 95% Chebyshev(Mean, Sd) UCL 157.5 | | | | | | |
| 84 | | | 97.5% Ch | ebyshev(Me | an, Sd) UCL | 174.1 | | | 99% Ch | ebyshev(Me | an, Sd) UCL | 206.8 | |
| 85 | | | | | | | | | | | | | |
| 86 | Suggested UCL to Use | | | | | | | | | | | | |
| 87 | | | | 95% Stu | dent's-t UCL | 139.8 | | | | | | | |
| 88 | | | | | | • | • | | | | | - | |
| 89 | ľ | Note: Sugges | stions regard | ing the selec | tion of a 95% | UCL are pr | ovided to hel | p the user to | select the m | ost appropria | ate 95% UCL | | |
| 90 | | Recommendations are based upon data size, data distribution, and skewness using results from simulation studies. | | | | | | | | | | | |
| 91 | Но | wever, simul | lations result | s will not cov | er all Real W | orld data se | ts; for addition | nal insight th | ne user may | want to cons | ult a statistici | ian. | |
| 92 | | | | | | | | | | | | | |

| | A B C D E | F | G H I J K | L | | | | | | | |
|----------|---|-----------------------|---|-----------------|--|--|--|--|--|--|--|
| 2 | UCL Statis | stics for Unc | ensored Full Data Sets | | | | | | | | |
| 3 | User Selected Options | | | | | | | | | | |
| 4 5 | Date/Time of Computation ProUCL 5.2 10/31/2024 | 4:36:18 PM | | | | | | | | | |
| 6 | Full Precision OFF | | | | | | | | | | |
| 7 | Confidence Coefficient 95% Number of Bootstrap Operations 2000 | | | | | | | | | | |
| 9 | Number of Bootstrap Operations 2000 | | | | | | | | | | |
| 10 | OF WDD 0.5.0 | | | | | | | | | | |
| 12 | GF-WRB-0.5-2 | | | | | | | | | | |
| 13 | | | Statistics | | | | | | | | |
| 14 15 | Total Number of Observations | 4 | Number of Distinct Observations Number of Missing Observations | 0 | | | | | | | |
| 16 | Minimum | 68 | | 78 | | | | | | | |
| 17 18 | Maximum | | | 78.5 | | | | | | | |
| 19 | SD Coefficient of Variation | | | 4.143 -0.274 | | | | | | | |
| 20 | | , | | | | | | | | | |
| 21 22 | | | I using incremental sampling methodology (ISM) approach, C 2020 and ITRC 2012) for additional guidance, | | | | | | | | |
| 23 | | | the Chebyshev UCL for small sample sizes (n < 7). | | | | | | | | |
| 24 25 | The Chebyshev UCL o | often results | in gross overestimates of the mean. | | | | | | | | |
| 26 | Refer to the ProUCL 5.2 Tec | <u>:nnical Guid</u> | e for a discussion of the Chebyshev UCL. | | | | | | | | |
| 27 | | | GOF Test | | | | | | | | |
| 28 29 | Shapiro Wilk Test Statistic 1% Shapiro Wilk Critical Value | | Shapiro Wilk GOF Test | | | | | | | | |
| 30 | 1% Snapiro Wilk Critical Value Lilliefors Test Statistic | | Data appear Normal at 1% Significance Level Lilliefors GOF Test | | | | | | | | |
| 31 | 1% Lilliefors Critical Value | 0.413 | Data appear Normal at 1% Significance Level | | | | | | | | |
| 32 33 | | | t 1% Significance Level | | | | | | | | |
| 34 | Note GOF tests may be unreliable for small sample sizes | | | | | | | | | | |
| 35 36 | Assuming Normal Distribution | | | | | | | | | | |
| 37 | 95% Normal UCL 95% Student's-t UCL | 87.75 | 95% UCLs (Adjusted for Skewness) 95% Adjusted-CLT UCL (Chen-1995) | 84.21 | | | | | | | |
| 38 | 30% Statistics (002 | 07.70 | | 87.66 | | | | | | | |
| 39 40 | | | COF Test | | | | | | | | |
| 41 | A-D Test Statistic | | GOF Test Anderson-Darling Gamma GOF Test | | | | | | | | |
| 42 | 5% A-D Critical Value | 0.657 | Detected data appear Gamma Distributed at 5% Significance I | Level | | | | | | | |
| 43 44 | K-S Test Statistic 5% K-S Critical Value | | Kolmogorov-Smirnov Gamma GOF Test Detected data appear Gamma Distributed at 5% Significance I | Lovol | | | | | | | |
| 45 | | | stributed at 5% Significance Level | Levei | | | | | | | |
| 46 47 | | | eliable for small sample sizes | | | | | | | | |
| 47 | | Gamma | Statistics | | | | | | | | |
| 49 | k hat (MLE) | | | 29.26 | | | | | | | |
| 50 51 | Theta hat (MLE) | | | 2.666 | | | | | | | |
| 52 | nu hat (MLE) MLE Mean (bias corrected) | | | 234.1 14.42 | | | | | | | |
| 53 | | | Approximate Chi Square Value (0.05) 1 | 99.6 | | | | | | | |
| 54 55 | Adjusted Level of Significance | N/A | Adjusted Chi Square Value | N/A | | | | | | | |
| 56 | As | suming Garr | nma Distribution | | | | | | | | |
| 57 58 | 95% Approximate Gamma UCL | | | N/A | | | | | | | |
| 58 | | Lognorma | I GOF Test | | | | | | | | |
| 60 | Shapiro Wilk Test Statistic | 0.978 | Shapiro Wilk Lognormal GOF Test | | | | | | | | |
| 61 62 | 10% Shapiro Wilk Critical Value | | Data appear Lognormal at 10% Significance Level | | | | | | | | |
| 63 | Lilliefors Test Statistic 10% Lilliefors Critical Value | | Lilliefors Lognormal GOF Test Data appear Lognormal at 10% Significance Level | | | | | | | | |
| 64 | Data appear | Lognormal a | at 10% Significance Level | | | | | | | | |
| 65 66 | Note GOF tests | may be unre | eliable for small sample sizes | | | | | | | | |
| 67 | | Lognorma | I Statistics | | | | | | | | |
| 68 | Minimum of Logged Data | 4.22 | Mean of logged Data | 4.352 | | | | | | | |
| 69 70 | Maximum of Logged Data | 4.466 | SD of logged Data | 0.108 | | | | | | | |
| 71 | Assı | uming Logno | ormal Distribution | | | | | | | | |
| 72 73 | 95% H-UCL | 89.76 | 90% Chebyshev (MVUE) UCL | 90.58 | | | | | | | |
| 74 | 95% Chebyshev (MVUE) UCL 99% Chebyshev (MVUE) UCL | 96.27 119.7 | 97.5% Chebyshev (MVUE) UCL 1 | 04.2 | | | | | | | |
| 75 | | | | | | | | | | | |
| 76 77 | | | tion Free UCL Statistics | | | | | | | | |
| 78 | Data appea | <u>ir to follow a</u> | Discernible Distribution | | | | | | | | |
| 79 | | | tribution Free UCLs | | | | | | | | |
| 80 81 | 95% CLT UCL | 84.82 | 95% BCA Bootstrap UCL N | N/A | | | | | | | |
| 82 | 95% Standard Bootstrap UCL 95% Hall's Bootstrap UCL | | • | N/A N/A | | | | | | | |
| | 30 /0 Hall 3 DOUISHAP UCL | 13773 | 1 20 /0 1 GLOGHING DOORSHAD OCK | 1// 1 | | | | | | | |

| | Α | В | С | D | E | F | G | Н | I | J | K | L |
|----|--|--------------|----------------|----------------|---------------|----------------|------------------|----------------|----------------|--------------|-----------------|-------|
| 83 | | - | 90% Ch | ebyshev(Me | an, Sd) UCL | 90.43 | | | 95% Ch | ebyshev(Me | an, Sd) UCL | 96.06 |
| 84 | | | 97.5% Ch | ebyshev(Me | an, Sd) UCL | 103.9 | | | 99% Ch | ebyshev(Me | an, Sd) UCL | 119.2 |
| 85 | | | | | | | | | | | | |
| 86 | | | | | | Suggested | UCL to Use | | | | | |
| 87 | | | | 95% Stu | dent's-t UCL | 87.75 | | | | | | |
| 88 | Trocommonaca Col Crocoac ale maximam obcorvation | | | | | | | | | | | |
| 89 | | | | | | | | | | | | |
| 90 | 1 | Note: Sugges | stions regard | ling the selec | tion of a 95% | 6 UCL are pr | ovided to hel | p the user to | select the m | ost appropri | ate 95% UCL | |
| 91 | | Recom | mendations | are based up | on data size | , data distrib | ution, and sk | ewness usin | g results fror | m simulation | studies. | |
| 92 | Но | wever, simu | lations result | s will not cov | er all Real V | Vorld data se | ts; for addition | nal insight th | ne user may | want to cons | ult a statistic | ian. |
| 93 | | | | | | | | | | | | |
| 94 | | Note: For | highly negat | ively-skewe | d data, confi | dence limits | (e.g., Chen, | Johnson, Lo | ognormal, ar | nd Gamma) i | may not be | |
| 95 | | | reliable. | Chen's and J | lohnson's m | ethods provi | de adjustme | nts for posit | vely skewed | data sets. | | |
| 96 | | | | | | | | | | | | |

| CF-WRB-0.5-3 CR | | A B C D E | F | G H I J K | L | | | | | | | |
|--|----------|--|---------------|--|----------------|--|--|--|--|--|--|--|
| Date Price of Computation ProdUCL Input.45 | 2 | UCL Statis | stics for Unc | ensored Full Data Sets | | | | | | | | |
| From File Product Installation OFF Confidence Coefficient SPS. Number of Disease potentions SPS. | | | | | | | | | | | | |
| Full Processon OFF Today Control Contr | | | 4:37:39 PM | | | | | | | | | |
| Function | 6 | | | | | | | | | | | |
| Total Number of Disservations 4 | | | | | | | | | | | | |
| General Statistics General Statistics Number of Distinct Observations 4 | | Number of Bootstrap Operations 2000 | | | | | | | | | | |
| Total Number of Observations | 10 | | | | | | | | | | | |
| 14 | | GF-WRB-0.5-3 | | | | | | | | | | |
| Total Number of Observations 4 | | | General | Statistics | | | | | | | | |
| Monimum 60 | 14 | Total Number of Observations | | | 4 | | | | | | | |
| Maximum 87 | | Marian | 60 | | | | | | | | | |
| Note: Sample size is small (a.g. <10, if data are collected using incremental sampling methodology (ISM) approach, rafer also to ITDC fieth Res Quite on ISM (ITRC 2002 and ITRC 2012 for saddlinosit guidence.) | | | | | | | | | | | | |
| Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach, refer also to ITRC Tech Rag Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance. | | SD | 12.57 | | 6.285 | | | | | | | |
| Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (SMM approach, refer also to ITRC Tech Reg Guide on ISM (TRC 2020 and ITRC 2012) for additional guidance, state of the control o | | Coefficient of Variation | 0.177 | Skewness | 0.705 | | | | | | | |
| | | Note: Sample size is small (e.g., <10), if data a | are collected | using incremental sampling methodology (ISM) approach. | | | | | | | | |
| The Chebyshev UCL often results in gross overestimates of the mean. | 22 | refer also to ITRC Tech Reg Guide of | on ISM (ITR | C 2020 and ITRC 2012) for additional guidance, | - | | | | | | | |
| Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL | 23 | | | | | | | | | | | |
| Shapiro Wilk Test Statistic | 25 | | | | | | | | | | | |
| Shapiro Wilk Test Statistic 0.907 Shapiro Wilk GOF Test | 26 | 110.01 to the 11000£ 0.2 160 | | • | | | | | | | | |
| 1% Shapiro Wilk Critical Value | | Objection MPD To Control | | | | | | | | | | |
| | 29 | | | | | | | | | | | |
| Second Part | 30 | Lilliefors Test Statistic | 0.263 | Lilliefors GOF Test | | | | | | | | |
| Note GOF tests may be unreliable for small sample sizes | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | 34 | | | | | | | | | | | |
| | | | | | | | | | | | | |
| Semma GOF Test | | | 85 79 | | 83.7 | | | | | | | |
| Gamma GOF Test | 38 | 35% Gludents-t GGE | 00.70 | | | | | | | | | |
| AD Test Statistic | | | | | | | | | | | | |
| 1.0 | | A-D Test Statistic | | | | | | | | | | |
| SK STEAST Statistic 0.296 School Common Commo | 42 | | | | e Level | | | | | | | |
| Detected data appear Gamma Distributed at 5% Significance Level | | | | | | | | | | | | |
| Note GOF tests may be unreliable for small sample sizes | | | | | <u>e Level</u> | | | | | | | |
| | 46 | Note GOF tests | may be unre | eliable for small sample sizes | | | | | | | | |
| R R R R R R R R R R | | | • | Orania di La | | | | | | | | |
| Theta hat (MLE) | 49 | k hat (MLF) | | | 11 11 | | | | | | | |
| MLE Mean (bias corrected) 71 | 50 | | 1.621 | Theta star (bias corrected MLE) | 6.388 | | | | | | | |
| Adjusted Level of Significance N/A | | | 350.3 | | | | | | | | | |
| Adjusted Level of Significance N/A | 53 | MILE Mean (bias corrected) | / 1 | | | | | | | | | |
| Section | 54 | Adjusted Level of Significance | N/A | | | | | | | | | |
| S7 | | | | - Distribution | | | | | | | | |
| Lognormal GOF Test | | | | | N/A | | | | | | | |
| Shapiro Wilk Test Statistic 0.912 Shapiro Wilk Lognormal GOF Test | 58 | CONT. INSTITUTE CONTINUE CONTI | | | | | | | | | | |
| 10% Shapiro Wilk Critical Value 0.792 Data appear Lognormal at 10% Significance Level | | Chanira Will Took Chakinkin | | | | | | | | | | |
| Lilliefors Test Statistic 0.263 Lilliefors Lognormal GOF Test | | | | | | | | | | | | |
| Data appear Lognormal at 10% Significance Level | 62 | Lilliefors Test Statistic | 0.263 | Lilliefors Lognormal GOF Test | | | | | | | | |
| Note GOF tests may be unreliable for small sample sizes | | | | | | | | | | | | |
| Comparison Com | 65 | | | | | | | | | | | |
| 68 Minimum of Logged Data 4.094 Mean of logged Data 4.251 69 Maximum of Logged Data 4.466 SD of logged Data 0.174 70 71 Assuming Lognormal Distribution 72 95% H-UCL 90.58 90% Chebyshev (MVUE) UCL 89.44 73 95% Chebyshev (MVUE) UCL 97.8 97.5% Chebyshev (MVUE) UCL 109.4 74 99% Chebyshev (MVUE) UCL 132.2 75 Nonparametric Distribution Free UCL Statistics 77 Data appear to follow a Discernible Distribution 78 Nonparametric Distribution Free UCLs 80 Nonparametric Distribution Free UCLs 80 95% BCA Bootstrap UCL N/A 81 95% Standard Bootstrap UCL N/A | 66 | | - | • | | | | | | | | |
| Maximum of Logged Data 4.466 SD of logged Data 0.174 | | Minimum of Laure 1 Date | | | 4 251 | | | | | | | |
| 70 Assuming Lognormal Distribution 72 95% H-UCL 90.58 90% Chebyshev (MVUE) UCL 89.44 73 95% Chebyshev (MVUE) UCL 97.8 97.5% Chebyshev (MVUE) UCL 109.4 74 99% Chebyshev (MVUE) UCL 132.2 75 76 Nonparametric Distribution Free UCL Statistics 77 Data appear to follow a Discernible Distribution 78 79 Nonparametric Distribution Free UCLs 80 95% BCA Bootstrap UCL N/A 80 95% Standard Bootstrap UCL N/A 95% Bootstrap-t UCL N/A 81 95% Standard Bootstrap UCL N/A 95% Bootstrap-t UCL N/A | 69 | | | | | | | | | | | |
| 72 95% H-UCL 90.58 90% Chebyshev (MVUE) UCL 89.44 73 95% Chebyshev (MVUE) UCL 97.8 97.5% Chebyshev (MVUE) UCL 109.4 74 99% Chebyshev (MVUE) UCL 132.2 75 76 Nonparametric Distribution Free UCL Statistics 77 Data appear to follow a Discernible Distribution 78 Nonparametric Distribution Free UCLs 80 95% BCA Bootstrap UCL N/A 80 95% Standard Bootstrap UCL N/A 95% Bootstrap-t UCL N/A | 70 | | | | | | | | | | | |
| 73 95% Chebyshev (MVUE) UCL 97.8 97.5% Chebyshev (MVUE) UCL 109.4 74 99% Chebyshev (MVUE) UCL 132.2 75 76 Nonparametric Distribution Free UCL Statistics 77 Data appear to follow a Discernible Distribution 78 Nonparametric Distribution Free UCLs 80 95% BCA Bootstrap UCL N/A 80 95% Standard Bootstrap UCL N/A 95% Bootstrap-t UCL N/A | 71 72 | | | | 90.44 | | | | | | | |
| 74 99% Chebyshev (MVUE) UCL 132.2 75 Nonparametric Distribution Free UCL Statistics 77 Data appear to follow a Discernible Distribution 78 Nonparametric Distribution Free UCLs 80 Nonparametric Distribution Free UCLs 80 95% CLT UCL 81.34 95% BCA Bootstrap UCL N/A 81 95% Standard Bootstrap UCL N/A 95% Bootstrap-t UCL N/A | 73 | | | | | | | | | | | |
| Nonparametric Distribution Free UCL Statistics Data appear to follow a Discernible Distribution Nonparametric Distribution Free UCLs Nonparametric Distribution Free UCLs 80 95% CLT UCL 81.34 95% BCA Bootstrap UCL N/A 81 95% Standard Bootstrap UCL N/A 95% Bootstrap-t UCL N/A | 74 | | | | | | | | | | | |
| Data appear to follow a Discernible Distribution 78 Nonparametric Distribution Free UCLs 80 95% CLT UCL 81.34 95% BCA Bootstrap UCL N/A 81 95% Standard Bootstrap UCL N/A 95% Bootstrap-t UCL N/A | 75 76 | Nazarana | telo Distelle | tion Erna LICI Statistics | | | | | | | | |
| 78 79 Nonparametric Distribution Free UCLs 80 95% CLT UCL 81.34 95% BCA Bootstrap UCL N/A 81 95% Standard Bootstrap UCL N/A 95% Bootstrap-t UCL N/A | 77 | | | | | | | | | | | |
| 80 95% CLT UCL 81.34 95% BCA Bootstrap UCL N/A 81 95% Standard Bootstrap UCL N/A 95% Bootstrap-t UCL N/A | 78 | | | | | | | | | | | |
| 81 95% Standard Bootstrap UCL N/A 95% Bootstrap-t UCL N/A | | | | | NI/A | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |

| | Α | В | С | D | E | F | G | Н | I | J | K | L |
|----|----|--------------|----------------|----------------|---------------|----------------|------------------|----------------|----------------|---------------|-----------------|-------|
| 83 | | | 90% Ch | ebyshev(Me | an, Sd) UCL | 89.85 | | | 95% Ch | ebyshev(Me | an, Sd) UCL | 98.4 |
| 84 | | | 97.5% Ch | ebyshev(Me | an, Sd) UCL | 110.2 | | | 99% Ch | ebyshev(Me | an, Sd) UCL | 133.5 |
| 85 | | | | | | | | | | | | |
| 86 | | | | | | Suggested | UCL to Use | | | | | |
| 87 | | | | 95% Stu | dent's-t UCL | 85.79 | | | | | | |
| 88 | | | | | | • | • | | | | | |
| 89 | 1 | Note: Sugges | stions regard | ing the selec | tion of a 95% | UCL are pr | ovided to hel | p the user to | select the m | nost appropri | ate 95% UCL | |
| 90 | | Recom | mendations | are based up | on data size | , data distrib | ution, and sk | ewness usin | g results fror | m simulation | studies. | |
| 91 | Но | wever, simu | lations result | s will not cov | er all Real W | orld data se | ts; for addition | nal insight th | ne user may | want to cons | ult a statistic | ian. |
| 92 | | | | | | | | | | | | |

| 1 | A B C D E UCL Statis | F stics for Unc | G H I J K ensored Full Data Sets | L | | | | | | |
|----------|---|----------------------|---|----------------|--|--|--|--|--|--|
| 2 | | | | | | | | | | |
| 3 | User Selected Options | | | | | | | | | |
| 5 | Date/Time of Computation ProUCL 5.2 10/31/2024 4 From File ProUCL Input.xls | 4:46:09 PM | | | | | | | | |
| 6 | Full Precision OFF | | | | | | | | | |
| 7 | Confidence Coefficient 95% | | | | | | | | | |
| 8 | Number of Bootstrap Operations 2000 | | | | | | | | | |
| 9 | | | | | | | | | | |
| | GF-WRC-0.5-1 | | | | | | | | | |
| 12 | GF-WNC-0.5-1 | | | | | | | | | |
| 13 | | General | Statistics | | | | | | | |
| 14 15 | Total Number of Observations | 4 | Number of Distinct Observations | 4 | | | | | | |
| 16 | Minimum | 78 | Number of Missing Observations Mean | 0 85 | | | | | | |
| 17 | Maximum | | Median | 80 | | | | | | |
| 18 | SD | 11.4 | Std. Error of Mean | 5.701 | | | | | | |
| 19 | Coefficient of Variation | 0.134 | Skewness | 1.93 | | | | | | |
| 20 21 | Notes Occurred also to small (a.g., 440). We detect | | ! | | | | | | | |
| 22 | Note: Sample size is small (e.g., <10), if data a | are collected | using incremental sampling methodology (ISM) approach, C 2020 and ITRC 2012) for additional guidance, | | | | | | | |
| 23 | | | he Chebyshev UCL for small sample sizes (n < 7). | | | | | | | |
| 24 | The Chebyshev UCL or | ften results i | in gross overestimates of the mean. | | | | | | | |
| 25 | Refer to the ProUCL 5.2 Tec | hnical Guide | e for a discussion of the Chebyshev UCL. | | | | | | | |
| 26 27 | | Marral | POE Toet | | | | | | | |
| 28 | Shapiro Wilk Test Statistic | 0.726 | GOF Test Shapiro Wilk GOF Test | | | | | | | |
| 29 | 1% Shapiro Wilk Critical Value | 0.687 | Data appear Normal at 1% Significance Level | | | | | | | |
| 30 | Lilliefors Test Statistic | 0.387 | Lilliefors GOF Test | | | | | | | |
| 31 32 | 1% Lilliefors Critical Value | | Data appear Normal at 1% Significance Level | | | | | | | |
| 33 | | | 1% Significance Level liable for small sample sizes | | | | | | | |
| 34 | Note GOF Tests I | may be unife | music for small satiffic sizes | | | | | | | |
| 35 | Assuming Normal Distribution | | | | | | | | | |
| 36 | 95% Normal UCL | | 95% UCLs (Adjusted for Skewness) | | | | | | | |
| 37 38 | 95% Student's-t UCL | 98.42 | 95% Adjusted-CLT UCL (Chen-1995) 95% Modified-t UCL (Johnson-1978) | 100.3 99.33 | | | | | | |
| 39 | | | 95% Modified-t UCL (Johnson-1978) | 99.33 | | | | | | |
| 40 | | Gamma (| GOF Test | | | | | | | |
| 41 | A-D Test Statistic | 0.71 | Anderson-Darling Gamma GOF Test | | | | | | | |
| 42 43 | 5% A-D Critical Value | 0.656 | Data Not Gamma Distributed at 5% Significance Leve | 1 | | | | | | |
| 44 | K-S Test Statistic 5% K-S Critical Value | 0.402 0.394 | Kolmogorov-Smirnov Gamma GOF Test Data Not Gamma Distributed at 5% Significance Leve | .1 | | | | | | |
| 45 | | | ed at 5% Significance Level | | | | | | | |
| 46 | | | | | | | | | | |
| 47 48 | k hat (MLE) | Gamma 80.08 | Statistics k star (bias corrected MLE) | 20.19 | | | | | | |
| 49 | Theta hat (MLE) | 1.061 | Theta star (bias corrected MLE) | 4.211 | | | | | | |
| 50 | nu hat (MLE) | | nu star (bias corrected) | 161.5 | | | | | | |
| 51 | MLE Mean (bias corrected) | 85 | MLE Sd (bias corrected) | 18.92 | | | | | | |
| 52 53 | A diverse del constant di maifra a cons | NI/A | Approximate Chi Square Value (0.05) | 133.1 | | | | | | |
| 54 | Adjusted Level of Significance | N/A | Adjusted Chi Square Value | N/A | | | | | | |
| 55 | Ass | suming Gam | ma Distribution | | | | | | | |
| 56 | 95% Approximate Gamma UCL | | 95% Adjusted Gamma UCL | N/A | | | | | | |
| 57 58 | | | COFToo | | | | | | | |
| 59 | Shapiro Wilk Test Statistic | 0.738 | GOF Test Shapiro Wilk Lognormal GOF Test | | | | | | | |
| 60 | 10% Shapiro Wilk Critical Value | 0.738 | Data Not Lognormal at 10% Significance Level | | | | | | | |
| 61 | Lilliefors Test Statistic | 0.38 | Lilliefors Lognormal GOF Test | | | | | | | |
| 62 | 10% Lilliefors Critical Value | | Data Not Lognormal at 10% Significance Level | | | | | | | |
| 63 64 | Data Not Lo | ognormal at | 10% Significance Level | | | | | | | |
| 65 | | Lognorma | I Statistics | | | | | | | |
| 66 | Minimum of Logged Data | 4.357 | Mean of logged Data | 4.436 | | | | | | |
| 67 | Maximum of Logged Data | 4.625 | SD of logged Data | 0.127 | | | | | | |
| 68 69 | | | mad Distribution | | | | | | | |
| 70 | ASSU 95% H-UCL | uming Logno 100.6 | rmal Distribution 90% Chebyshev (MVUE) UCL | 101.1 | | | | | | |
| 71 | 95% Chebyshev (MVUE) UCL | 108.4 | 97.5% Chebyshev (MVUE) UCL | 118.6 | | | | | | |
| 72 | 99% Chebyshev (MVUE) UCL | 138.5 | | | | | | | | |
| 73 | | ad Birth | there For a LIOI. Observations | | | | | | | |
| 74 75 | | | tion Free UCL Statistics Discernible Distribution | | | | | | | |
| 76 | рака арреа | ii to follow a | Discernible Distribution | | | | | | | |
| 77 | | rametric Dist | ribution Free UCLs | | | | | | | |
| 78 | 95% CLT UCL | 94.38 | 95% BCA Bootstrap UCL | N/A | | | | | | |
| 79 80 | 95% Standard Bootstrap UCL | N/A | 95% Bootstrap-t UCL | N/A | | | | | | |
| 81 | 95% Hall's Bootstrap UCL 90% Chebyshev(Mean, Sd) UCL | N/A 102.1 | 95% Percentile Bootstrap UCL 95% Chebyshev(Mean, Sd) UCL | N/A 109.8 | | | | | | |
| 82 | 97.5% Chebyshev(Mean, Sd) UCL | 120.6 | 99% Chebyshev(Mean, Sd) UCL | 141.7 | | | | | | |
| 02 | | | 55.5 5.155 for 10 f (111 car), Ca/ OOL | | | | | | | |

| | Α | В | С | D | E | F | G | Н | ı | J | K | L |
|----|---|--------------|----------------|----------------|---------------|----------------|-------------------|----------------|----------------|---------------|-----------------|------|
| 83 | | | | | | | | | | | | |
| 84 | | | | | | Suggested | UCL to Use | | | | | |
| 85 | | | | 95% Stu | dent's-t UCL | 98.42 | | | | | | |
| 86 | | | | | | | • | | | | | |
| 87 | 1 | Note: Sugges | stions regard | ling the selec | tion of a 95% | 6 UCL are pr | ovided to hel | p the user to | select the m | ost appropria | ate 95% UCL | |
| 88 | | Recom | mendations | are based up | on data size | , data distrib | ution, and sk | ewness usin | g results fror | n simulation | studies. | |
| 89 | | wever, simu | lations result | s will not cov | er all Real V | Vorld data se | ts; for addition | nal insight th | ne user may | want to consi | ult a statistic | ian. |
| 90 | | | | | | | | | | | | |

| | A B C D E | F | G H I J K L | | | | | | | | |
|----------|---|----------------|---|--|--|--|--|--|--|--|--|
| 2 | UCL Statis | stics for Unc | ensored Full Data Sets | | | | | | | | |
| 3 | User Selected Options | 4.47.40 DM | | | | | | | | | |
| 5 | Date/Time of Computation ProUCL 5.2 10/31/2024 From File ProUCL Input.xls | 4:47:42 PIVI | | | | | | | | | |
| 6 7 | Full Precision OFF Confidence Coefficient 95% | | | | | | | | | | |
| 8 | Number of Bootstrap Operations 2000 | | | | | | | | | | |
| 9 | | | | | | | | | | | |
| 11 | GF-WRC-0.5-2 | | | | | | | | | | |
| 12 13 | | General | Statistics | | | | | | | | |
| 14 | Total Number of Observations | | Number of Distinct Observations 4 | | | | | | | | |
| 15 16 | Minimum | 75 | Number of Missing Observations 0 Mean 87 | | | | | | | | |
| 17 | Maximum | 100 | Median 86.5 | | | | | | | | |
| 18 19 | SD Coefficient of Variation | | Std. Error of Mean 5.148 Skewness 0.282 | | | | | | | | |
| 20 | | | | | | | | | | | |
| 21 22 | | | using incremental sampling methodology (ISM) approach, C 2020 and ITRC 2012) for additional guidance, | | | | | | | | |
| 23 | but note that ITRC may recommend the | he t-UCL or t | he Chebyshev UCL for small sample sizes (n < 7). | | | | | | | | |
| 24 25 | | | in gross overestimates of the mean. e for a discussion of the Chebyshev UCL. | | | | | | | | |
| 26 | | | • | | | | | | | | |
| 27 28 | Shapiro Wilk Test Statistic | | GOF Test Shapiro Wilk GOF Test | | | | | | | | |
| 29 | 1% Shapiro Wilk Critical Value | 0.687 | Data appear Normal at 1% Significance Level | | | | | | | | |
| 30 31 | Lilliefors Test Statistic 1% Lilliefors Critical Value | | Lilliefors GOF Test Data appear Normal at 1% Significance Level | | | | | | | | |
| 32 33 | Data appe | ear Normal at | 1% Significance Level | | | | | | | | |
| 34 | Note GOF tests may be unreliable for small sample sizes | | | | | | | | | | |
| 35 36 | Assuming Normal Distribution | | | | | | | | | | |
| 37 | 95% Normal UCL 95% Student's-t UCL | . 99.11 | 95% UCLs (Adjusted for Skewness) 95% Adjusted-CLT UCL (Chen-1995) 96.24 | | | | | | | | |
| 38 39 | | | 95% Modified-t UCL (Johnson-1978) 99.24 | | | | | | | | |
| 40 | Gamma GOF Test | | | | | | | | | | |
| 41 42 | A-D Test Statistic 5% A-D Critical Value | | Anderson-Darling Gamma GOF Test | | | | | | | | |
| 43 | K-S Test Statistic | | Detected data appear Gamma Distributed at 5% Significance Level Kolmogorov-Smirnov Gamma GOF Test | | | | | | | | |
| 44 45 | 5% K-S Critical Value | | Detected data appear Gamma Distributed at 5% Significance Level stributed at 5% Significance Level | | | | | | | | |
| 46 | Note GOF tests | may be unre | eliable for small sample sizes | | | | | | | | |
| 47 48 | | Gamma | Statistics | | | | | | | | |
| 49 | k hat (MLE) | 95.47 | k star (bias corrected MLE) 24.03 | | | | | | | | |
| 50 51 | Theta hat (MLE) nu hat (MLE) | | Theta star (bias corrected MLE) 3.62 nu star (bias corrected) 192.3 | | | | | | | | |
| 52 | MLE Mean (bias corrected) | 87 | MLE Sd (bias corrected) 17.75 | | | | | | | | |
| 53 54 | Adjusted Level of Significance | N/A | Approximate Chi Square Value (0.05) 161.2 Adjusted Chi Square Value N/A | | | | | | | | |
| 55 | | · | | | | | | | | | |
| 56 57 | As 95% Approximate Gamma UCL | | ma Distribution 95% Adjusted Gamma UCL N/A | | | | | | | | |
| 58 59 | | | | | | | | | | | |
| 60 | Shapiro Wilk Test Statistic | | GOF Test Shapiro Wilk Lognormal GOF Test | | | | | | | | |
| 61 62 | 10% Shapiro Wilk Critical Value | 0.792 | Data appear Lognormal at 10% Significance Level | | | | | | | | |
| 63 | Lilliefors Test Statistic 10% Lilliefors Critical Value | | Lilliefors Lognormal GOF Test Data appear Lognormal at 10% Significance Level | | | | | | | | |
| 64 65 | Data appear | Lognormal | at 10% Significance Level | | | | | | | | |
| 66 | Note GOF tests | inay be unre | sliable for small sample sizes | | | | | | | | |
| 67 68 | Attainment on the same to | | Statistics | | | | | | | | |
| 69 | Minimum of Logged Data Maximum of Logged Data | | Mean of logged Data 4.461 SD of logged Data 0.118 | | | | | | | | |
| 70 71 | | | | | | | | | | | |
| 72 | 95% H-UCL | . 101.7 | prmal Distribution 90% Chebyshev (MVUE) UCL 102.4 | | | | | | | | |
| 73 74 | 95% Chebyshev (MVUE) UCL | | 97.5% Chebyshev (MVUE) UCL 119.1 | | | | | | | | |
| 75 | 99% Chebyshev (MVUE) UCL | . 138.1 | <u> </u> | | | | | | | | |
| 76 77 | | | tion Free UCL Statistics | | | | | | | | |
| 78 | Data appea | ar io toliow a | Discernible Distribution | | | | | | | | |
| 79 80 | | | tribution Free UCLs | | | | | | | | |
| 81 | 95% CLT UCL 95% Standard Bootstrap UCL | | 95% BCA Bootstrap UCL N/A 95% Bootstrap-t UCL N/A | | | | | | | | |
| 82 | 95% Hall's Bootstrap UCL | | 95% Percentile Bootstrap UCL N/A | | | | | | | | |

| | Α | В | С | D | E | F | G | Н | I | J | K | L |
|----|----|--------------|----------------|----------------|---------------|----------------|------------------|----------------|----------------|----------------|-----------------|-------|
| 83 | | | 90% Ch | ebyshev(Me | an, Sd) UCL | 102.4 | | | 95% Ch | ebyshev(Me | an, Sd) UCL | 109.4 |
| 84 | | | 97.5% Ch | ebyshev(Me | an, Sd) UCL | 119.1 | | | 99% Ch | ebyshev(Me | an, Sd) UCL | 138.2 |
| 85 | | | | | | | | | | | | |
| 86 | | | | | | Suggested | UCL to Use | | | | | |
| 87 | | | | 95% Stu | dent's-t UCL | 99.11 | | | | | | |
| 88 | | | | | | • | • | | | | | |
| 89 | 1 | Note: Sugges | stions regard | ing the selec | tion of a 95% | UCL are pr | ovided to hel | p the user to | select the m | nost appropria | ate 95% UCL | |
| 90 | | Recom | mendations | are based up | on data size | , data distrib | ution, and sk | ewness usin | g results from | m simulation | studies. | |
| 91 | Но | wever, simul | lations result | s will not cov | er all Real W | orld data se | ts; for addition | nal insight th | ne user may | want to cons | ult a statistic | ian. |
| 92 | | | | | | | | | | | | |

| | A B C D E | F | G H I J K | L | | | | | | | |
|----------|---|-----------------------------------|---|-----------------|--|--|--|--|--|--|--|
| 2 | UCL Statis | stics for Unc | ensored Full Data Sets | | | | | | | | |
| 3 | User Selected Options | 4.54.50.DM | | | | | | | | | |
| 4 5 | Date/Time of Computation ProUCL 5.2 10/31/2024 | 4:51:58 PM | | | | | | | | | |
| 6 | Full Precision OFF | | | | | | | | | | |
| 7 8 | Confidence Coefficient 95% Number of Bootstrap Operations 2000 | | | | | | | | | | |
| 9 | Number of Bootstrap Operations 2000 | | | | | | | | | | |
| 10 | | | | | | | | | | | |
| 12 | GF-WRC-0.5-3 | | | | | | | | | | |
| 13 | | | Statistics | | | | | | | | |
| 14 15 | Total Number of Observations | 4 | Number of Distinct Observations Number of Missing Observations | 0 | | | | | | | |
| 16 | Minimum | 41 | Mean | 46 | | | | | | | |
| 17 18 | Maximum | | | 46.5 | | | | | | | |
| 19 | SD Coefficient of Variation | | Std. Error of Mean Skewness | 1.871 -0.764 | | | | | | | |
| 20 | | | | | | | | | | | |
| 21 22 | | | l using incremental sampling methodology (ISM) approach, C 2020 and ITRC 2012) for additional guidance, | | | | | | | | |
| 23 | | | he Chebyshev UCL for small sample sizes (n < 7). | | | | | | | | |
| 24 25 | The Chebyshev UCL o | often results | in gross overestimates of the mean. | | | | | | | | |
| 26 | Refer to the ProUCL 5.2 Tec | chnical Guide | e for a discussion of the Chebyshev UCL. | | | | | | | | |
| 27 | | | OF Test | | | | | | | | |
| 28 29 | Shapiro Wilk Test Statistic 1% Shapiro Wilk Critical Value | | Shapiro Wilk GOF Test | | | | | | | | |
| 30 | 1% Snapiro Wilk Critical Value Lilliefors Test Statistic | | Data appear Normal at 1% Significance Level Lilliefors GOF Test | | | | | | | | |
| 31 | 1% Lilliefors Critical Value | 0.413 | Data appear Normal at 1% Significance Level | | | | | | | | |
| 32 33 | | | t 1% Significance Level | | | | | | | | |
| 34 | Note GOF tests may be unreliable for small sample sizes | | | | | | | | | | |
| 35 36 | Assuming Normal Distribution | | | | | | | | | | |
| 37 | 95% Normal UCL 95% UCLs (Adjusted for Skewness) 95% Student's-t UCL 50.4 95% Adjusted-CLT UCL (Chen-1995) 48.31 | | | | | | | | | | |
| 38 | 50% StadSht 8 1 00 E | 95% Modified-t UCL (Johnson-1978) | 50.28 | | | | | | | | |
| 39 40 | | | COF Took | | | | | | | | |
| 41 | A-D Test Statistic | | GOF Test Anderson-Darling Gamma GOF Test | | | | | | | | |
| 42 | 5% A-D Critical Value | 0.657 | Detected data appear Gamma Distributed at 5% Significance | Level | | | | | | | |
| 43 44 | K-S Test Statistic 5% K-S Critical Value | | Kolmogorov-Smirnov Gamma GOF Test Detected data appear Gamma Distributed at 5% Significance | Lovol | | | | | | | |
| 45 | | | stributed at 5% Significance Level | Level | | | | | | | |
| 46 47 | Note GOF tests | may be unre | eliable for small sample sizes | | | | | | | | |
| 47 | | Gamma | Statistics | | | | | | | | |
| 49 | k hat (MLE) | 196.6 | | 49.32 | | | | | | | |
| 50 51 | Theta hat (MLE) | | Theta star (bias corrected MLE) | 0.933 | | | | | | | |
| 52 | nu hat (MLE) MLE Mean (bias corrected) | | nu star (bias corrected) 3 MLE Sd (bias corrected) | 394.5 6.55 | | | | | | | |
| 53 | | | Approximate Chi Square Value (0.05) 3 | 349.5 | | | | | | | |
| 54 55 | Adjusted Level of Significance | N/A | Adjusted Chi Square Value | N/A | | | | | | | |
| 56 | As | suming Garr | ma Distribution | | | | | | | | |
| 57 58 | 95% Approximate Gamma UCL | | | N/A | | | | | | | |
| 59 | | Lognorma | GOF Test | | | | | | | | |
| 60 | Shapiro Wilk Test Statistic | 0.95 | Shapiro Wilk Lognormal GOF Test | | | | | | | | |
| 61 62 | 10% Shapiro Wilk Critical Value | | Data appear Lognormal at 10% Significance Level | | | | | | | | |
| 63 | Lilliefors Test Statistic 10% Lilliefors Critical Value | | Lilliefors Lognormal GOF Test Data appear Lognormal at 10% Significance Level | | | | | | | | |
| 64 | Data appear | Lognormal a | at 10% Significance Level | | | | | | | | |
| 65 66 | Note GOF tests | may be unre | eliable for small sample sizes | | | | | | | | |
| 67 | | Lognorma | I Statistics | | | | | | | | |
| 68 | Minimum of Logged Data | 3.714 | Mean of logged Data | 3.826 | | | | | | | |
| 69 70 | Maximum of Logged Data | 3.912 | SD of logged Data | 0.0829 | | | | | | | |
| 71 | Assı | uming Logno | ormal Distribution | | | | | | | | |
| 72 73 | 95% H-UCL | N/A | 90% Chebyshev (MVUE) UCL | 51.72 | | | | | | | |
| 74 | 95% Chebyshev (MVUE) UCL 99% Chebyshev (MVUE) UCL | | 97.5% Chebyshev (MVUE) UCL | 57.91 | | | | | | | |
| 75 | | | · · · · · · · · · · · · · · · · · · · | | | | | | | | |
| 76 77 | | | tion Free UCL Statistics | | | | | | | | |
| 78 | Data appea | ar to follow a | Discernible Distribution | | | | | | | | |
| 79 | | | tribution Free UCLs | | | | | | | | |
| 80 81 | 95% CLT UCL | 49.08 | 95% BCA Bootstrap UCL | N/A | | | | | | | |
| 82 | 95% Standard Bootstrap UCL 95% Hall's Bootstrap UCL | | | N/A N/A | | | | | | | |
| | 30 /0 Hall 3 DOUISHAP UCL | 1.1//-1 | JO /0 1 GLOGHUIG DUUISHAD UCL | 17// 1 | | | | | | | |

| | Α | В | С | D | E | F | G | Н | I | J | K | L |
|----|---|--------------|----------------|----------------|---------------|----------------|------------------|----------------|----------------|---------------|-----------------|-------|
| 83 | | | 90% Ch | ebyshev(Me | an, Sd) UCL | 51.61 | | | 95% Ch | ebyshev(Me | an, Sd) UCL | 54.15 |
| 84 | | | 97.5% Ch | ebyshev(Me | an, Sd) UCL | 57.68 | | | 99% Ch | ebyshev(Me | an, Sd) UCL | 64.61 |
| 85 | | | | | | | | | | | | |
| 86 | | | | | | Suggested | UCL to Use | | | | | |
| 87 | | | | 95% Stu | dent's-t UCL | 50.4 | | | | | | |
| 88 | Recommended UCL exceeds the maximum observation | | | | | | | | | | | |
| 89 | | | | | | | | | | | | |
| 90 | 1 | Note: Sugges | stions regard | ling the selec | tion of a 95% | 6 UCL are pr | ovided to hel | p the user to | select the m | nost appropri | ate 95% UCL | |
| 91 | | Recom | mendations | are based up | on data size | , data distrib | ution, and sk | ewness usin | g results fror | m simulation | studies. | |
| 92 | Но | wever, simul | lations result | s will not cov | er all Real V | Vorld data se | ts; for addition | nal insight th | ne user may | want to cons | ult a statistic | ian. |
| 93 | | | | | | | | | | | | |
| 94 | | Note: For | highly negat | tively-skewe | d data, confi | dence limits | (e.g., Chen, | Johnson, Lo | ognormal, ar | nd Gamma) ı | may not be | |
| 95 | | | reliable. | Chen's and J | ohnson's m | ethods provi | de adjustme | nts for posit | vely skewed | data sets. | | |
| 96 | | | | | | | | | | | | |

| | A B C D E | F | G H I J K | L | | | | | | | |
|----------|--|----------------|--|----------------|--|--|--|--|--|--|--|
| 2 | UCL Statis | stics for Unc | ensored Full Data Sets | | | | | | | | |
| 3 | User Selected Options | 4.E0.00 DM | | | | | | | | | |
| 5 | Date/Time of Computation ProUCL 5.2 10/31/2024 | 4:53:20 PM | | | | | | | | | |
| 6 | Full Precision OFF | | | | | | | | | | |
| 7 | Confidence Coefficient 95% Number of Bootstrap Operations 2000 | | | | | | | | | | |
| 9 | Number of Bootstrap Operations (2000 | | | | | | | | | | |
| 10 11 | GF-WRC-0.5-4 | | | | | | | | | | |
| 12 | di -WNO-0.5-4 | | | | | | | | | | |
| 13 14 | Total Number of Observations | General 4 | Statistics Number of Distinct Observations | 4 | | | | | | | |
| 15 | Total Nulliber of Observations | 4 | Number of Missing Observations | 0 | | | | | | | |
| 16 17 | Minimum | 42 67 | Mean | 55.25 56 | | | | | | | |
| 18 | Maximum SD | | Median Std. Error of Mean | 5.186 | | | | | | | |
| 19 | Coefficient of Variation | 0.188 | Skewness | -0.409 | | | | | | | |
| 20 21 | Note: Sample size is small (e.g., <10), if data a | are collected | using incremental sampling methodology (ISM) approach, | | | | | | | | |
| 22 | refer also to ITRC Tech Reg Guide | on ISM (ITR | C 2020 and ITRC 2012) for additional guidance, | | | | | | | | |
| 23 24 | | | he Chebyshev UCL for small sample sizes (n < 7). in gross overestimates of the mean. | | | | | | | | |
| 25 | | | e for a discussion of the Chebyshev UCL. | | | | | | | | |
| 26 27 | | Normal | POE Toot | | | | | | | | |
| 28 | Shapiro Wilk Test Statistic | | GOF Test Shapiro Wilk GOF Test | | | | | | | | |
| 29 30 | 1% Shapiro Wilk Critical Value | | Data appear Normal at 1% Significance Level | | | | | | | | |
| 31 | Lilliefors Test Statistic 1% Lilliefors Critical Value | | Lilliefors GOF Test Data appear Normal at 1% Significance Level | | | | | | | | |
| 32 | Data appe | ar Normal at | 1% Significance Level | | | | | | | | |
| 33 34 | Note GOF tests may be unreliable for small sample sizes | | | | | | | | | | |
| 35 | Assuming Normal Distribution | | | | | | | | | | |
| 36 37 | 95% Normal UCL 95% UCLs (Adjusted for Skewness) 95% Student's-t UCL 67.45 95% Adjusted-CLT UCL (Chen-1995) 62.65 | | | | | | | | | | |
| 38 | 95% Students-1 OCL (07.45 95% Adulsted-CLT OCL (Cher-1995) 02.05 95% Modified-t UCL (Johnson-1978) 67.28 | | | | | | | | | | |
| 39 40 | | | | | | | | | | | |
| 41 | A-D Test Statistic 0.241 Anderson-Darling Gamma GOF Test | | | | | | | | | | |
| 42 | 5% A-D Critical Value | 0.656 | Detected data appear Gamma Distributed at 5% Significance | Level | | | | | | | |
| 43 44 | K-S Test Statistic 5% K-S Critical Value | | Kolmogorov-Smirnov Gamma GOF Test Detected data appear Gamma Distributed at 5% Significance | e Level | | | | | | | |
| 45 | Detected data appear | r Gamma Di | stributed at 5% Significance Level | | | | | | | | |
| 46 47 | Note GOF tests | may be unre | eliable for small sample sizes | | | | | | | | |
| 48 | | | Statistics | | | | | | | | |
| 49 50 | k hat (MLE) Theta hat (MLE) | 36.08 1.531 | k star (bias corrected MLE) Theta star (bias corrected MLE) | 9.187 6.014 | | | | | | | |
| 51 | nu hat (MLE) | 288.7 | nu star (bias corrected MLE) | 73.5 | | | | | | | |
| 52 53 | MLE Mean (bias corrected) | 55.25 | MLE Sd (bias corrected) | 18.23 | | | | | | | |
| 54 | Adjusted Level of Significance | N/A | Approximate Chi Square Value (0.05) Adjusted Chi Square Value | 54.76 N/A | | | | | | | |
| 55 | | ! | | | | | | | | | |
| 56 57 | Ase 95% Approximate Gamma UCL | | ma Distribution 95% Adjusted Gamma UCL | N/A | | | | | | | |
| 58 | 00707 pproximate dumina OOL | | | | | | | | | | |
| 59 60 | Shapiro Wilk Test Statistic | | GOF Test Shapiro Wilk Lognormal GOF Test | | | | | | | | |
| 61 | 10% Shapiro Wilk Critical Value | 0.792 | Data appear Lognormal at 10% Significance Level | | | | | | | | |
| 62 63 | Lilliefors Test Statistic | | Lilliefors Lognormal GOF Test | | | | | | | | |
| 64 | 10% Lilliefors Critical Value Data appear | | Data appear Lognormal at 10% Significance Level at 10% Significance Level | | | | | | | | |
| 65 66 | | | liable for small sample sizes | | | | | | | | |
| 66 67 | | Lognorma | I Statistics | | | | | | | | |
| 68 | Minimum of Logged Data | 3.738 | Mean of logged Data | 3.998 | | | | | | | |
| 69 70 | Maximum of Logged Data | 4.205 | SD of logged Data | 0.195 | | | | | | | |
| 71 | Assı | uming Logno | ormal Distribution | | | | | | | | |
| 72 73 | 95% H-UCL | 73.21 | 90% Chebyshev (MVUE) UCL | 71.42 | | | | | | | |
| 74 | 95% Chebyshev (MVUE) UCL 99% Chebyshev (MVUE) UCL | 78.73 108.8 | 97.5% Chebyshev (MVUE) UCL | 88.88 | | | | | | | |
| 75 | | | | | | | | | | | |
| 76 77 | | | tion Free UCL Statistics Discernible Distribution | | | | | | | | |
| 78 | | | | | | | | | | | |
| 79 80 | | | tribution Free UCLs | NI/A | | | | | | | |
| 81 | 95% CLT UCL 95% Standard Bootstrap UCL | | 95% BCA Bootstrap UCL 95% Bootstrap-t UCL | N/A N/A | | | | | | | |
| 82 | 95% Hall's Bootstrap UCL | | 95% Percentile Bootstrap UCL | N/A | | | | | | | |

| | Α | В | С | D | E | F | G | Н | I | J | K | L |
|----|---|--------------|----------------|----------------|---------------|----------------|------------------|----------------|----------------|--------------|-----------------|-------|
| 83 | | - | 90% Ch | ebyshev(Me | an, Sd) UCL | 70.81 | | | 95% Ch | ebyshev(Me | an, Sd) UCL | 77.86 |
| 84 | | | 97.5% Ch | ebyshev(Me | an, Sd) UCL | 87.64 | | | 99% Ch | ebyshev(Me | an, Sd) UCL | 106.9 |
| 85 | | | | | | | | | | | | |
| 86 | Suggested UCL to Use | | | | | | | | | | | |
| 87 | | | | 95% Stu | dent's-t UCL | 67.45 | | | | | | |
| 88 | Recommended UCL exceeds the maximum observation | | | | | | | | | | | |
| 89 | | | | | | | | | | | | |
| 90 | 1 | Note: Sugges | stions regard | ling the selec | tion of a 95% | 6 UCL are pr | ovided to hel | p the user to | select the m | ost appropri | ate 95% UCL | |
| 91 | | Recom | mendations | are based up | on data size | , data distrib | ution, and sk | ewness usin | g results fror | m simulation | studies. | |
| 92 | Но | wever, simul | lations result | s will not cov | er all Real W | Vorld data se | ts; for addition | nal insight th | ne user may | want to cons | ult a statistic | ian. |
| 93 | | | | | | | | | | | | |
| 94 | | Note: For | highly negat | ively-skewe | d data, confi | dence limits | (e.g., Chen, | Johnson, Lo | ognormal, ar | nd Gamma) ı | may not be | |
| 95 | | | reliable. | Chen's and J | lohnson's m | ethods provi | de adjustme | nts for posit | vely skewed | data sets. | | |
| 96 | | | | | | | | | | | | |

| 4 | A B C D E | F | G H I J K | L |
|----------|---|----------------|--|----------------|
| 2 | UCL Statis | stics for Unc | ensored Full Data Sets | |
| 3 | User Selected Options | 4.E4:20 DM | | |
| 5 | Date/Time of Computation ProUCL 5.2 10/31/2024 4 From File ProUCL Input.xls | 4:54:30 PIVI | | |
| 6 | Full Precision OFF | | | |
| 7 | Confidence Coefficient 95% Number of Bootstrap Operations 2000 | | | |
| 9 | Number of Bootstrap Operations (2000 | | | |
| 10 11 | GF-WRC-0.5-4-DS | | | |
| 12 | ui -\\i\o-0.5-4-00 | | | |
| 13 14 | Total Number of Observations | General 4 | Statistics Number of Distinct Observations | 4 |
| 15 | Total Number of Observations | 4 | Number of Missing Observations | 0 |
| 16 17 | Minimum | 31 62 | Mean | 48.25 |
| 18 | Maximum SD | 13.23 | Median Std. Error of Mean | 50 6.613 |
| 19 | Coefficient of Variation | 0.274 | Skewness | -0.679 |
| 20 21 | Note: Sample size is small (e.g., <10), if data a | are collected | using incremental sampling methodology (ISM) approach, | |
| 22 | refer also to ITRC Tech Reg Guide of | on ISM (ITR | C 2020 and ITRC 2012) for additional guidance, | |
| 23 24 | | | he Chebyshev UCL for small sample sizes (n < 7). in gross overestimates of the mean. | |
| 25 | | | e for a discussion of the Chebyshev UCL. | |
| 26 27 | | Normal | POE Toet | |
| 28 | Shapiro Wilk Test Statistic | | GOF Test Shapiro Wilk GOF Test | |
| 29 30 | 1% Shapiro Wilk Critical Value | | Data appear Normal at 1% Significance Level | |
| 31 | Lilliefors Test Statistic 1% Lilliefors Critical Value | | Lilliefors GOF Test Data appear Normal at 1% Significance Level | |
| 32 | Data appe | ar Normal at | 1% Significance Level | |
| 33 34 | Note GOF tests | may be unre | liable for small sample sizes | |
| 35 | | suming Nor | mal Distribution | |
| 36 37 | 95% Normal UCL 95% Student's-t UCL | T | 95% UCLs (Adjusted for Skewness) 95% Adjusted-CLT UCL (Chen-1995) | 56.72 |
| 38 | 95% Student s-t UCL | 63.81 | 95% Adjusted-CLT OCL (Chen-1995) 95% Modified-t UCL (Johnson-1978) | 56.73 63.44 |
| 39 40 | | 0 | | |
| 41 | A-D Test Statistic | 0.271 | GOF Test Anderson-Darling Gamma GOF Test | |
| 42 | 5% A-D Critical Value | 0.657 | Detected data appear Gamma Distributed at 5% Significance | Level |
| 43 44 | K-S Test Statistic 5% K-S Critical Value | | Kolmogorov-Smirnov Gamma GOF Test Detected data appear Gamma Distributed at 5% Significance | e Level |
| 45 | Detected data appear | r Gamma Di | stributed at 5% Significance Level | |
| 46 47 | Note GOF tests | may be unre | eliable for small sample sizes | |
| 48 | | | Statistics | |
| 49 50 | k hat (MLE) Theta hat (MLE) | 15.93 3.028 | k star (bias corrected MLE) Theta star (bias corrected MLE) | 4.15 11.63 |
| 51 | nu hat (MLE) | 127.5 | nu star (bias corrected) | 33.2 |
| 52 53 | MLE Mean (bias corrected) | 48.25 | MLE Sd (bias corrected) | 23.69 |
| 54 | Adjusted Level of Significance | N/A | Approximate Chi Square Value (0.05) Adjusted Chi Square Value | 21.03 N/A |
| 55 56 | | ! | | |
| 55 | Ass 95% Approximate Gamma UCL | | ma Distribution 95% Adjusted Gamma UCL | N/A |
| 58 | 55.0. ipproximate damini OOL | | | |
| 59 60 | Shapiro Wilk Test Statistic | | GOF Test Shapiro Wilk Lognormal GOF Test | |
| 61 | 10% Shapiro Wilk Critical Value | 0.792 | Data appear Lognormal at 10% Significance Level | |
| 62 63 | Lilliefors Test Statistic 10% Lilliefors Critical Value | | Lilliefors Lognormal GOF Test Data appear Lognormal at 10% Significance Level | |
| 64 | Data appear | Lognormal a | at 10% Significance Level | |
| 65 66 | Note GOF tests | may be unre | liable for small sample sizes | |
| 67 | | Lognorma | I Statistics | |
| 68 | Minimum of Logged Data | 3.434 | Mean of logged Data | 3.845 |
| 69 70 | Maximum of Logged Data | 4.127 | SD of logged Data | 0.3 |
| 71 | Assı | uming Logno | rmal Distribution | |
| 72 73 | 95% H-UCL 95% Chebyshev (MVUE) UCL | 79.05 79.7 | 90% Chebyshev (MVUE) UCL 97.5% Chebyshev (MVUE) UCL | 69.92 93.27 |
| 74 | 95% Chebyshev (MVUE) UCL 99% Chebyshev (MVUE) UCL | | 97.3% Chebysnev (MIVUE) UCL | 33.Z1 |
| 75 76 | | | Non-Free HOL Obelieties | |
| 77 | | | tion Free UCL Statistics Discernible Distribution | |
| 78 | | | | |
| 79 80 | Nonpar 95% CLT UCL | | tribution Free UCLs 95% BCA Bootstrap UCL | N/A |
| 81 | 95% Standard Bootstrap UCL | | 95% BCA Bootstrap UCL 95% Bootstrap-t UCL | N/A N/A |
| 82 | 95% Hall's Bootstrap UCL | N/A | 95% Percentile Bootstrap UCL | N/A |

| | Α | В | С | D | E | F | G | Н | I | J | K | L | | |
|----|---|---------------------------|----------------|----------------|---------------|----------------|-----------------------------------|----------------|----------------|---------------|-----------------|------|--|--|
| 83 | | | 90% Ch | ebyshev(Mea | an, Sd) UCL | 68.09 | 95% Chebyshev(Mean, Sd) UCL 77.07 | | | | | | | |
| 84 | | | 97.5% Ch | ebyshev(Mea | an, Sd) UCL | 89.55 | | | 99% Ch | ebyshev(Me | an, Sd) UCL | 114 | | |
| 85 | | | | | | | | | | | | | | |
| 86 | Caggoold CCL to CCC | | | | | | | | | | | | | |
| 87 | | 95% Student's-t UCL 63.81 | | | | | | | | | | | | |
| 88 | Recommended UCL exceeds the maximum observation | | | | | | | | | | | | | |
| 89 | | | | | | | | | | | | | | |
| 90 | 1 | Note: Sugges | stions regard | ing the selec | tion of a 95% | UCL are pr | ovided to hel | p the user to | select the m | ost appropria | ate 95% UCL | | | |
| 91 | | Recom | mendations | are based up | on data size | , data distrib | ution, and sk | ewness usin | g results fror | m simulation | studies. | | | |
| 92 | Ho | wever, simul | lations result | s will not cov | er all Real W | orld data se | ts; for additio | nal insight th | ne user may | want to cons | ult a statistic | ian. | | |
| 93 | | | | | | | | | | | | | | |
| 94 | | Note: For | highly negat | ively-skewed | d data, confi | dence limits | (e.g., Chen, | Johnson, Lo | ognormal, ar | nd Gamma) r | may not be | | | |
| 95 | | | reliable. | Chen's and J | ohnson's me | ethods provi | de adjustme | nts for posit | vely skewed | data sets. | | | | |
| 96 | | | | | | | | | | | | | | |

| 1 | A B C D | E UCL Statis | F tics for Unc | G H I J K L ensored Full Data Sets |
|----------|--|---------------------------------------|-------------------|--|
| 2 | | | | |
| 3 | User Selected Options | E 0 40/04/0001 | LEE-EZ 234 | |
| 5 | | 5.2 10/31/2024 4 Input.xls | 1:55:57 PM | |
| 6 | Full Precision OFF | присло | | |
| 7 | Confidence Coefficient 95% | | | |
| 8 | Number of Bootstrap Operations 2000 | | | |
| 9 | | | | |
| | GF-WRD-0.5-1 | | | |
| 12 | GI -VVIND-0.0-1 | | | |
| 13 | | | General | Statistics |
| 14 15 | Total Number | of Observations | 4 | Number of Distinct Observations 3 |
| 16 | | Minimum | 59 | Number of Missing Observations 0 Mean 62 |
| 17 | | Maximum | 69 | Median 60 |
| 18 | | SD | 4.69 | Std. Error of Mean 2.345 |
| 19 | Coeffic | cient of Variation | 0.0757 | Skewness 1.938 |
| 20 21 | Note: Sample size is small (e. | a <10) if data a | ro collected | using incremental sampling methodology (ISM) approach, |
| 22 | | | | C 2020 and ITRC 2012) for additional guidance, |
| 23 | | | | he Chebyshev UCL for small sample sizes (n < 7). |
| 24 | | | | in gross overestimates of the mean. |
| 25 26 | Refer to the | ProUCL 5.2 Tec | hnical Guid | e for a discussion of the Chebyshev UCL. |
| 27 | | | Normal (| GOF Test |
| 28 | Shapiro W | ilk Test Statistic | 0.716 | Shapiro Wilk GOF Test |
| 29 | | ilk Critical Value | 0.687 | Data appear Normal at 1% Significance Level |
| 30 31 | | ors Test Statistic | 0.415 | Lilliefors GOF Test |
| 32 | | rs Critical Value | 0.413 | Data Not Normal at 1% Significance Level rmal at 1% Significance Level |
| 33 | | | | Iliable for small sample sizes |
| 34 | | | | • |
| 35 | | Ass | suming Norr | nal Distribution |
| 36 37 | 95% Normal UC | Student's-t UCL | 67.52 | 95% UCLs (Adjusted for Skewness) 95% Adjusted-CLT UCL (Chen-1995) 68.29 |
| 38 | 95 // | Students-t OCL | 07.52 | 95% Modified-t UCL (Johnson-1978) 67.9 |
| 39 | | - | | |
| 40 | | | | GOF Test |
| 41 42 | | -D Test Statistic -D Critical Value | 0.762 0.657 | Anderson-Darling Gamma GOF Test Data Not Gamma Distributed at 5% Significance Level |
| 43 | | -S Test Statistic | 0.437 | Kolmogorov-Smirnov Gamma GOF Test |
| 44 | 5% K | -S Critical Value | 0.394 | Data Not Gamma Distributed at 5% Significance Level |
| 45 46 | | Data Not Gamn | na Distribute | ed at 5% Significance Level |
| 47 | | | Gamma | Statistics |
| 48 | | k hat (MLE) | 243.9 | k star (bias corrected MLE) 61.15 |
| 49 | | Theta hat (MLE) | 0.254 | Theta star (bias corrected MLE) 1.014 |
| 50 51 | MI E Mana | nu hat (MLE) | | nu star (bias corrected) 489.2 |
| 52 | MILE Mean | (bias corrected) | 62 | MLE Sd (bias corrected) 7.928 Approximate Chi Square Value (0.05) 438.9 |
| 53 | Adjusted Leve | l of Significance | N/A | Adjusted Chi Square Value N/A |
| 54 | | | | |
| 55 56 | OE0/ A | | | ma Distribution |
| 57 | 95% Approxima | te Gamma UCL | 69.1 | 95% Adjusted Gamma UCL N/A |
| 58 | | | Lognorma | GOF Test |
| 59 | | ilk Test Statistic | 0.722 | Shapiro Wilk Lognormal GOF Test |
| 60 61 | | ilk Critical Value | 0.792 | Data Not Lognormal at 10% Significance Level |
| 62 | | ors Test Statistic ors Critical Value | 0.413 0.346 | Lilliefors Lognormal GOF Test Data Not Lognormal at 10% Significance Level |
| 63 | 10 /6 LIIIIeiC | | | 10% Significance Level |
| 64 | | | | |
| 65 66 | | -41 15 - | | I Statistics |
| 67 | | of Logged Data of Logged Data | 4.078 4.234 | Mean of logged Data 4.125 SD of logged Data 0.0731 |
| 68 | iviaXIIIIuII | or Logged Data | 7.204 | OD 01 logged Data 0.0731 |
| 69 | | | | rmal Distribution |
| 70 71 | 2-2/ 2/ - | 95% H-UCL | N/A | 90% Chebyshev (MVUE) UCL 68.79 |
| 71 72 | , | ev (MVUE) UCL | 71.87 84.54 | 97.5% Chebyshev (MVUE) UCL 76.14 |
| 73 | 99% Cnebysn | ev (MVUE) UCL | 04.54 | |
| 74 | | Nonparame | tric Distribu | tion Free UCL Statistics |
| 75 76 | | Data appea | r to follow a | Discernible Distribution |
| 76 77 | | N | omotrio Di- | ribution Fron LICLo |
| 78 | | Nonpar 95% CLT UCL | 65.86 | tribution Free UCLs 95% BCA Bootstrap UCL N/A |
| 79 | 95% Standard | Bootstrap UCL | N/A | 95% Bootstrap-t UCL N/A |
| | | Bootstrap UCL | N/A | 95% Percentile Bootstrap UCL N/A |
| 80 | | | | |
| | 95% Hall's 90% Chebyshev 97.5% Chebyshev | (Mean, Sd) UCL | 69.04 76.65 | 95% Chebyshev(Mean, Sd) UCL 72.22 99% Chebyshev(Mean, Sd) UCL 85.33 |

| | Α | В | С | D | E | F | G | Н | I | J | K | L | | |
|----|---|---------------------------|----------------|----------------|---------------|---------------|------------------|----------------|----------------|--------------|-----------------|------|--|--|
| 83 | | | | | | | | | | | | | | |
| 84 | Suggested UCL to Use | | | | | | | | | | | | | |
| 85 | | 95% Student's-t UCL 67.52 | | | | | | | | | | | | |
| 86 | | | | | | | | | | | | | | |
| 87 | When a data set follows an approximate distribution passing only one of the GOF tests, | | | | | | | | | | | | | |
| 88 | | | it is su | ggested to us | se a UCL bas | sed upon a d | istribution pa | ssing both C | OF tests in F | ProUCL | | | | |
| 89 | | | | | | | | | | | | | | |
| 90 | 1 | Note: Sugges | stions regard | ling the selec | tion of a 95% | 6 UCL are pr | ovided to hel | p the user to | select the m | ost appropri | ate 95% UCI | | | |
| 91 | | | | | | | | | g results fron | | | | | |
| 92 | Ho | wever, simu | lations result | s will not cov | er all Real W | Vorld data se | ts; for addition | nal insight th | ne user may v | want to cons | ult a statistic | ian. | | |
| 93 | However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician. | | | | | | | | | | | | | |

| | A B C D E | F | G H I J K | L |
|----------|---|-----------------------|---|----------------|
| 2 | UCL Statis | stics for Unc | ensored Full Data Sets | |
| 3 | User Selected Options | | | |
| 4 5 | Date/Time of Computation ProUCL 5.2 10/31/2024 4 From File ProUCL Input.xls | 4:58:14 PM | | |
| 6 | Full Precision OFF | | | |
| 7 | Confidence Coefficient 95% Number of Bootstrap Operations 2000 | | | |
| 9 | Number of Bootstrap Operations 2000 | | | |
| 10 | OF WDD 0.5.0 | | | |
| 12 | GF-WRD-0.5-3 | | | |
| 13 | | | Statistics | |
| 14 15 | Total Number of Observations | 4 | Number of Distinct Observations Number of Missing Observations | 0 |
| 16 | Minimum | 55 | Mean | 61.75 |
| 17 18 | Maximum | | Median | 59 |
| 19 | SD Coefficient of Variation | | Std. Error of Mean Skewness | 4.366 1.342 |
| 20 | | , | | |
| 21 22 | | | using incremental sampling methodology (ISM) approach, C 2020 and ITRC 2012) for additional guidance, | |
| 23 | | | he Chebyshev UCL for small sample sizes (n < 7). | |
| 24 25 | The Chebyshev UCL o | often results | in gross overestimates of the mean. | |
| 26 | Refer to the ProUCL 5.2 Tec | nnical Guide | e for a discussion of the Chebyshev UCL. | |
| 27 | | | OF Test | |
| 28 29 | Shapiro Wilk Test Statistic 1% Shapiro Wilk Critical Value | | Shapiro Wilk GOF Test Data appear Normal at 1% Significance Level | |
| 30 | 1% Snapiro Wilk Critical Value Lilliefors Test Statistic | | Lilliefors GOF Test | |
| 31 | 1% Lilliefors Critical Value | 0.413 | Data appear Normal at 1% Significance Level | |
| 32 33 | | | t 1% Significance Level Bliable for small sample sizes | |
| 34 | | | | |
| 35 36 | | suming Norr | mal Distribution | |
| 37 | 95% Normal UCL 95% Student's-t UCL | 72.02 | 95% UCLs (Adjusted for Skewness) 95% Adjusted-CLT UCL (Chen-1995) | 72.06 |
| 38 | 30% Cladoliko (002 | 72.02 | 95% Modified-t UCL (Johnson-1978) | 72.51 |
| 39 40 | | | COT Test | |
| 41 | A-D Test Statistic | | GOF Test Anderson-Darling Gamma GOF Test | |
| 42 | 5% A-D Critical Value | 0.656 | Detected data appear Gamma Distributed at 5% Significance | Level |
| 43 44 | K-S Test Statistic 5% K-S Critical Value | | Kolmogorov-Smirnov Gamma GOF Test Detected data appear Gamma Distributed at 5% Significance | Lovol |
| 45 | | | stributed at 5% Significance Level | Levei |
| 46 47 | Note GOF tests | may be unre | eliable for small sample sizes | |
| 47 | | Gamma | Statistics | |
| 49 | k hat (MLE) | | k star (bias corrected MLE) | 17.76 |
| 50 51 | Theta hat (MLE) | | Theta star (bias corrected MLE) | 3.477 |
| 52 | nu hat (MLE) MLE Mean (bias corrected) | | nu star (bias corrected) MLE Sd (bias corrected) | 142.1 14.65 |
| 53 | | | Approximate Chi Square Value (0.05) | 115.5 |
| 54 55 | Adjusted Level of Significance | N/A | Adjusted Chi Square Value | N/A |
| 56 | Ass | suming Garr | ma Distribution | |
| 57 58 | 95% Approximate Gamma UCL | | 95% Adjusted Gamma UCL | N/A |
| 58 | | Lognorma | GOF Test | |
| 60 | Shapiro Wilk Test Statistic | 0.88 | Shapiro Wilk Lognormal GOF Test | |
| 61 62 | 10% Shapiro Wilk Critical Value | | Data appear Lognormal at 10% Significance Level | |
| 63 | Lilliefors Test Statistic 10% Lilliefors Critical Value | | Lilliefors Lognormal GOF Test Data appear Lognormal at 10% Significance Level | |
| 64 | Data appear | Lognormal a | at 10% Significance Level | |
| 65 66 | Note GOF tests | may be unre | eliable for small sample sizes | |
| 67 | | Lognorma | I Statistics | |
| 68 | Minimum of Logged Data | 4.007 | Mean of logged Data | 4.116 |
| 69 70 | Maximum of Logged Data | 4.304 | SD of logged Data | 0.136 |
| 71 | | | ormal Distribution | |
| 72 73 | 95% H-UCL | 74.14 | 90% Chebyshev (MVUE) UCL | 74.32 |
| 74 | 95% Chebyshev (MVUE) UCL 99% Chebyshev (MVUE) UCL | 80.02 103.5 | 97.5% Chebyshev (MVUE) UCL | 87.93 |
| 75 | | | <u> </u> | |
| 76 77 | | | tion Free UCL Statistics | |
| 78 | Data appea | <u>ir to follow a</u> | Discernible Distribution | |
| 79 | | | tribution Free UCLs | |
| 80 81 | 95% CLT UCL | 68.93 | 95% BCA Bootstrap UCL | N/A |
| 82 | 95% Standard Bootstrap UCL 95% Hall's Bootstrap UCL | | 95% Bootstrap-t UCL 95% Percentile Bootstrap UCL | N/A N/A |
| | 33 /0 Fiall's DOUISHAP UCL | 1.10/77 | 1 Jo /o T el Certille DOUISITAD OCL | 1 1// 1 |

| | Α | В | С | D | E | F | G | Н | - 1 | J | K | L | |
|----|---------------------------|--------------|---------------|---------------|---------------|----------------|--------------------------------|---------------|----------------|---------------|-------------|-------|--|
| 83 | | | 90% Ch | ebyshev(Me | an, Sd) UCL | 74.85 | 95% Chebyshev(Mean, Sd) UCL 80 | | | | | | |
| 84 | | | 97.5% Ch | ebyshev(Me | an, Sd) UCL | 89.02 | | | 99% Ch | ebyshev(Me | an, Sd) UCL | 105.2 | |
| 85 | | | | | | | | | | | | | |
| 86 | Suggested UCL to Use | | | | | | | | | | | | |
| 87 | 95% Student's-t UCL 72.02 | | | | | | | | | | | | |
| 88 | | | | | | | | | | | | | |
| 89 | | Note: Sugges | stions regard | ing the selec | tion of a 95% | 6 UCL are pr | ovided to hel | p the user to | select the m | nost appropri | ate 95% UCL | | |
| 90 | | Recom | mendations | are based up | on data size | , data distrib | ution, and sk | ewness usin | g results fror | m simulation | studies. | | |
| 91 | | | | | | | | | | | | | |
| 92 | | | | | | | | | | | | | |

| | A B C D E | F | G H I J K | L |
|----------|---|---------------------|--|----------------|
| 2 | UCL Statis | tics for Unc | ensored Full Data Sets | |
| 3 | User Selected Options | 4.E0.22 DM | | |
| 5 | Date/Time of Computation ProUCL 5.2 10/31/2024 4 From File ProUCL Input.xls | 4:59:32 PIVI | | |
| 6 | Full Precision OFF | | | |
| 7 | Confidence Coefficient 95% Number of Bootstrap Operations 2000 | | | |
| 9 | Number of Bookstup Operations 2000 | | | |
| 10 11 | GF-WRD-0.5-4 | | | |
| 12 | GI -WND-0.5-4 | | | |
| 13 14 | Total Number of Observations | General 4 | Statistics Number of Distinct Observations | 4 |
| 15 | Total Number of Observations | 4 | | 0 |
| 16 17 | Minimum | 42 57 | | 50.75 52 |
| 18 | Maximum SD | 6.752 | | 3.376 |
| 19 | Coefficient of Variation | 0.133 | | 0.768 |
| 20 21 | Note: Sample size is small (e.g., <10), if data a | are collected | using incremental sampling methodology (ISM) approach, | |
| 22 | refer also to ITRC Tech Reg Guide of | on ISM (ITR | C 2020 and ITRC 2012) for additional guidance, | |
| 23 24 | | | the Chebyshev UCL for small sample sizes (n < 7). in gross overestimates of the mean. | |
| 25 | | | e for a discussion of the Chebyshev UCL. | |
| 26 27 | | Normal (| GOF Test | |
| 28 | Shapiro Wilk Test Statistic | 0.936 | Shapiro Wilk GOF Test | |
| 29 30 | 1% Shapiro Wilk Critical Value | 0.687 | Data appear Normal at 1% Significance Level | |
| 31 | Lilliefors Test Statistic 1% Lilliefors Critical Value | 0.235 0.413 | Lilliefors GOF Test Data appear Normal at 1% Significance Level | |
| 32 | Data appea | ar Normal at | t 1% Significance Level | |
| 33 34 | Note GOF tests | may be unre | eliable for small sample sizes | |
| 35 | | suming Nor | mal Distribution | |
| 36 37 | 95% Normal UCL 95% Student's-t UCL | | 95% UCLs (Adjusted for Skewness) | 54.02 |
| 38 | 95% Students-t UCL | 58.69 | | 54.92 58.48 |
| 39 40 | | 0 | | |
| 41 | A-D Test Statistic | 0.311 | GOF Test Anderson-Darling Gamma GOF Test | |
| 42 | 5% A-D Critical Value | 0.656 | Detected data appear Gamma Distributed at 5% Significance L | evel |
| 43 44 | K-S Test Statistic 5% K-S Critical Value | 0.268 0.394 | Kolmogorov-Smirnov Gamma GOF Test Detected data appear Gamma Distributed at 5% Significance L | evel |
| 45 | Detected data appear | Gamma Di | stributed at 5% Significance Level | |
| 46 47 | Note GOF tests | may be unre | eliable for small sample sizes | |
| 48 | | | Statistics | |
| 49 50 | k hat (MLE) Theta hat (MLE) | 72.18 0.703 | , , , | 18.21 2.787 |
| 51 | nu hat (MLE) | 577.4 | nu star (bias corrected) 14 | 45.7 |
| 52 53 | MLE Mean (bias corrected) | 50.75 | MLE Sd (bias corrected) | 11.89 |
| 54 | Adjusted Level of Significance | N/A | | 18.8 I/A |
| 55 | | | | |
| 56 57 | Ass 95% Approximate Gamma UCL | suming Gam 62.24 | nma Distribution 95% Adjusted Gamma UCL N | I/A |
| 58 | 5577 Typroximate dumina OOL | | | |
| 59 60 | Shapiro Wilk Test Statistic | Lognorma 0.925 | I GOF Test Shapiro Wilk Lognormal GOF Test | |
| 61 | 10% Shapiro Wilk Critical Value | 0.792 | Data appear Lognormal at 10% Significance Level | |
| 62 63 | Lilliefors Test Statistic | 0.237 0.346 | Lilliefors Lognormal GOF Test | |
| 64 | 10% Lilliefors Critical Value Data appear | | Data appear Lognormal at 10% Significance Level at 10% Significance Level | |
| 65 66 | | | eliable for small sample sizes | |
| 66 67 | | Lognorma | Il Statistics | |
| 68 | Minimum of Logged Data | 3.738 | Mean of logged Data | 3.92 |
| 69 70 | Maximum of Logged Data | 4.043 | SD of logged Data | 0.138 |
| 71 | Assu | ıming Logno | ormal Distribution | |
| 72 73 | 95% H-UCL | 61.1 | 90% Chebyshev (MVUE) UCL | 61.22 |
| 74 | 95% Chebyshev (MVUE) UCL 99% Chebyshev (MVUE) UCL | 65.96 85.46 | 97.5% Chebyshev (MVUE) UCL | 72.54 |
| 75 | | | | |
| 76 77 | | | tion Free UCL Statistics Discernible Distribution | |
| 78 | | | | |
| 79 80 | | | tribution Free UCLs | 1/4 |
| 81 | 95% CLT UCL 95% Standard Bootstrap UCL | 56.3 N/A | | I/A I/A |
| 82 | 95% Hall's Bootstrap UCL | N/A | | I/A |

| | Α | В | С | D | E | F | G | Н | I | J | K | L | | |
|----|---|--------------|----------------|----------------|---------------|----------------|----------------------------------|----------------|----------------|--------------|-----------------|-------|--|--|
| 83 | | - | 90% Ch | ebyshev(Me | an, Sd) UCL | 60.88 | 95% Chebyshev(Mean, Sd) UCL 65.4 | | | | | | | |
| 84 | | | 97.5% Ch | ebyshev(Me | an, Sd) UCL | 71.83 | | | 99% Ch | ebyshev(Me | an, Sd) UCL | 84.34 | | |
| 85 | _ | | | | | | | | | | | | | |
| 86 | Suggested UCL to Use | | | | | | | | | | | | | |
| 87 | 95% Student's-t UCL 58.69 | | | | | | | | | | | | | |
| 88 | Recommended UCL exceeds the maximum observation | | | | | | | | | | | | | |
| 89 | | | | | | | | | | | | | | |
| 90 | 1 | Note: Sugges | stions regard | ling the selec | tion of a 95% | 6 UCL are pr | ovided to hel | p the user to | select the m | ost appropri | ate 95% UCL | | | |
| 91 | | Recom | mendations | are based up | on data size | , data distrib | ution, and sk | ewness usin | g results fror | m simulation | studies. | | | |
| 92 | Но | wever, simul | lations result | s will not cov | er all Real V | Vorld data se | ts; for addition | nal insight th | ne user may | want to cons | ult a statistic | ian. | | |
| 93 | | | | | | | | | | | | | | |
| 94 | | Note: For | highly negat | ively-skewe | d data, confi | dence limits | (e.g., Chen, | Johnson, Lo | ognormal, ar | nd Gamma) ı | may not be | | | |
| 95 | | | reliable. | Chen's and J | ohnson's m | ethods provi | de adjustme | nts for posit | vely skewed | data sets. | | | | |
| 96 | | | | | | | | | | | | | | |

| | A B C D E | F | G H I J K | L |
|----------|---|----------------|---|----------------|
| 2 | UCL Statis | stics for Unc | ensored Full Data Sets | |
| 3 | User Selected Options | | | |
| 4 5 | Date/Time of Computation ProUCL 5.2 10/31/2024 From File ProUCL Input.xls | 5:01:02 PM | | |
| 6 | Full Precision OFF | | | |
| 7 | Confidence Coefficient 95% Number of Bootstrap Operations 2000 | | | |
| 9 | Number of Bootstrap Operations 2000 | | | |
| 10 | | | | |
| 12 | GF-WRD-0.5-5 | | | |
| 13 | | | Statistics | |
| 14 15 | Total Number of Observations | 4 | Number of Distinct Observations Number of Missing Observations | 0 |
| 16 | Minimum | 52 | | 56 |
| 17 18 | Maximum | | | 55 |
| 19 | SD Coefficient of Variation | | Std. Error of Mean Skewness | 2.121 1.309 |
| 20 | | , | | |
| 21 22 | | | l using incremental sampling methodology (ISM) approach, C 2020 and ITRC 2012) for additional guidance, | |
| 23 | | | he Chebyshev UCL for small sample sizes (n < 7). | |
| 24 25 | | | in gross overestimates of the mean. | |
| 26 | Refer to the ProUCL 5.2 Led | chnical Guid | e for a discussion of the Chebyshev UCL. | |
| 27 | | | GOF Test | |
| 28 29 | Shapiro Wilk Test Statistic 1% Shapiro Wilk Critical Value | | Shapiro Wilk GOF Test Data appear Normal at 1% Significance Level | |
| 30 | 1% Snapiro Wilk Critical Value Lilliefors Test Statistic | | Lilliefors GOF Test | |
| 31 | 1% Lilliefors Critical Value | 0.413 | Data appear Normal at 1% Significance Level | |
| 32 33 | | | t 1% Significance Level Bliable for small sample sizes | |
| 34 | | | | |
| 35 36 | | suming Nor | mal Distribution | |
| 37 | 95% Normal UCL 95% Student's-t UCL | 60.99 | 95% UCLs (Adjusted for Skewness) 95% Adjusted-CLT UCL (Chen-1995) | 60.97 |
| 38 | 30% StadSht 8 1 30E | 00.00 | | 61.22 |
| 39 40 | | Commo | COF Took | |
| 41 | A-D Test Statistic | | GOF Test Anderson-Darling Gamma GOF Test | |
| 42 | 5% A-D Critical Value | 0.657 | Detected data appear Gamma Distributed at 5% Significance | Level |
| 43 44 | K-S Test Statistic 5% K-S Critical Value | | Kolmogorov-Smirnov Gamma GOF Test Detected data appear Gamma Distributed at 5% Significance | Level |
| 45 | Detected data appear | r Gamma Di | stributed at 5% Significance Level | LEVEI |
| 46 47 | Note GOF tests | may be unre | eliable for small sample sizes | |
| 48 | | Gamma | Statistics | |
| 49 | k hat (MLE) | 239.3 | | 60 |
| 50 51 | Theta hat (MLE) nu hat (MLE) | | Theta star (bias corrected MLE) nu star (bias corrected) 4 | 0.933 180 |
| 52 | MLE Mean (bias corrected) | | MLE Sd (bias corrected) | 7.23 |
| 53 | | | Approximate Chi Square Value (0.05) 4 | 130.2 |
| 54 55 | Adjusted Level of Significance | N/A | Adjusted Chi Square Value | N/A |
| 56 | As | suming Gam | ma Distribution | |
| 57 58 | 95% Approximate Gamma UCL | | | N/A |
| 59 | | Lognorma | GOF Test | |
| 60 | Shapiro Wilk Test Statistic | 0.886 | Shapiro Wilk Lognormal GOF Test | |
| 61 62 | 10% Shapiro Wilk Critical Value Lilliefors Test Statistic | | Data appear Lognormal at 10% Significance Level Lilliefors Lognormal GOF Test | |
| 63 | 10% Lilliefors Critical Value | | Data appear Lognormal at 10% Significance Level | |
| 64 | Data appear | Lognormal a | at 10% Significance Level | |
| 65 66 | Note GOF tests | may be unre | eliable for small sample sizes | |
| 67 | | Lognorma | I Statistics | |
| 68 | Minimum of Logged Data | 3.951 | Mean of logged Data | 4.023 |
| 69 70 | Maximum of Logged Data | 4.127 | SD of logged Data | 0.0741 |
| 71 | Ass | uming Logno | ormal Distribution | |
| 72 73 | 95% H-UCL | N/A | 90% Chebyshev (MVUE) UCL | 62.22 |
| 74 | 95% Chebyshev (MVUE) UCL 99% Chebyshev (MVUE) UCL | 65.04 76.64 | 97.5% Chebyshev (MVUE) UCL | 68.95 |
| 75 | | | | |
| 76 77 | | | tion Free UCL Statistics | |
| 78 | Data appea | ar to follow a | Discernible Distribution | |
| 79 | | | tribution Free UCLs | |
| 80 81 | 95% CLT UCL | 59.49 | 95% BCA Bootstrap UCL | N/A |
| 82 | 95% Standard Bootstrap UCL 95% Hall's Bootstrap UCL | | , | N/A N/A |
| ļ | 30 /0 Hall 5 DOOISHAD OCL | 11// | 30 /0 1 GIOGINING DOORSHAP OCL | 17// |

| | Α | В | С | D | E | F | G | Н | I | J | K | L | |
|----|-----------------------------|--------------|----------------|----------------|---------------|--------------|--------------------------------|----------------|----------------|---------------|------------------|-------|--|
| 83 | | | 90% Ch | ebyshev(Mea | n, Sd) UCL | 62.36 | 95% Chebyshev(Mean, Sd) UCL 65 | | | | | | |
| 84 | | | 97.5% Ch | ebyshev(Mea | an, Sd) UCL | 69.25 | | | 99% Ch | ebyshev(Me | an, Sd) UCL | 77.11 | |
| 85 | | | | | | | | | | | | | |
| 86 | Suggested UCL to Use | | | | | | | | | | | | |
| 87 | 95% Student's-t UCL 60.99 | | | | | | | | | | | | |
| 88 | | | | | | | | | | | | | |
| 89 | | Note: Sugges | stions regard | ing the selec | tion of a 95% | UCL are pr | ovided to hel | p the user to | select the m | nost appropri | ate 95% UCL | | |
| 90 | | Recom | mendations | are based up | on data size | data distrib | ution, and sk | ewness usin | g results from | m simulation | studies. | | |
| 91 | Ho | wever, simul | lations result | s will not cov | er all Real W | orld data se | ts; for addition | nal insight th | ne user may | want to cons | ult a statistici | an. | |
| 92 | | | | | | | | | | | | | |

| 1 | A B C D E | F stics for Unc | G ensored Full | H Data Sets | I | J | K | L |
|----------|---|---------------------|-------------------|------------------|---------------------------|--------------------------------|------------------------------|----------------|
| 2 | OOL Statis | | CHOOLEG FUIL | | | | | |
| 3 | User Selected Options | | | | | | | |
| 4 5 | Date/Time of Computation ProUCL 5.2 10/31/2024 From File ProUCL Input.xls | 5:02:22 PM | | | | | | |
| 6 | Full Precision OFF | | | | | | | |
| 7 | Confidence Coefficient 95% | | | | | | | |
| 8 | Number of Bootstrap Operations 2000 | | | | | | | |
| 9 | | | | | | | | |
| | GF-WRD-0.5-6 | | | | | | | |
| 12 | a. 777.15 0.0 0 | | | | | | | |
| 13 | | | Statistics | | | | _ | |
| 14 15 | Total Number of Observations | 4 | | | | | Observations | 0 |
| 16 | Minimum | 51 | | | Number | or wissing | Observations Mean | 59 |
| 17 | Maximum | | | | | | Median | 52.5 |
| 18 | SD | | | | | Std. I | Frror of Mean | 7.012 |
| 19 20 | Coefficient of Variation | 0.238 | | | | | Skewness | 1.98 |
| 21 | Note: Sample size is small (e.g., <10), if data | are collected | l using increr | mental samplir | na methodo | ology (ISM) | annroach | |
| 22 | refer also to ITRC Tech Reg Guide | on ISM (ITR | C 2020 and I | TRC 2012) for | r additional | guidance, | | |
| 23 | but note that ITRC may recommend to | | | | | sizes (n < | 7). | |
| 24 25 | The Chebyshev UCL on Refer to the ProUCL 5.2 Te | | | | | ICI | | |
| 26 | Neiei tu tile F100CL 5.2 Tel | cillical Guid | e ivi a uiscus | salon of tile of | IGDYSHEV C | , _O L. | | |
| 27 | | | GOF Test | | | | | |
| 28 | Shapiro Wilk Test Statistic | 0.685 | | | | k GOF Tes | | |
| 29 30 | 1% Shapiro Wilk Critical Value Lilliefors Test Statistic | | | Data Not N | lormal at 1 st | % Significa | nce Level | |
| 31 | Lillefors Lest Statistic 1% Lilliefors Critical Value | | | Data Not N | | % Significa | nce Level | |
| 32 | | t Normal at 1 | % Significan | | | | | |
| 33 | | | | | | | | |
| 34 35 | | suming Nor | mal Distributi | | Ol - / A -!! | ata difa a Ole | | |
| 36 | 95% Normal UCL 95% Student's-t UCL | 75.5 | | | | sted for Ske | (Chen-1995) | 77.95 |
| 37 | 33% otddont 3-t OCL | 70.0 | | | | | hnson-1978) | 76.66 |
| 38 | | | | | | , | | |
| 39 40 | A.D.T. (0) (1) | | GOF Test | A | - Deallers | 0 | SE T | |
| 41 | A-D Test Statistic 5% A-D Critical Value | | Da | | | Gamma GO | gnificance Leve | ام |
| 42 | K-S Test Statistic | | D(| | | v Gamma (| | 01 |
| 43 | 5% K-S Critical Value | 0.394 | | | | ed at 5% Sig | gnificance Leve | el |
| 44 45 | Data Not Gam | ma Distribute | ed at 5% Sig | nificance Leve | el . | | | |
| 46 | | Gamma | Statistics | | | | | |
| 47 | k hat (MLE) | | Otationio | | k s | tar (bias co | rrected MLE) | 6.896 |
| 48 | Theta hat (MLE) | | | | Theta s | | rrected MLE) | 8.556 |
| 49 50 | nu hat (MLE) | | | | | | as corrected) | 55.17 |
| 51 | MLE Mean (bias corrected) | 59 | | An | | | as corrected) Value (0.05) | 22.47 39.1 |
| 52 | Adjusted Level of Significance | N/A | | , ,, | | | Square Value | N/A |
| 53 | | | | _ | | | | |
| 54 55 | As 95% Approximate Gamma UCL | suming Gam 83.25 | ma Distribut | ion | OEO | / Adiustad | Gamma UCL | N/A |
| 56 | 95% Appioximate Gamma UCL | 00.20 | <u> </u> | | 95% | o Aujusted | uannid UUL | IN/A |
| 57 | | | GOF Test | | | | | |
| 58 | Shapiro Wilk Test Statistic | | | | | normal GO | | |
| 59 60 | 10% Shapiro Wilk Critical Value Lilliefors Test Statistic | | | Data Not Log | | <u>10% Signifi</u> rmal GOF | | |
| 61 | 10% Lilliefors Critical Value | | | Data Not Loc | | | | |
| 62 | | ognormal at | 10% Signific | | | | | |
| 63 64 | | 1 | I Otatiati | | | | | |
| 65 | Minimum of Logged Data | | I Statistics | | | Mean | f logged Data | 4.059 |
| 66 | Maximum of Logged Data Maximum of Logged Data | | | | | | f logged Data | 0.216 |
| 67 | | | | | | | | |
| 68 69 | Ass | uming Logno | rmal Distribu | ution | 000/ 0 | Na a b · · - ¹ | /M//UE\ LIQI | 77.05 |
| 70 | 95% H-UCL 95% Chebyshev (MVUE) UCL | | | | | | (MVUE) UCL (MVUE) UCL | 77.95 98.54 |
| 71 | 99% Chebyshev (MVUE) UCL | | | | J1.J/0 C | on Conyonie V | (IVI V OL) OCL | 50.54 |
| 72 | | | • | | | | | |
| 73 | | etric Distribu | | | | | | |
| 74 75 | Data do r | not follow a D | uscernible D | stribution | | | | |
| 76 | Nonna | rametric Dis | tribution Free | UCLs | | | | |
| 77 | 95% CLT UCL | 70.53 | | | 9 | | ootstrap UCL | N/A |
| 78 | 95% Standard Bootstrap UCL | N/A | | | | | otstrap-t UCL | N/A |
| 79 80 | 95% Hall's Bootstrap UCL 90% Chebyshev(Mean, Sd) UCL | | | | | | ootstrap UCL ean, Sd) UCL | N/A 89.56 |
| 81 | 90% Chebyshev(Mean, Sd) UCL 97.5% Chebyshev(Mean, Sd) UCL | | | | | | ean, Sd) UCL ean, Sd) UCL | 128.8 |
| 82 | 57.5% Chebyshev(Mean, 30) UCL | ., 102.0 | | | | | Jan, Juj JUL | 120.0 |
| | | | | | | | | |

| | Α | В | С | D | E | F | G | Н | I | J | K | L | | |
|----|---|-------|------------|--------------|--------------|----------------|---------------|-------------|----------------|--------------|----------|---|--|--|
| 83 | Suggested UCL to Use | | | | | | | | | | | | | |
| 84 | Recommendation cannot be provided | | | | | | | | | | | | | |
| 85 | | | | | | | | | | | | | | |
| 86 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. | | | | | | | | | | | | | |
| 87 | | Recom | mendations | are based up | on data size | , data distrib | ution, and sk | ewness usin | g results fror | n simulation | studies. | | | |
| 88 | Recommendations are based upon data size, data distribution, and skewness using results from simulation studies. However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician. | | | | | | | | | | | | | |
| 89 | | | | | | | | | | | | | | |

| | A B C D E | F | G H I J K | L | | | | | | | |
|----------|---|---|--|----------------|--|--|--|--|--|--|--|
| 2 | UCL Statis | tics for Unc | ensored Full Data Sets | | | | | | | | |
| 3 | User Selected Options | 4 57 44 514 | | | | | | | | | |
| 5 | Date/Time of Computation ProUCL 5.2 10/31/2024 | 4:57:11 PM | | | | | | | | | |
| 6 | Full Precision OFF | | | | | | | | | | |
| 7 | Confidence Coefficient 95% Number of Bootstrap Operations 2000 | | | | | | | | | | |
| 9 | | | | | | | | | | | |
| 10 11 | GF-WRD-0.5-2 | | | | | | | | | | |
| 12 | ai -WIAD-0.3-2 | | | | | | | | | | |
| 13 14 | Total Number of Observations | General 4 | Statistics Number of Distinct Observations | 4 | | | | | | | |
| 15 | Total Number of Observations | 4 | Number of Missing Observations | 0 | | | | | | | |
| 16 17 | Minimum | 30 44 | Mean | 38.5 40 | | | | | | | |
| 18 | Maximum SD | 6.191 | Median Std. Error of Mean | 3.096 | | | | | | | |
| 19 | Coefficient of Variation | 0.161 | Skewness | -1.138 | | | | | | | |
| 20 21 | Note: Sample size is small (e.g., <10), if data a | are collected | using incremental sampling methodology (ISM) approach, | | | | | | | | |
| 22 | refer also to ITRC Tech Reg Guide | on ISM (ITR | C 2020 and ITRC 2012) for additional guidance, | | | | | | | | |
| 23 24 | | | he Chebyshev UCL for small sample sizes (n < 7). in gross overestimates of the mean. | | | | | | | | |
| 25 | | | e for a discussion of the Chebyshev UCL. | | | | | | | | |
| 26 27 | | Normal (| POE Toet | | | | | | | | |
| 28 | Shapiro Wilk Test Statistic | 0.921 | GOF Test Shapiro Wilk GOF Test | | | | | | | | |
| 29 30 | 1% Shapiro Wilk Critical Value | 0.687 | Data appear Normal at 1% Significance Level | | | | | | | | |
| 31 | Lilliefors Test Statistic 1% Lilliefors Critical Value | 0.218 0.413 | Lilliefors GOF Test Data appear Normal at 1% Significance Level | | | | | | | | |
| 32 | Data appe | ar Normal at | 1% Significance Level | | | | | | | | |
| 33 34 | Note GOF tests | may be unre | liable for small sample sizes | | | | | | | | |
| 35 | Assuming Normal Distribution | | | | | | | | | | |
| 36 37 | 95% Normal UCL 95% Student's-t UCL | | 95% UCLs (Adjusted for Skewness) 95% Adjusted-CLT UCL (Chen-1995) | 41.71 | | | | | | | |
| 38 | 95% Students-t UCL | 45.79 | 95% Adjusted-CLT UCL (Chen-1995) 95% Modified-t UCL (Johnson-1978) | 41.71 | | | | | | | |
| 39 40 | | 0 | | | | | | | | | |
| 41 | A-D Test Statistic | 0.354 | GOF Test Anderson-Darling Gamma GOF Test | | | | | | | | |
| 42 | 5% A-D Critical Value | 0.656 | Detected data appear Gamma Distributed at 5% Significance | Level | | | | | | | |
| 43 44 | K-S Test Statistic 5% K-S Critical Value | y . | | | | | | | | | |
| 45 | Detected data appear | ar Gamma Distributed at 5% Significance Level | | | | | | | | | |
| 46 47 | Note GOF tests | may be unre | eliable for small sample sizes | | | | | | | | |
| 48 | | | Statistics | | | | | | | | |
| 49 50 | k hat (MLE) Theta hat (MLE) | 47.8 0.806 | k star (bias corrected MLE) Theta star (bias corrected MLE) | 12.12 3.178 | | | | | | | |
| 51 | nu hat (MLE) | | nu star (bias corrected MLE) | 96.93 | | | | | | | |
| 52 53 | MLE Mean (bias corrected) | 38.5 | MLE Sd (bias corrected) | 11.06 | | | | | | | |
| 54 | Adjusted Level of Significance | N/A | Approximate Chi Square Value (0.05) Adjusted Chi Square Value | 75.22 N/A | | | | | | | |
| 55 | | | | | | | | | | | |
| 56 57 | Ase 95% Approximate Gamma UCL | <u>suming Gam</u> 49.61 | ma Distribution 95% Adjusted Gamma UCL | N/A | | | | | | | |
| 58 | oo in a provintido dumina doc | | | | | | | | | | |
| 59 60 | Shapiro Wilk Test Statistic | Lognorma 0.897 | GOF Test Shapiro Wilk Lognormal GOF Test | | | | | | | | |
| 61 | 10% Shapiro Wilk Critical Value | 0.792 | Data appear Lognormal at 10% Significance Level | | | | | | | | |
| 62 63 | Lilliefors Test Statistic | 0.244 0.346 | Lilliefors Lognormal GOF Test | | | | | | | | |
| 64 | 10% Lilliefors Critical Value Data appear | | Data appear Lognormal at 10% Significance Level at 10% Significance Level | | | | | | | | |
| 65 66 | | | liable for small sample sizes | | | | | | | | |
| 66 67 | | Lognorma | I Statistics | | | | | | | | |
| 68 | Minimum of Logged Data | 3.401 | Mean of logged Data | 3.64 | | | | | | | |
| 69 70 | Maximum of Logged Data | 3.784 | SD of logged Data | 0.171 | | | | | | | |
| 71 | Assu | | rmal Distribution | | | | | | | | |
| 72 73 | 95% H-UCL 95% Chebyshev (MVUE) UCL | 48.89 52.81 | 90% Chebyshev (MVUE) UCL 97.5% Chebyshev (MVUE) UCL | 48.35 58.99 | | | | | | | |
| 74 | 95% Chebyshev (MVUE) UCL 99% Chebyshev (MVUE) UCL | 71.14 | 97.3% Chebysnev (MIVUE) UCL | 50.33 | | | | | | | |
| 75 76 | | | Non-Free HOL Obskielies | | | | | | | | |
| 77 | | | tion Free UCL Statistics Discernible Distribution | | | | | | | | |
| 78 | | | | | | | | | | | |
| 79 80 | Nonpar 95% CLT UCL | rametric Dis 43.59 | tribution Free UCLs 95% BCA Bootstrap UCL | N/A | | | | | | | |
| 81 | 95% CLT OCL 95% Standard Bootstrap UCL | 43.59 N/A | 95% BCA Bootstrap UCL 95% Bootstrap-t UCL | N/A N/A | | | | | | | |
| 82 | 95% Hall's Bootstrap UCL | N/A | 95% Percentile Bootstrap UCL | N/A | | | | | | | |

| | Α | В | С | D | E | F | G | Н | I | J | K | L |
|----|---|--------------|----------------|----------------|---------------|----------------|------------------|----------------|----------------|--------------|-----------------|------|
| 83 | 90% Chebyshev(Mean, Sd) UCL 47.79 95% Chebyshev(Mean, Sd) UCL | | | | | | | | 51.99 | | | |
| 84 | | | 97.5% Ch | ebyshev(Me | an, Sd) UCL | 57.83 | | | 99% Ch | ebyshev(Me | an, Sd) UCL | 69.3 |
| 85 | | | | | | | | | | | | |
| 86 | Suggested UCL to Use | | | | | | | | | | | |
| 87 | 95% Student's-t UCL 45.79 | | | | | | | | | | | |
| 88 | Recommended UCL exceeds the maximum observation | | | | | | | | | | | |
| 89 | | | | | | | | | | | | |
| 90 | 1 | Note: Sugges | stions regard | ling the selec | tion of a 95% | 6 UCL are pr | ovided to hel | p the user to | select the m | ost appropri | ate 95% UCL | |
| 91 | | Recom | mendations | are based up | on data size | , data distrib | ution, and sk | ewness usin | g results fror | n simulation | studies. | |
| 92 | Но | wever, simul | lations result | s will not cov | er all Real W | Vorld data se | ts; for addition | nal insight th | ne user may | want to cons | ult a statistic | ian. |
| 93 | | | | | | | | | | | | |
| 94 | Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be | | | | | | | | | | | |
| 95 | | | reliable. | Chen's and J | lohnson's m | ethods provi | de adjustme | nts for posity | vely skewed | data sets. | | |
| 96 | | | | | | | | | | | | |

| 1 | A B C D E | F | G H I J K L ensored Full Data Sets | | | | | | | | |
|----------|--|-----------------|--|--|--|--|--|--|--|--|--|
| 2 | OOL Olds | 131103 101 0110 | Chisored Full Data Octs | | | | | | | | |
| 3 | User Selected Options | | | | | | | | | | |
| <u>4</u> | Date/Time of Computation ProUCL 5.2 10/28/2024 | 4:24:54 PM | | | | | | | | | |
| 6 | From File WorkSheet.xls Full Precision OFF | | | | | | | | | | |
| 7 | Confidence Coefficient 95% | | | | | | | | | | |
| 8 | Number of Bootstrap Operations 2000 | | | | | | | | | | |
| 9 | | | | | | | | | | | |
| 10 11 | | | | | | | | | | | |
| 12 | LMM-TLA-0.5-1 | | | | | | | | | | |
| 13 | | General | Statistics | | | | | | | | |
| 14 | Total Number of Observations | 10 | Number of Distinct Observations 10 | | | | | | | | |
| 15 16 | | 2054 | Number of Missing Observations 0 | | | | | | | | |
| 17 | Minimum Maximum | | Mean 3873 Median 3926 | | | | | | | | |
| 18 | SE | | Std. Error of Mean 156.6 | | | | | | | | |
| 19 | Coefficient of Variation | | Skewness 0.273 | | | | | | | | |
| 20 21 | | | | | | | | | | | |
| 22 | Shapiro Wilk Test Statistic | | GOF Test Shapiro Wilk GOF Test | | | | | | | | |
| 23 | 1% Shapiro Wilk Critical Value | | Data appear Normal at 1% Significance Level | | | | | | | | |
| 24 | Lilliefors Test Statistic | 0.185 | Lilliefors GOF Test | | | | | | | | |
| 25 | 1% Lilliefors Critical Value | | Data appear Normal at 1% Significance Level | | | | | | | | |
| 26 27 | Data appe | ear Normal a | t 1% Significance Level | | | | | | | | |
| 28 | Δ | ssumina Non | mal Distribution | | | | | | | | |
| 29 | 95% Normal UCL | ocuming ito | 95% UCLs (Adjusted for Skewness) | | | | | | | | |
| 30 | 95% Student's-t UCL | 4160 | 95% Adjusted-CLT UCL (Chen-1995) 4145 | | | | | | | | |
| 31 | | | 95% Modified-t UCL (Johnson-1978) 4162 | | | | | | | | |
| 33 | | Gamma | GOF Test | | | | | | | | |
| 34 | A-D Test Statistic 0.297 Anderson-Darling Gamma GOF Test | | | | | | | | | | |
| 35 | 5% A-D Critical Value | 0.724 | Detected data appear Gamma Distributed at 5% Significance Level | | | | | | | | |
| 36 37 | K-S Test Statistic | | Kolmogorov-Smirnov Gamma GOF Test | | | | | | | | |
| 38 | 5% K-S Critical Value Detected data appea | | Detected data appear Gamma Distributed at 5% Significance Level stributed at 5% Significance Level | | | | | | | | |
| 39 | | anning Di | and the state of the significance better | | | | | | | | |
| 40 | | | Statistics 47.00 | | | | | | | | |
| 41 | k hat (MLE Theta hat (MLE | | k star (bias corrected MLE) 47.68 Theta star (bias corrected MLE) 81.23 | | | | | | | | |
| 43 | nu hat (MLE) | , | nu star (bias corrected MLE) 81.23 | | | | | | | | |
| 44 | MLE Mean (bias corrected) | | MLE Sd (bias corrected) 560.9 | | | | | | | | |
| 45 | · | | Approximate Chi Square Value (0.05) 882.9 | | | | | | | | |
| 46 47 | Adjusted Level of Significance | 0.0267 | Adjusted Chi Square Value 871 | | | | | | | | |
| 48 | As | suming Gan | nma Distribution | | | | | | | | |
| 49 | 95% Approximate Gamma UCL | | 95% Adjusted Gamma UCL 4240 | | | | | | | | |
| 50 51 | | | LCOFTeet | | | | | | | | |
| 52 | Shapiro Wilk Test Statistic | | GOF Test Shapiro Wilk Lognormal GOF Test | | | | | | | | |
| 53 | 10% Shapiro Wilk Critical Value | | Data appear Lognormal at 10% Significance Level | | | | | | | | |
| 54 | Lilliefors Test Statistic | 0.172 | Lilliefors Lognormal GOF Test | | | | | | | | |
| 55 | 10% Lilliefors Critical Value | | Data appear Lognormal at 10% Significance Level | | | | | | | | |
| 56 57 | Data appear | r Lognormal a | at 10% Significance Level | | | | | | | | |
| 58 | | Lognorma | al Statistics | | | | | | | | |
| 59 | Minimum of Logged Data | a 8.024 | Mean of logged Data 8.254 | | | | | | | | |
| 60 61 | Maximum of Logged Data | 8.485 | SD of logged Data 0.128 | | | | | | | | |
| 62 | Δοσ | sumina I oan | ormal Distribution | | | | | | | | |
| 63 | 95% H-UCL | | 90% Chebyshev (MVUE) UCL 4345 | | | | | | | | |
| 64 | 95% Chebyshev (MVUE) UCL | | 97.5% Chebyshev (MVUE) UCL 4855 | | | | | | | | |
| 65 66 | 99% Chebyshev (MVUE) UCL | _ 5438 | | | | | | | | | |
| 67 | Nonnaram | etric Distribu | tion Free UCL Statistics | | | | | | | | |
| 68 | | | Discernible Distribution | | | | | | | | |
| 69 | | | 17 d F 1101 | | | | | | | | |
| 70 71 | Nonpa 95% CLT UCL | | tribution Free UCLs 95% BCA Bootstrap UCL 4125 | | | | | | | | |
| 72 | 95% CET OCL 95% Standard Bootstrap UCL | | 95% BCA Bootstrap UCL 4125 95% Bootstrap-t UCL 4179 | | | | | | | | |
| 73 | 95% Hall's Bootstrap UCL | | 95% Percentile Bootstrap UCL 4113 | | | | | | | | |
| 74 | 90% Chebyshev(Mean, Sd) UCL | 4343 | 95% Chebyshev(Mean, Sd) UCL 4556 | | | | | | | | |
| 75 76 | 97.5% Chebyshev(Mean, Sd) UCL | 4851 | 99% Chebyshev(Mean, Sd) UCL 5431 | | | | | | | | |
| 77 | | Suggested | UCL to Use | | | | | | | | |
| 78 | 95% Student's-t UCL | | | | | | | | | | |
| 79 | | | | | | | | | | | |
| 80 81 | | | ovided to help the user to select the most appropriate 95% UCL. ution, and skewness using results from simulation studies. | | | | | | | | |
| 82 | | | ution, and skewness using results from simulation studies. ts; for additional insight the user may want to consult a statistician. | | | | | | | | |
| | sdiadono rocalio Will flot covor all recar | | 25, 25 25 25 25 25 25 25 25 25 25 25 25 25 | | | | | | | | |

| 1 | A B C D E | F | G H I J K L | | | | | | | |
|----------|---|----------------|--|--|--|--|--|--|--|--|
| 2 | | istics for Unc | ensored Full Data Sets | | | | | | | |
| 3 | User Selected Options Date/Time of Computation ProUCL 5.2 10/28/2024 | 4:27:20 DM | | | | | | | | |
| 5 | From File WorkSheet.xls | 4.27.30 PIVI | | | | | | | | |
| 6 7 | Full Precision OFF Confidence Coefficient 95% | | | | | | | | | |
| 8 | Number of Bootstrap Operations 2000 | | | | | | | | | |
| 9 10 | | | | | | | | | | |
| 11 | LMM-TLA-0.5-2 | | | | | | | | | |
| 12 13 | | General | Statistics | | | | | | | |
| 14 15 | Total Number of Observations | | Number of Distinct Observations 10 | | | | | | | |
| 16 | Minimum | 1 4263 | Number of Missing Observations 0 Mean 8805 | | | | | | | |
| 17 18 | Maximum | n 17380 | Median 8345 | | | | | | | |
| 19 | SD Coefficient of Variation | | Std. Error of Mean 1134 Skewness 1.493 | | | | | | | |
| 20 | | | | | | | | | | |
| 21 22 | Shapiro Wilk Test Statistic | | GOF Test Shapiro Wilk GOF Test | | | | | | | |
| 23 24 | 1% Shapiro Wilk Critical Value | 0.781 | Data appear Normal at 1% Significance Level | | | | | | | |
| 25 | Lilliefors Test Statistic 1% Lilliefors Critical Value | | Lilliefors GOF Test Data appear Normal at 1% Significance Level | | | | | | | |
| 26 27 | | | :1% Significance Level | | | | | | | |
| 28 | A | ssumina Nori | nal Distribution | | | | | | | |
| 29 | 95% Normal UCL | | 95% UCLs (Adjusted for Skewness) | | | | | | | |
| 30 31 | 95% Student's-t UCL | 10884 | 95% Adjusted-CLT UCL (Chen-1995) 11242 95% Modified-t UCL (Johnson-1978) 10973 | | | | | | | |
| 32 | | | | | | | | | | |
| 34 | A-D Test Statistic | | GOF Test Anderson-Darling Gamma GOF Test | | | | | | | |
| 35 36 | 5% A-D Critical Value | 0.727 | Detected data appear Gamma Distributed at 5% Significance Level | | | | | | | |
| 37 | K-S Test Statistic 5% K-S Critical Value | | Kolmogorov-Smirnov Gamma GOF Test Detected data appear Gamma Distributed at 5% Significance Level | | | | | | | |
| 38 39 | Detected data appear Gamma Distributed at 5% Significance Level | | | | | | | | | |
| 40 | | Gamma | Statistics | | | | | | | |
| 41 42 | k hat (MLE | | k star (bias corrected MLE) 5.395 Theta star (bias corrected MLE) 1632 | | | | | | | |
| 43 | Theta hat (MLE nu hat (MLE | ′ | Theta star (bias corrected MLE) 1632 nu star (bias corrected) 107.9 | | | | | | | |
| 44 45 | MLE Mean (bias corrected) |) 8805 | MLE Sd (bias corrected) 3791 Approximate Chi Square Value (0.05) 84.93 | | | | | | | |
| 46 | Adjusted Level of Significance | 0.0267 | Approximate Chi Square Value (0.05) 64.95 Adjusted Chi Square Value 81.39 | | | | | | | |
| 47 48 | ٨ | seumina Gam | ma Distribution | | | | | | | |
| 49 | 95% Approximate Gamma UCL | | 95% Adjusted Gamma UCL 11673 | | | | | | | |
| 50 51 | | Lognorma | GOF Test | | | | | | | |
| 52 | Shapiro Wilk Test Statistic | 0.97 | Shapiro Wilk Lognormal GOF Test | | | | | | | |
| 53 54 | 10% Shapiro Wilk Critical Value Lilliefors Test Statistic | | Data appear Lognormal at 10% Significance Level Lilliefors Lognormal GOF Test | | | | | | | |
| 55 | 10% Lilliefors Critical Value | 0.241 | Data appear Lognormal at 10% Significance Level | | | | | | | |
| 56 57 | Data appear | r Lognormal a | at 10% Significance Level | | | | | | | |
| 58 | | | Statistics | | | | | | | |
| 59 60 | Minimum of Logged Data Maximum of Logged Data | | Mean of logged Data 9.016 SD of logged Data 0.382 | | | | | | | |
| 61 | | | | | | | | | | |
| 62 63 | | | mal Distribution 90% Chebyshev (MVUE) UCL 12012 | | | | | | | |
| 64 | 95% Chebyshev (MVUE) UCL | 13472 | 97.5% Chebyshev (MVUE) UCL 15498 | | | | | | | |
| 65 66 | 99% Chebyshev (MVUE) UCL | _ 19478 | | | | | | | | |
| 67 | | | tion Free UCL Statistics | | | | | | | |
| 68 69 | Data appe | ar to follow a | Discernible Distribution | | | | | | | |
| 70 | | | tribution Free UCLs | | | | | | | |
| 71 72 | 95% CLT UCL 95% Standard Bootstrap UCL | | 95% BCA Bootstrap UCL 11206 95% Bootstrap-t UCL 11658 | | | | | | | |
| 73 | 95% Hall's Bootstrap UCL | 20697 | 95% Percentile Bootstrap UCL 10662 | | | | | | | |
| 74 75 | 90% Chebyshev(Mean, Sd) UCL 97.5% Chebyshev(Mean, Sd) UCL | | 95% Chebyshev(Mean, Sd) UCL 13748 99% Chebyshev(Mean, Sd) UCL 20088 | | | | | | | |
| 76 | | | | | | | | | | |
| 77 78 | 95% Student's-t UCL | | UCL to Use | | | | | | | |
| 79 80 | | | avided to belie the yearth as lead to the work of the second of the seco | | | | | | | |
| 81 | | | ovided to help the user to select the most appropriate 95% UCL. ution, and skewness using results from simulation studies. | | | | | | | |
| 82 | | | ts; for additional insight the user may want to consult a statistician. | | | | | | | |

| | A B C D E | F | G H I J K | L |
|----------|---|----------------|---|----------------|
| 2 | UCL Statis | stics for Unc | ensored Full Data Sets | |
| 3 | User Selected Options | 4.04.40.004 | | |
| 4 5 | Date/Time of Computation ProUCL 5.2 10/28/2024 | 4:31:16 PM | | |
| 6 | Full Precision OFF | | | |
| 7 8 | Confidence Coefficient 95% Number of Bootstrap Operations 2000 | | | |
| 9 | Number of Bootstrap Operations 2000 | | | |
| 10 11 | LMM-TLA-0.5-3 | | | |
| 12 | LMM-1LA-0.5-3 | | | |
| 13 14 | T. IN 1 (0) | | Statistics | 4 |
| 15 | Total Number of Observations | 4 | Number of Distinct Observations Number of Missing Observations | 0 |
| 16 | Minimum | 10 | Mean | 11.5 |
| 17 18 | Maximum SD | 13 1.291 | Median Std. Error of Mean | 11.5 0.645 |
| 19 | Coefficient of Variation | | Skewness | 0.043 |
| 20 21 | Note: Comple size is small (a.g. <10) if data | ana aallaataa | l using incremental sampling methodology (ISM) approach, | |
| 22 | | | C 2020 and ITRC 2012) for additional guidance, | |
| 23 | but note that ITRC may recommend the | ne t-UCL or t | he Chebyshev UCL for small sample sizes (n < 7). | |
| 24 25 | | | in gross overestimates of the mean. e for a discussion of the Chebyshev UCL. | |
| 26 | 110101 10 110 1 10002 0.2 100 | | • | |
| 27 28 | Shapiro Wilk Test Statistic | | GOF Test Shapiro Wilk GOF Test | |
| 29 | 1% Shapiro Wilk Test Statistic | | Data appear Normal at 1% Significance Level | |
| 30 31 | Lilliefors Test Statistic | 0.151 | Lilliefors GOF Test | |
| 32 | 1% Lilliefors Critical Value Data appe | | Data appear Normal at 1% Significance Level 1 1% Significance Level | |
| 33 | | | eliable for small sample sizes | |
| 34 35 | Λο | suming Non | mal Distribution | |
| 36 | 95% Normal UCL | | 95% UCLs (Adjusted for Skewness) | |
| 37 38 | 95% Student's-t UCL | 13.02 | 95% Adjusted-CLT UCL (Chen-1995) 95% Modified-t UCL (Johnson-1978) | 12.56 13.02 |
| 39 | | | 35% Modified-t OCL (301118011-1978) | 13.02 |
| 40 41 | A.D.T. (0) (1) | | GOF Test | |
| 42 | A-D Test Statistic 5% A-D Critical Value | 0.202 0.657 | Anderson-Darling Gamma GOF Test Detected data appear Gamma Distributed at 5% Significance | e Level |
| 43 | K-S Test Statistic | 0.182 | Kolmogorov-Smirnov Gamma GOF Test | |
| 44 45 | 5% K-S Critical Value Detected data appear | | Detected data appear Gamma Distributed at 5% Significance stributed at 5% Significance Level | : Level |
| 46 | Note GOF tests | may be unre | eliable for small sample sizes | |
| 47 48 | | Gamma | Statistics | |
| 49 | k hat (MLE) | 105.1 | k star (bias corrected MLE) | 26.45 |
| 50 51 | Theta hat (MLE) | | Theta star (bias corrected MLE) | 0.435 |
| 52 | nu hat (MLE) MLE Mean (bias corrected) | | nu star (bias corrected) MLE Sd (bias corrected) | 211.6 2.236 |
| 53 | | | Approximate Chi Square Value (0.05) | 179 |
| 54 55 | Adjusted Level of Significance | N/A | Adjusted Chi Square Value | N/A |
| 56 | | | ma Distribution | |
| 57 58 | 95% Approximate Gamma UCL | 13.6 | 95% Adjusted Gamma UCL | N/A |
| 59 | | Lognorma | GOF Test | |
| 60 61 | Shapiro Wilk Test Statistic | 0.993 | Shapiro Wilk Lognormal GOF Test | |
| 62 | 10% Shapiro Wilk Critical Value Lilliefors Test Statistic | | Data appear Lognormal at 10% Significance Level Lilliefors Lognormal GOF Test | |
| 63 | 10% Lilliefors Critical Value | 0.346 | Data appear Lognormal at 10% Significance Level | |
| 64 65 | | | at 10% Significance Level Bliable for small sample sizes | |
| 66 | Note GOF lests | | | |
| 67 68 | Minimum of Lange 1 Date | | I Statistics | 2.420 |
| 69 | Minimum of Logged Data Maximum of Logged Data | | Mean of logged Data SD of logged Data | 2.438 0.113 |
| 70 71 | | • | | |
| 71 72 | Assu 95% H-UCL | | prmal Distribution 90% Chebyshev (MVUE) UCL | 13.45 |
| 73 | 95% Chebyshev (MVUE) UCL | 14.33 | 97.5% Chebyshev (MVUE) UCL | 15.55 |
| 74 75 | 99% Chebyshev (MVUE) UCL | 17.96 | | |
| 76 | Nonparame | etric Distribu | tion Free UCL Statistics | |
| 77 | | | Discernible Distribution | |
| 78 79 | Nonna | rametric Die | tribution Free UCLs | |
| 80 | 95% CLT UCL | 12.56 | 95% BCA Bootstrap UCL | N/A |
| 81 82 | 95% Standard Bootstrap UCL | 1 | 95% Bootstrap LICL | N/A |
| υZ | 95% Hall's Bootstrap UCL | N/A | 95% Percentile Bootstrap UCL | N/A |

| | Α | В | С | D | Е | F | G | Н | | J | K | L |
|----|--|--|----------------|----------------|---------------|--------------|------------------|----------------|-------------|--------------|-----------------|-------|
| 83 | | | 90% Ch | ebyshev(Me | an, Sd) UCL | 13.44 | | | 95% Ch | ebyshev(Me | an, Sd) UCL | 14.31 |
| 84 | 97.5% Chebyshev(Mean, Sd) UCL 15.53 99% Chebyshev(Mean, Sd) | | | | | | | an, Sd) UCL | 17.92 | | | |
| 85 | | | | | | | | | | | | |
| 86 | | Suggested UCL to Use | | | | | | | | | | |
| 87 | 95% Student's-t UCL 13.02 | | | | | | | | | | | |
| 88 | Recommended UCL exceeds the maximum observation | | | | | | | | | | | |
| 89 | | | | | | | | | | | | |
| 90 | | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. | | | | | | | | | | |
| 91 | Recommendations are based upon data size, data distribution, and skewness using results from simulation studies. | | | | | | | | | | | |
| 92 | Но | wever, simu | lations result | s will not cov | er all Real W | orld data se | ts; for addition | nal insight th | ne user may | want to cons | ult a statistic | an. |
| 93 | | | - | - | | - | | | | | | |

| User Selected Options ProJUCL 5.2 10282024 4.34:10 PM | 1 | A B C D E | F tics for Unc | G ensored Full D | H ata Sets | I | J | K | L | |
|--|---|---|-------------------|---------------------|----------------------------|-------------|-------------------|------------------|--------------|---------|
| Determine of Conductation | 2 | | 103 101 0110 | crisored i dii b | ata Octo | | | | | |
| From File Words Service Serv | | | 1.24.40 DM | | | | | | | |
| Full Precision OFF | | | 1:34:10 PM | | | | | | | |
| MM-TLA-0.5-4 | - | Full Precision OFF | | | | | | | | |
| MATILA-0.5-4 Cannel Statistics Total Number of Observations 10 | | | | | | | | | | |
| MM-TLA-0.5-4 | 9 | Number of Bootstrap Operations 2000 | | | | | | | | |
| Total Number of Observations 10 | 10 | | | | | | | | | |
| Total Number of Observations 10 | | LMM-TLA-0.5-4 | | | | | | | | |
| Minimum 461 | 13 | | General | Statistics | | | | | | |
| Minimum 451 | | Total Number of Observations | 10 | | | | | | | |
| Maximum 1213 | 16 | Minimum | 461 | | | Numbe | r ot iviissin | | | |
| Coefficient of Variation | 17 | Maximum | 1213 | | | | | Media | n 562.5 | |
| Shapiro Wilk Test Statistic Normal GOF Test | | | | | | | Std | | | |
| Shapiro Wilk Test Statistic 0.783 | 20 | Coefficient of Variation | 0.535 | | | | | Skewnes | 5 1.511 | |
| 1985 | 21 | | | GOF Test | | | | | | |
| Common | | | | | | | | | | |
| Data appear Normal at 1% Significance Level | 24 | Lilliefors Test Statistic | | | Data appea | | | | | |
| | | 1% Lilliefors Critical Value | | | | ar Normal a | at 1% Sign | ificance Level | | |
| Assuming Normal Distribution S7% UCLs (Adjusted for Skewness) 805 95% Normal UCL 838.9 95% Adjusted-CLT UCL (Liber-1995) 805.5 | 27 | Data appea | ar inormal a | 1 1% Significan | ce Level | | | | | |
| | 28 | | suming Nor | mal Distribution | n | | | | | |
| Seminary | | | 838 0 | | | | | | 5) 860 5 | |
| | 31 | 95 % Students-t UCL | UJU.3 | | | | | | | |
| A-D Test Statistic 0.775 | | | | 0057 | | | | | | |
| Syk A-D Critical Value 0.726 | | A_D Test Statistic | | GOF Test | Anders | on-Darling | Gamma (| GOF Test | | |
| 1973 1986 | 35 | | | Data | | | | | evel | |
| Detected data follow Appr. Gamma Distribution at 5% Significance Level | | | | Detected | | | | | | |
| Comma Comm | 38 | | | Distribution at | iata appear 5% Signific | cance Leve | istributea a I | at 5% Significa | ance Level | |
| A | 39 | | | | | | | | | |
| Theta hat (MLE) | | k hat /MI ⊏\ | | Statistics | | · ν | star (hias | corrected MI C | 6 063 | |
| A | 42 | | | | | | | | | |
| Adjusted Level of Significance 0.0267 | | | | | | | nu star (| bias corrected | 121.3 | |
| Adjusted Level of Significance 0.0267 | 45 | MLE Mean (bias corrected) | ხგვ.1 | | Δ | Approximate | | | | |
| Assuming Gamma Distribution S55.4 95% Adjusted Gamma UCL 890.3 | 46 | Adjusted Level of Significance | 0.0267 | | | | | | | |
| Second | | Λοο | umina Ca~ | nma Dietributio | n | | | | | |
| Lognormal GOF Test Shapiro Wilk Test Statistic 0.847 | 49 | | | a Distribution | ·· | 95 | % Adjuste | ed Gamma UC | L 890.3 | |
| Shapiro Wilk Test Statistic 0.847 Shapiro Wilk Lognormal QOF Test 10% Shapiro Wilk Critical Value 0.869 Data Not Lognormal at 10% Significance Level 10% Critical Value 0.236 Lilliefors Test Statistic 0.236 Lilliefors Lognormal dept 10% Significance Level 10% Lilliefors Test Statistic 0.241 Data appear Lognormal at 10% Significance Level 10% Lilliefors Critical Value 0.241 Data appear Lognormal at 10% Significance Level 10% Signific | | | l acres | LCOF Tart | | | | | | |
| 10% Shapiro Wilk Critical Value | 52 | Shaniro Wilk Test Statistic | | IGOF Test | Shani | iro Wilk Lo | normal G | OF Test | | |
| Data appear Approximate Data appear Lognormal at 10% Significance Level | 53 | 10% Shapiro Wilk Critical Value | 0.869 | [| Data Not Lo | ognormal a | t 10% Sigr | nificance Leve | | |
| Data appear Approximate Lognormal at 10% Significance Level | 54 55 | | | D. | | | | | vol | |
| | 56 | | | | | | at 10 /0 319 | grillicarice Lev | OI . | |
| Minimum of Logged Data 6.133 Mean of logged Data 6.467 | 57 | | | | | | | | | |
| Maximum of Logged Data 7.101 SD of logged Data 0.349 | | Minimum of Logged Data | | II STATISTICS | | | Mean | of logged Dat | a 6.467 | |
| Assuming Lognormal Distribution 90% Chebyshev (MVUE) UCL 907.3 | 60 | | | | | | | | | |
| Suggested UCL to Use Suggestions regarding the selection of a 95% Student's-t UCL 866.7 90% Chebyshev (MVUE) UCL 907.3 90% Chebyshev (MVUE) UCL 1010 97.5% Chebyshev (MVUE) UCL 1153 1153 99% Chebyshev (MVUE) UCL 1434 1153 | | Λοοιι | mina Loana | ormal Dietributi | on | | | | | |
| 64 95% Chebyshev (MVUE) UCL 1010 97.5% Chebyshev (MVUE) UCL 1153 65 99% Chebyshev (MVUE) UCL 1434 Inches (MVUE) UCL 1434 66 Komparametric Distribution Free UCL Statistics 68 Data appear to follow a Discernible Distribution 69 To Nonparametric Distribution Free UCLs 70 Nonparametric Distribution Free UCLs 71 95% BCA Bootstrap UCL 869 72 95% Standard Bootstrap UCL 815.6 95% Bootstrap-t UCL 1015 73 95% Hall's Bootstrap UCL 1046 95% Percentile Bootstrap UCL 82.6 74 90% Chebyshev(Mean, Sd) UCL 1046 95% Chebyshev(Mean, Sd) UCL 1054 75 97.5% Chebyshev(Mean, Sd) UCL 1214 99% Chebyshev(Mean, Sd) UCL 1529 76 30 30 30 30 30 30 30 <td rowspa<="" th=""><th>63</th><th></th><th></th><th>Jimai Distributi</th><th><u> </u></th><th>90%</th><th>Chebyshe</th><th>ev (MVUE) UC</th><th>L 907.3</th></td> | <th>63</th> <th></th> <th></th> <th>Jimai Distributi</th> <th><u> </u></th> <th>90%</th> <th>Chebyshe</th> <th>ev (MVUE) UC</th> <th>L 907.3</th> | 63 | | | Jimai Distributi | <u> </u> | 90% | Chebyshe | ev (MVUE) UC | L 907.3 |
| Nonparametric Distribution Free UCL Statistics | 64 65 | 95% Chebyshev (MVUE) UCL | | | | | | | | |
| Nonparametric Distribution Free UCL Statistics Data appear to follow a Discernible Distribution Nonparametric Distribution Nonparametric Distribution Free UCLs Nonparametric Distribution Free UCLs Standard Bootstrap UCL 822.9 95% BCA Bootstrap UCL 1015 Standard Bootstrap UCL 815.6 95% Bootstrap-t UCL 1015 Standard Bootstrap UCL 1046 95% Percentile Bootstrap UCL 822.6 Standard Bootstrap UCL 1046 95% Percentile Bootstrap UCL 822.6 Standard Bootstrap UCL 1046 95% Percentile Bootstrap UCL 822.6 Standard Bootstrap UCL 1015 Stan | | 99% Chebyshev (MVUE) UCL | 1434 | | | | | | | |
| Nonparametric Distribution Free UCLs | 67 | | | | | | | | | |
| Nonparametric Distribution Free UCLs | | Data appear | r to follow a | Discernible Di | stribution | | | | | |
| 71 95% CLT UCL 822.9 95% BCA Bootstrap UCL 869 72 95% Standard Bootstrap UCL 815.6 95% Bootstrap-t UCL 1015 73 95% Hall's Bootstrap UCL 1046 95% Percentile Bootstrap UCL 822.6 74 90% Chebyshev(Mean, Sd) UCL 938.1 95% Chebyshev(Mean, Sd) UCL 1054 75 97.5% Chebyshev(Mean, Sd) UCL 1214 99% Chebyshev(Mean, Sd) UCL 1529 77 Suggested UCL to Use 78 95% Student's-t UCL 838.9 Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. 80 Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. 81 Recommendations are based upon data size, data distribution, and skewness using results from simulation studies. | 70 | Nonpar | ametric Dis | tribution Free U | JCLs | | | | | |
| 73 95% Hall's Bootstrap UCL 1046 95% Percentile Bootstrap UCL 822.6 74 90% Chebyshev(Mean, Sd) UCL 938.1 95% Chebyshev(Mean, Sd) UCL 1054 75 97.5% Chebyshev(Mean, Sd) UCL 1214 99% Chebyshev(Mean, Sd) UCL 1529 76 77 Suggested UCL to Use 78 95% Student's-t UCL 838.9 79 80 Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. 81 Recommendations are based upon data size, data distribution, and skewness using results from simulation studies. | 71 72 | 95% CLT UCL | 822.9 | | | | | | | |
| 90% Chebyshev(Mean, Sd) UCL 938.1 95% Chebyshev(Mean, Sd) UCL 1054 97.5% Chebyshev(Mean, Sd) UCL 1214 99% Chebyshev(Mean, Sd) UCL 1529 980 Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. 81 Recommendations are based upon data size, data distribution, and skewness using results from simulation studies. | | | | | | 95% | | | | |
| Suggested UCL to Use | 74 | 90% Chebyshev(Mean, Sd) UCL | 938.1 | | | 95% CI | nebyshev(| Mean, Sd) UC | L 1054 | |
| Suggested UCL to Use | 75 76 | 97.5% Chebyshev(Mean, Sd) UCL | 1214 | | | 99% CI | nebyshev(| Mean, Sd) UC | L 1529 | |
| 95% Student's-t UCL 838.9 Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. Recommendations are based upon data size, data distribution, and skewness using results from simulation studies. | 77 | | Sugaested | UCL to Use | | | | | | |
| Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. Recommendations are based upon data size, data distribution, and skewness using results from simulation studies. | 78 | | | | | | | | | |
| Recommendations are based upon data size, data distribution, and skewness using results from simulation studies. | | Note: Suggestions regarding the selection of a 0E9/ | IICI aro nr | ovided to bole + | the user to | select than | noet annro | nriate 05% III | <u> </u> | |
| | 81 | | | | | | | | /L. | |
| | 82 | | | | | | | | cian. | |

| 4 | A B C D E | F | G H I J K | L |
|----------|---|--------------------|---|----------------|
| 2 | | stics for Unc | ensored Full Data Sets | |
| 3 | User Selected Options Date/Time of Computation ProUCL 5.2 10/28/2024 4 | 4.00.14 DM | | |
| 5 | From File WorkSheet.xls | 4.00.14 FIVI | | |
| 6 7 | Full Precision OFF | | | |
| 8 | Confidence Coefficient 95% Number of Bootstrap Operations 2000 | | | |
| 9 | | | | |
| 10 11 | LMM-WRA-0.5-1 | | | |
| 12 | LIVINI-VVI (A-0.3-1 | | | |
| 13 14 | Total Number of Observations | General 10 | Statistics Number of Distinct Observations | 10 |
| 15 | Total Number of Observations | 10 | Number of Missing Observations | 0 |
| 16 17 | Minimum | 95 | Mean | 238.8 |
| 18 | Maximum SD | | Median Std. Error of Mean | 244 27.8 |
| 19 | Coefficient of Variation | 0.368 | Skewness | 0.591 |
| 20 21 | | Normal (| GOF Test | |
| 22 | Shapiro Wilk Test Statistic | 0.947 | Shapiro Wilk GOF Test | |
| 23 24 | 1% Shapiro Wilk Critical Value Lilliefors Test Statistic | 0.781 0.208 | Data appear Normal at 1% Significance Level Lilliefors GOF Test | |
| 25 | 1% Lilliefors Critical Value | | Data appear Normal at 1% Significance Level | |
| 26 27 | | | 1% Significance Level | |
| 28 | Ας | sumina Nor | mal Distribution | |
| 29 | 95% Normal UCL | | 95% UCLs (Adjusted for Skewness) | |
| 30 31 | 95% Student's-t UCL | 289.8 | 95% Adjusted-CLT UCL (Chen-1995) 95% Modified-t UCL (Johnson-1978) | 290.1 290.6 |
| 32 | | | | 230.0 |
| 33 34 | A D T O | | GOF Test | |
| 35 | A-D Test Statistic 5% A-D Critical Value | 0.304 0.727 | Anderson-Darling Gamma GOF Test Detected data appear Gamma Distributed at 5% Significance | e Level |
| 36 | K-S Test Statistic | 0.173 | Kolmogorov-Smirnov Gamma GOF Test | |
| 37 38 | 5% K-S Critical Value | | Detected data appear Gamma Distributed at 5% Significanc stributed at 5% Significance Level | e Level |
| 39 | Detected data appear | Gamma Di | Surbated at 0.70 Organicalities Level | |
| 40 41 | L bot /AMI ES | Gamma 7.698 | Statistics | 5.455 |
| 42 | k hat (MLE) Theta hat (MLE) | | k star (bias corrected MLE) Theta star (bias corrected MLE) | 43.77 |
| 43 | nu hat (MLE) | _ | nu star (bias corrected) | 109.1 |
| 44 45 | MLE Mean (bias corrected) | 238.8 | MLE Sd (bias corrected) Approximate Chi Square Value (0.05) | 102.2 86 |
| 46 | Adjusted Level of Significance | 0.0267 | Adjusted Chi Square Value | 82.44 |
| 47 48 | Δει | suming Gam | nma Distribution | |
| 49 | 95% Approximate Gamma UCL | | 95% Adjusted Gamma UCL | 316.1 |
| 50 51 | | Lognormo | LCOE Took | |
| 52 | Shapiro Wilk Test Statistic | | GOF Test Shapiro Wilk Lognormal GOF Test | |
| 53 | 10% Shapiro Wilk Critical Value | 0.869 | Data appear Lognormal at 10% Significance Level | |
| 54 55 | Lilliefors Test Statistic 10% Lilliefors Critical Value | 0.177 0.241 | Lilliefors Lognormal GOF Test Data appear Lognormal at 10% Significance Level | |
| 56 | | | at 10% Significance Level | |
| 57 58 | | Lognorma | I Statistics | |
| 59 | Minimum of Logged Data | 4.554 | Mean of logged Data | 5.409 |
| 60 61 | Maximum of Logged Data | 6.047 | SD of logged Data | 0.4 |
| 62 | Assı | uming Loand | ormal Distribution | |
| 63 | 95% H-UCL | 319.7 | 90% Chebyshev (MVUE) UCL | 332.1 |
| 64 65 | 95% Chebyshev (MVUE) UCL 99% Chebyshev (MVUE) UCL | 373.8 545.5 | 97.5% Chebyshev (MVUE) UCL | 431.7 |
| 66 | | | | |
| 67 68 | | | tion Free UCL Statistics Discernible Distribution | |
| 69 | | | | |
| 70 71 | Nonpar 95% CLT UCL | | tribution Free UCLs 95% BCA Bootstrap UCL | 284.4 |
| 72 | 95% Standard Bootstrap UCL | 284.5 281.4 | 95% BCA Bootstrap UCL 95% Bootstrap-t UCL | 293 |
| 73 74 | 95% Hall's Bootstrap UCL | 305.7 | 95% Percentile Bootstrap UCL | 281.9 |
| 74 75 | 90% Chebyshev(Mean, Sd) UCL 97.5% Chebyshev(Mean, Sd) UCL | 322.2 412.4 | 95% Chebyshev(Mean, Sd) UCL 99% Chebyshev(Mean, Sd) UCL | 360 515.4 |
| 76 | 57.575 Chebyonovimoun, our out | | | 3.0.1 |
| 77 78 | 95% Student's-t UCL | | UCL to Use | |
| 79 | | 1 | | |
| 80 81 | | | ovided to help the user to select the most appropriate 95% UCL. | |
| 81 82 | | | ution, and skewness using results from simulation studies. ts; for additional insight the user may want to consult a statisticia | n. |
| | Tiomoroi, cimalationo rocalto Will flot cover all Medi W | ona aata 30 | additional moight and door may want to conduit a statisticia | |

| -1 | Α | В | С | D | E LIOL Otatia | F | G | H | I | J | K | L |
|----------|---------|---------------------------|---------------|--------------------------------|--------------------------------|-----------------------------|--|---------------|--------------------------|-----------------------------|---------------------------------|----------------|
| 2 | | | | | UCL Statis | tics for Unc | ensored Full D | vata Sets | | | | |
| 3 | Da | User Sele te/Time of C | cted Options | ProUCL 5.2 | 10/28/2024 | 1·11·12 DM | | | | | | |
| 5 | Da | | From File | WorkSheet.x | | +. . Z F VI | | | | | | |
| 6 7 | | Fu Confidence | Il Precision | OFF 95% | | | | | | | | |
| 8 | Number | of Bootstrap | | 2000 | | | | | | | | |
| 9 10 | | | | | | | | | | | | |
| 11 | LMM-WRA | -0.5-2 | | | | | | | | | | |
| 12 13 | | | | | | General | Statistics | | | | | |
| 14 | | | Total | Number of O | bservations | 10 | | | | | Observations | 10 |
| 15 16 | | | | | Minimum | 209 | | | Numbe | r of Missing | Observations Mean | 0 320.5 |
| 17 | | | | | Maximum | 531 | | | | | Median | 308.5 |
| 18 19 | | | | Coefficient | SD of Variation | 103.2 0.322 | | | | Std. | Error of Mean Skewness | 32.63 1.09 |
| 20 | | | | | 0. 70 | | | | | | | |
| 21 22 | | | S | Shapiro Wilk T | est Statistic | Normal 0 0.886 | GOF Test | | Shapiro W | ilk GOF Tes | st | |
| 23 | | | | hapiro Wilk C | ritical Value | 0.781 | | | r Normal a | at 1% Signific | cance Level | |
| 24 25 | | | 1 | % Lilliefors C | est Statistic ritical Value | 0.263 0.304 | | Data appea | | GOF Test at 1% Signific | cance Level | |
| 26 | | | | | | | 1% Significan | | | | 20101 | |
| 27 28 | | | | | Ass | sumina Norr | mal Distribution | | | | | |
| 29 | | | 95% No | ormal UCL | | | | 95% U | | usted for Sk | | 200.0 |
| 30 31 | | | | 95% Stud | dent's-t UCL | 380.3 | | 95 | 5% Adjuste 95% Modifi | ea-CLT UCL ed-t UCL (Ja | (Chen-1995) ohnson-1978) | 386.2 382.2 |
| 32 | | | | | | 0 | 005 7: | | | (50 | | |
| 34 | | | | A-D T | est Statistic | 0.374 | GOF Test | Anderse | on-Darling | Gamma G | OF Test | |
| 35 36 | | | | 5% A-D C | ritical Value | 0.725 | Detected of | data appear | Gamma D | istributed at | 5% Significan | ce Level |
| 37 | | | | | est Statistic ritical Value | 0.222 0.267 | Detected of | | | ov Gamma (istributed at | GOF Test :5% Significan | ce Level |
| 38 39 | | | | Detected | data appear | Gamma Di | stributed at 5% | | | | • | |
| 40 | | | | | | Gamma | Statistics | | | | | |
| 41 42 | | | | | k hat (MLE) | 11.88 | | | | | orrected MLE) | 8.381 |
| 43 | | | | | a hat (MLE) u hat (MLE) | 26.98 237.6 | nu star (bias correc | | | | | 38.24 167.6 |
| 44 45 | | | MI | LE Mean (bias | s corrected) | 320.5 | MLE Sd (bias corre Approximate Chi Square Value (| | | | | 110.7 138.7 |
| 46 | | | Adjus | sted Level of S | Significance | 0.0267 | | A | рргохіпіац А | djusted Chi | Square Value | 134.1 |
| 47 48 | | | | | ۸۵ | numing Gam | ıma Distributio | <u> </u> | | | | |
| 49 | | | 95% A | pproximate G | | | | <u>'''</u> | 95 | 5% Adjusted | Gamma UCL | 400.6 |
| 50 51 | | | | | | Lognorma | I GOF Test | | | | | |
| 52 | | | | Shapiro Wilk T | | 0.936 | | | | gnormal GO | | |
| 53 54 | | | 10% S | hapiro Wilk C | ritical Value est Statistic | 0.869 0.206 | Da | | | at 10% Sigr ormal GOF | nificance Level | |
| 55 | | | 10 | % Lilliefors C | ritical Value | 0.241 | | ata appear L | | | nificance Level | |
| 56 57 | | | | | Data appear | Lognormal a | at 10% Signific | ance Level | | | | |
| 58 | | | | NAIi Ci | | | I Statistics | | | | 41 15 . 1 | F 707 |
| 59 60 | | | | Minimum of L Maximum of L | | 5.342 6.275 | | | | | of logged Data of logged Data | 5.727 0.302 |
| 61 62 | | | • | | | | man District | | | | | |
| 63 | | | | | Assu 95% H-UCL | <u>ıming Logno</u> 392.5 | rmal Distributi | ION | 90% | Chebyshev | (MVUE) UCL | 412.4 |
| 64 65 | | | | Chebyshev (N | MVUE) UCL | 454.3 | | | | | (MVUE) UCL | 512.4 |
| 66 | | | 99% | Chebyshev (N | vivue) UCL | 626.6 | | | | | | |
| 67 68 | | | | | | | tion Free UCL | | | | | |
| 69 | | | | | uata appea | r to tollow a | Discernible Di | ISTRIDUTION | | | | |
| 70 71 | | | | 05 | | | tribution Free l | UCLs | | 050/ DOA D | Poototro = 1101 | 202.0 |
| 72 | | | 95% | Standard Boo | % CLT UCL otstrap UCL | 374.2 | | | | | Bootstrap UCL ootstrap-t UCL | 383.9 414 |
| 73 74 | | | 9 | 95% Hall's Boo nebyshev(Mea | otstrap UCL | 734.8 | | | | Percentile B | Bootstrap UCL | 377.3 462.7 |
| 75 | | | | nebysnev(Mea nebyshev(Mea | | | | | | | 462.7 645.2 | |
| 76 77 | | | | | | Suggested UCL to Use | | | | | | |
| 78 | | | | 95% Stuc | dent's-t UCL | | UCL IO USE | | | | | |
| 79 80 | | Note: Sugge | etions regard | ling the select | tion of a OEº/ | IICI ara nr | ovided to help t | the user to a | elect the | noet approx | riate 05% LICI | |
| 81 | | Recor | nmendations | are based up | on data size, | data distrib | ution, and skew | wness using | results fro | m simulation | n studies. | |
| 82 | Но | | | | | | ts; for additiona | | | | | an. |

| | A B C D E | F | G H I J K | L | | | | | | | |
|----------|---|--------------------|---|----------------|--|--|--|--|--|--|--|
| 2 | | tics for Unc | ensored Full Data Sets | | | | | | | | |
| 3 | User Selected Options Date/Time of Computation ProUCL 5.2 10/28/2024 4 | 1.12.00 DM | | | | | | | | | |
| 5 | From File WorkSheet.xls | 1. 13.06 PIVI | | | | | | | | | |
| 6 7 | Full Precision OFF | | | | | | | | | | |
| 8 | Confidence Coefficient 95% Number of Bootstrap Operations 2000 | | | | | | | | | | |
| 9 | 110000000000000000000000000000000000000 | | | | | | | | | | |
| 10 11 | LMM-WRA-0.5-3 | | | - | | | | | | | |
| 12 | ENW 111 0.0 0 | | | | | | | | | | |
| 13 14 | Total Number of Observations | General 10 | Statistics Number of Distinct Observations | 10 | | | | | | | |
| 15 | Total Number of Observations | 10 | Number of Missing Observations | 0 | | | | | | | |
| 16 17 | Minimum | 38 | Mean | 74.6 | | | | | | | |
| 18 | Maximum SD | 134 31.94 | Median Std. Error of Mean | 66 10.1 | | | | | | | |
| 19 | Coefficient of Variation | 0.428 | Skewness | 0.654 | | | | | | | |
| 20 21 | | Normal (| GOF Test | | | | | | | | |
| 22 | Shapiro Wilk Test Statistic | 0.912 | Shapiro Wilk GOF Test | | | | | | | | |
| 23 24 | 1% Shapiro Wilk Critical Value Lilliefors Test Statistic | 0.781 0.189 | Data appear Normal at 1% Significance Level Lilliefors GOF Test | | | | | | | | |
| 25 | 1% Lilliefors Critical Value | 0.169 | Data appear Normal at 1% Significance Level | | | | | | | | |
| 26 27 | | ar Normal at | 1% Significance Level | | | | | | | | |
| 28 | Assuming Normal Distribution | | | | | | | | | | |
| 29 | 95% Normal UCL | | 95% UCLs (Adjusted for Skewness) | | | | | | | | |
| 30 31 | 95% Student's-t UCL | 93.12 | 95% Adjusted-CLT UCL (Chen-1995) 95% Modified-t UCL (Johnson-1978) | 93.45 93.46 | | | | | | | |
| 32 | | | 95% Modified-t OCL (30111S011-1978) | 93.40 | | | | | | | |
| 33 34 | A D T+ 04-8-8-1 | | GOF Test | | | | | | | | |
| 35 | A-D Test Statistic 5% A-D Critical Value | 0.38 0.728 | Anderson-Darling Gamma GOF Test Detected data appear Gamma Distributed at 5% Significance | e Level | | | | | | | |
| 36 | K-S Test Statistic | 0.202 | Kolmogorov-Smirnov Gamma GOF Test | | | | | | | | |
| 37 38 | 5% K-S Critical Value | 0.267 Gamma Die | Detected data appear Gamma Distributed at 5% Significance | e Level | | | | | | | |
| 39 | Detected data appear Gamma Distributed at 5% Significance Level | | | | | | | | | | |
| 40 41 | Librat (MILE) | | Statistics | 4 471 | | | | | | | |
| 42 | k hat (MLE) Theta hat (MLE) | 6.292 11.86 | k star (bias corrected MLE) Theta star (bias corrected MLE) | 4.471 16.69 | | | | | | | |
| 43 | nu hat (MLE) | 125.8 | nu star (bias corrected) | 89.42 | | | | | | | |
| 44 45 | MLE Mean (bias corrected) | 74.6 | MLE Sd (bias corrected) Approximate Chi Square Value (0.05) | 35.28 68.62 | | | | | | | |
| 46 | Adjusted Level of Significance | 0.0267 | Adjusted Chi Square Value | 65.46 | | | | | | | |
| 47 48 | Λοι | umina Com | nma Distribution | | | | | | | | |
| 49 | 95% Approximate Gamma UCL | 97.22 | 95% Adjusted Gamma UCL | 101.9 | | | | | | | |
| 50 51 | | | LOOF T | | | | | | | | |
| 52 | Shapiro Wilk Test Statistic | 0.939 | GOF Test Shapiro Wilk Lognormal GOF Test | | | | | | | | |
| 53 | 10% Shapiro Wilk Critical Value | 0.869 | Data appear Lognormal at 10% Significance Level | | | | | | | | |
| 54 55 | Lilliefors Test Statistic 10% Lilliefors Critical Value | 0.187 0.241 | Lilliefors Lognormal GOF Test Data appear Lognormal at 10% Significance Level | | | | | | | | |
| 56 | | | at 10% Significance Level | | | | | | | | |
| 57 58 | | Lognorma | I Statistics | - | | | | | | | |
| 59 | Minimum of Logged Data | 3.638 | Mean of logged Data | 4.231 | | | | | | | |
| 60 61 | Maximum of Logged Data | 4.898 | SD of logged Data | 0.425 | | | | | | | |
| 62 | Assı | ımina Loana | ormal Distribution | | | | | | | | |
| 63 | 95% H-UCL | 101.7 | 90% Chebyshev (MVUE) UCL | 105 | | | | | | | |
| 64 65 | 95% Chebyshev (MVUE) UCL 99% Chebyshev (MVUE) UCL | 118.8 175.7 | 97.5% Chebyshev (MVUE) UCL | 138 | | | | | | | |
| 66 | 33 /0 Chebyshev (INIVOE) UCL | 173.7 | | | | | | | | | |
| 67 68 | | | tion Free UCL Statistics | | | | | | | | |
| 69 | | i to follow a | Discernible Distribution | | | | | | | | |
| 70 71 | | | tribution Free UCLs | 00.0 | | | | | | | |
| 71 72 | 95% CLT UCL 95% Standard Bootstrap UCL | 91.21 90.24 | 95% BCA Bootstrap UCL 95% Bootstrap-t UCL | 92.2 96.52 | | | | | | | |
| 73 | 95% Hall's Bootstrap UCL | 92.02 | 95% Percentile Bootstrap UCL | 90.5 | | | | | | | |
| 74 75 | 90% Chebyshev(Mean, Sd) UCL 97.5% Chebyshev(Mean, Sd) UCL | 104.9 137.7 | 95% Chebyshev(Mean, Sd) UCL 99% Chebyshev(Mean, Sd) UCL | 118.6 175.1 | | | | | | | |
| 76 | | | | 175.1 | | | | | | | |
| 77 78 | | | UCL to Use | | | | | | | | |
| 79 | 95% Student's-t UCL | 93.12 | | | | | | | | | |
| 80 | | | ovided to help the user to select the most appropriate 95% UCL. | | | | | | | | |
| 81 82 | | | ution, and skewness using results from simulation studies. ts; for additional insight the user may want to consult a statisticia | | | | | | | | |
| υŁ | nowever, simulations results will not cover all Real W | onu data se | is, for additional insignt the user may want to consult a statisticia | 11. | | | | | | | |

| | A B C D E | F | G H I J K | L | | | | | | | | |
|----------------|--|-----------------|---|-----------------|--|--|--|--|--|--|--|--|
| 2 | UCL Stati | stics for Unc | ensored Full Data Sets | | | | | | | | | |
| 3 | User Selected Options | | | | | | | | | | | |
| 4 5 | Date/Time of Computation ProUCL 5.2 10/28/2024 From File WorkSheet.xls | 4:15:12 PM | | | | | | | | | | |
| 6 | Full Precision OFF | | | | | | | | | | | |
| 7 8 | Confidence Coefficient 95% | | | | | | | | | | | |
| 9 | Number of Bootstrap Operations 2000 | | | | | | | | | | | |
| 10 | | | | | | | | | | | | |
| 11 12 | LMM-WRA-0.5-3-DS | | | | | | | | | | | |
| 13 | | General | Statistics | | | | | | | | | |
| 14 15 | Total Number of Observations | 4 | Number of Distinct Observations Number of Missing Observations | 0 | | | | | | | | |
| 16 | Minimum | 16 | Mean | 38.75 | | | | | | | | |
| 17 18 | Maximum | | Median | 44.5 | | | | | | | | |
| 19 | SD Coefficient of Variation | | Std. Error of Mean Skewness | 7.761 -1.739 | | | | | | | | |
| 20 | | | | | | | | | | | | |
| 21 | | | using incremental sampling methodology (ISM) approach, C 2020 and ITRC 2012) for additional guidance, | | | | | | | | | |
| 23 | | | he Chebyshev UCL for small sample sizes (n < 7). | | | | | | | | | |
| 24 25 | The Chebyshev UCL of | often results i | n gross overestimates of the mean. | | | | | | | | | |
| 26 | Refer to the ProUCL 5.2 Tec | unnical Guide | e for a discussion of the Chebyshev UCL. | | | | | | | | | |
| 27 | | Normal C | | | | | | | | | | |
| 28 29 | Shapiro Wilk Test Statistic 1% Shapiro Wilk Critical Value | | Shapiro Wilk GOF Test Data appear Normal at 1% Significance Level | | | | | | | | | |
| 30 | Lilliefors Test Statistic | | Lilliefors GOF Test | | | | | | | | | |
| 31 32 | 1% Lilliefors Critical Value | 0.413 | Data appear Normal at 1% Significance Level | | | | | | | | | |
| 33 | | | 1% Significance Level liable for small sample sizes | | | | | | | | | |
| 34 | The state of the s | | | | | | | | | | | |
| 35 36 | Assuming Normal Distribution 95% Normal UCL 95% UCLs (Adjusted for Skewness) | | | | | | | | | | | |
| 37 | 95% Normai UCL 95% Student's-t UCL | 57.01 | 95% UCLS (Adjusted for Skewness) 95% Adjusted-CLT UCL (Chen-1995) | 44.3 | | | | | | | | |
| 38 | | | 95% Modified-t UCL (Johnson-1978) | 55.89 | | | | | | | | |
| 39 40 | | Gamma (| GOF Test | | | | | | | | | |
| 41 | A-D Test Statistic | 0.64 | Anderson-Darling Gamma GOF Test | | | | | | | | | |
| 42 43 | 5% A-D Critical Value | | Detected data appear Gamma Distributed at 5% Significance | Level | | | | | | | | |
| 44 | K-S Test Statistic 5% K-S Critical Value | | Kolmogorov-Smirnov Gamma GOF Test Detected data appear Gamma Distributed at 5% Significance | Level | | | | | | | | |
| 45 46 | Detected data appea | r Gamma Dis | stributed at 5% Significance Level | | | | | | | | | |
| 46 47 | Note GOF tests | may be unre | liable for small sample sizes | | | | | | | | | |
| 48 | | Gamma | | | | | | | | | | |
| 49 50 | k hat (MLE) Theta hat (MLE) | | k star (bias corrected MLE) Theta star (bias corrected MLE) | 1.611 24.05 | | | | | | | | |
| 51 | nu hat (MLE) | 46.22 | nu star (bias corrected MLE) | 12.89 | | | | | | | | |
| 52 53 | MLE Mean (bias corrected) | | MLE Sd (bias corrected) | 30.53 | | | | | | | | |
| 54 | Adjusted Level of Significance | N/A | Approximate Chi Square Value (0.05) Adjusted Chi Square Value | 5.818 N/A | | | | | | | | |
| 55 | | | | | | | | | | | | |
| 56 57 | As 95% Approximate Gamma UCL | | ma Distribution 95% Adjusted Gamma UCL | N/A | | | | | | | | |
| 58 | ээ ло Арргохинате Ganiilla OCL | | | 111/7 | | | | | | | | |
| 59 60 | Observed MEH. To at On the | | GOF Test | | | | | | | | | |
| 61 | Shapiro Wilk Test Statistic 10% Shapiro Wilk Critical Value | | Shapiro Wilk Lognormal GOF Test Data Not Lognormal at 10% Significance Level | | | | | | | | | |
| 62 | Lilliefors Test Statistic | 0.374 | Lilliefors Lognormal GOF Test | | | | | | | | | |
| 63 64 | 10% Lilliefors Critical Value | 0.346 | Data Not Lognormal at 10% Significance Level 10% Significance Level | | | | | | | | | |
| 65 | Data Not L | | | | | | | | | | | |
| 66 67 | Materians (1) | Lognorma | | 2 500 | | | | | | | | |
| 68 | Minimum of Logged Data Maximum of Logged Data | 2.773 3.912 | Mean of logged Data SD of logged Data | 3.568 0.535 | | | | | | | | |
| 69 | | | | | | | | | | | | |
| 70 71 | | | rmal Distribution 90% Chebyshev (MVUE) UCL | 70.33 | | | | | | | | |
| 72 | 95% Chebyshev (MVUE) UCL | | | 103.8 | | | | | | | | |
| 73 | 99% Chebyshev (MVUE) UCL | | ,, | | | | | | | | | |
| 74 75 | Nonnaram | etric Distribut | tion Free UCL Statistics | —— | | | | | | | | |
| 76 | | | Discernible Distribution | | | | | | | | | |
| 77 | M | rometric Dist | with ution Eron IICLs | | | | | | | | | |
| | Nonna | | ribution Free UCLs | | | | | | | | | |
| 78 79 | | . 51.52 | 95% BCA Bootstrap UCL | N/A | | | | | | | | |
| 78 79 80 | 95% CLT UCL 95% Standard Bootstrap UCL | . N/A | 95% BCA Bootstrap UCL 95% Bootstrap-t UCL | N/A | | | | | | | | |
| 78 79 | 95% CLT UCL | . N/A . N/A | | | | | | | | | | |

| | Α | В | С | D | Е | F | G | Н | | J | K | L | |
|----|----------------------|--|----------------|----------------|---------------|----------------|------------------|----------------|----------------|--------------|-----------------|------|--|
| 83 | | | 97.5% Ch | ebyshev(Mea | an, Sd) UCL | 87.22 | | | 99% Ch | ebyshev(Me | an, Sd) UCL | 116 | |
| 84 | | | | | | | - | | | | | | |
| 85 | Suggested UCL to Use | | | | | | | | | | | | |
| 86 | | 95% Student's-t UCL 57.01 | | | | | | | | | | | |
| 87 | | Recommended UCL exceeds the maximum observation | | | | | | | | | | | |
| 88 | | | | | | | | | | | | | |
| 89 | | Note: Sugge | stions regard | ing the selec | tion of a 95% | 6 UCL are pr | ovided to hel | p the user to | select the m | ost appropri | ate 95% UCL | | |
| 90 | | Recom | mendations | are based up | on data size | , data distrib | ution, and sk | ewness usin | g results fror | n simulation | studies. | | |
| 91 | Ho | wever, simu | lations result | s will not cov | er all Real V | orld data se | ts; for addition | nal insight th | ne user may | want to cons | ult a statistic | ian. | |
| 92 | | | | | | | | | | | | | |
| 93 | | Note: For | highly negat | ively-skewed | d data, confi | dence limits | (e.g., Chen, | Johnson, Lo | ognormal, ar | nd Gamma) ı | may not be | | |
| 94 | | reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets. | | | | | | | | | | | |
| 95 | | | | | | | | | | | | | |

| 1 | Α | В | С | D | E | F | G | Н | ı | J | K | L | |
|----------|-----------|---------------------------|------------------------|------------------------------|-------------------------|--|---|---------------|----------------|---------------------------|---|----------------|--|
| 2 | | | | | UCL Statis | Stics for Unc | ensored Full D | Jata Sets | | | | | |
| 3 | Da | User Sele te/Time of C | ected Options | ProUCL 5.2 1 | 0/28/2024 / | 1.21.EQ DM | | | | | | | |
| 5 | Da | | From File | WorkSheet.xl | | 4.21.JO F W | | | | | | | |
| 6 7 | | Fu Confidence | Ill Precision | OFF 95% | | | | | | | | | |
| 8 | | of Bootstrap | | 2000 | | | | | | | | | |
| 9 10 | | | | | | | | | | | | | |
| 11 | LMM-WRA- | -0.5-4 | | | | | | | | | | | |
| 12 13 | | | | | | General | Statistics | | | | | | |
| 14 | | | Total | Number of Ob | servations | 10 | Otatiotics | | | | t Observations | 10 | |
| 15 16 | | | | | Minimum | 697 | | | Numbe | er of Missing | Observations Mean | 0 1594 | |
| 17 | | | | | Maximum | 2991 | | | | | Median | 1449 | |
| 18 19 | | | | Coefficient of | SD of Variation | 764.4 0.48 | | | | Std. | Error of Mean Skewness | 241.7 0.537 | |
| 20 | | | | Coemicient | n variation | | <u> </u> | | | | Skewiless | 0.557 | |
| 21 | | | 9 | Shapiro Wilk Te | et Statistic | Normal 0 0.929 | GOF Test | | Shaniro W | /ilk GOF Te | et | | |
| 23 | | | | hapiro Wilk Cri | tical Value | 0.781 | | | | | icance Level | | |
| 24 25 | | | 1 | Lilliefors Te | | 0.173 0.304 | | Data anna | | GOF Test | | | |
| 26 | | | I | % Lilliefors Cri | | | ⊥ t 1% Significar | | ai ivuiillal i | at 1 /0 OlyIlli | icance Level | | |
| 27 28 | | | | | ۸۵۰ | eumina Non | mal Distributio | n - | | | | | |
| 29 | | | 95% No | ormal UCL | | | וומו ווופוע ומוו | 95% | | usted for SI | | | |
| 30 31 | | | | 95% Stude | ent's-t UCL | 2037 | | (| 95% Adjust | ed-CLT UC | L (Chen-1995) Johnson-1978) | 2035 | |
| 32 | | | | | | | | | JJ /0 IVIOUIT | i c u-l UCL (c | , OI II I I I I I I I I I I I I I I I I | 2044 | |
| 33 34 | | | | 4 D To | st Statistic | Gamma 0.339 | GOF Test | Andor | oon Dorling | g Gamma G | OF Toot | | |
| 35 | | | | 5% A-D Cri | | 0.339 | Detected | | | | t 5% Significan | ce Level | |
| 36 37 | | | | K-S Te 5% K-S Cri | st Statistic | 0.175 0.268 | Detected | | | ov Gamma | | an Lovel | |
| 38 | | | | | | | stributed at 59 | | | distributed a | t 5% Significan | ce Level | |
| 39 40 | | | | | | Commo | Ctatiation | | | | | | |
| 41 | | | | k | hat (MLE) | 4.676 | Statistics | | k | star (bias c | orrected MLE) | 3.34 | |
| 42 43 | | | | Theta | hat (MLE) | | <u> </u> | | | | | 477.2 | |
| 44 | | | MI | nu LE Mean (bias | hat (MLE) corrected) | 93.52 1594 | 2 nu star (bias con MLE Sd (bias con | | | | | 66.79 872.1 | |
| 45 46 | | | ۸ طنب | sted Level of Si | ianificance | 0.0267 | | | Approximat | e Chi Squar | e Value (0.05) Square Value | 48.99 | |
| 47 | | | Adjus | sted Level of Si | ignificance | 0.0267 | | | | lajustea Chi | Square value | 46.35 | |
| 48 49 | | | 0E9/ A | pproximate Ga | | | ma Distributio | on | 01 | E0/ Adiustos | d Gamma UCL | 2207 | |
| 50 | | | 95% A | pproximate Ga | ımma UCL | 21/3 | | | 9: | 5% Adjusted | Gamma UCL | 2297 | |
| 51 52 | | | 0 | Shapiro Wilk Te | et Statistic | Lognorma 0.925 | ormal GOF Test Shapiro Wilk Lognormal GOF Test | | | | | | |
| 53 | | | | hapiro Wilk Cri | | 0.925 | D | | | | nificance Level | | |
| 54 55 | | | 10 | Lilliefors Te | | 0.206 | | | | normal GOF | | | |
| 56 | | | 10 | % Lilliefors Cri | | | at 10% Signific | | | at 10% SIG | nificance Level | | |
| 57 58 | | | | | | Lognormo | I Statistics | | | | | | |
| 59 | | | | Minimum of Lo | | 6.547 | i Giausucs | | | | of logged Data | 7.263 | |
| 60 61 | | | N | Maximum of Lo | gged Data | 8.003 | | | | SD | of logged Data | 0.508 | |
| 62 | | | | | | | rmal Distribut | tion | | | | | |
| 63 64 | | | 0E9/ | 99 Chebyshev (M | 5% H-UCL | | | | | | / (MVUE) UCL / (MVUE) UCL | 2386 3236 | |
| 65 | | | | Chebyshev (M Chebyshev (M | | | | | 97.5% | CHEDYSNE\ | / (IVIVUE) UCL | J∠J0 | |
| 66 67 | | | | | | | tion From LICI | Stations | | | | | |
| 68 | | | | | | | tion Free UCL Discernible D | | | | | | |
| 69 70 | | | | | • | | | | | | | | |
| 71 | | | | | CLT UCL | 1991 | tribution Free | UCLS | | | Bootstrap UCL | | |
| 72 73 | | | | Standard Boot | | L 1973 95% Bootstrap-t UCL | | | | | 2124 1971 | | |
| 74 | | | | ebyshev(Mear | | | | | | | lean, Sd) UCL | | |
| 75 76 | | | 97.5% Ch | nebyshev(Mear | n, Sd) UCL | d) UCL 3103 99% Chebyshev(Mean, Sd) UCL 3999 | | | | | | | |
| 77 | | | | | | | UCL to Use | | | | | | |
| 78 79 | | | | 95% Stude | ent's-t UCL | | | | | | | | |
| 80 | | | | | | | | | | | oriate 95% UCL | | |
| 81 82 | | Recom | nmendations | are based upo | n data size, | , data distrib | ution, and skev | wness using | g results fro | om simulatio | n studies. | | |
| 02 | <u>Hc</u> | owever, simu | <u>ııatıons result</u> | s will not cover | r all Real W | oria data se | s; for addition | aı ınsıght th | e user may | want to cor | nsult a statistici | an. | |

| 1 | _ | E Statis | F tics for Unc | G ensored Full Data | H Sets | ı | J | K | L | |
|----------|--|----------------|-------------------|-----------------------------|--------------|---------------|--------------------------|-----------------------------------|--------------------|--|
| 2 | 001 | _ Otalis | ucs for Offic | crisored i dii Dad | ia 00i3 | | | | | |
| 3 | User Selected Options | | _ | | | | | | | |
| 4 | Date/Time of Computation ProUCL 5.2 10/28 | /2024 4 | 1:37:03 PM | | | | | | | |
| 5 6 | From File WorkSheet.xls Full Precision OFF | | | | | | | | | |
| 7 | Confidence Coefficient 95% | | | | | | | | | |
| 8 | Number of Bootstrap Operations 2000 | | | | | | | | | |
| 9 | | | | | | | | | | |
| 10 11 | LMM-WRB-0.5-1 | | | | | | | | | |
| 12 | LIMINI-VVRD-U.3- I | | | | | | | | | |
| 13 | | | General | Statistics | | | | | | |
| 14 | Total Number of Observ | ations | 10 | | | | | t Observations | 10 | |
| 15 16 | N/i- | nimama | 645 | | | Number | of Missing | Observations Mean | 0 844.1 | |
| 17 | | nimum ximum | 978 | | | | | Median | 866.5 | |
| 18 | | SD | 108.3 | | | | Std. | Error of Mean | 34.25 | |
| 19 | Coefficient of Va | riation | 0.128 | | | | | Skewness | -0.612 | |
| 20 21 | | Normal (| GOF Test | | | | | | | |
| 22 | Shapiro Wilk Test St | tatistic | 0.94 | JOF TEST | S | hapiro Wi | lk GOF Te | est | | |
| 23 | 1% Shapiro Wilk Critical | | 0.781 | Da | | | | ficance Level | | |
| 24 | Lilliefors Test St | | 0.173 | | | | GOF Test | | | |
| 25 26 | 1% Lilliefors Critical | | 0.304 | Date 1% Significance | ata appear | Normal a | t 1% Signif | ficance Level | | |
| 27 | Data | a appea | ai inoiiiidi ai | с ти этуппісапсе | - Level | | | | | |
| 28 | | Ass | suming Nor | mal Distribution | | | | | | |
| 29 | 95% Normal UCL | | | | | | sted for SI | | | |
| 30 31 | 95% Student's- | -t UCL | 906.9 | | | | | L (Chen-1995) | 893.3 | |
| 32 | |] | | 1 | 95 | iVIOQITI6 % د | tu-ι UCL (c | Johnson-1978) | 905.8 | |
| 33 | Gamma GOF Test | | | | | | | | | |
| 34 | A-D Test St | | 0.361 | | | | Gamma G | | | |
| 35 36 | 5% A-D Critical | | 0.724 | | | | | t 5% Significan | ce Level | |
| 37 | K-S Test St 5% K-S Critical | | 0.19 0.266 | | | | | GOF Test at 5% Significan | ce Level | |
| 38 | | | | stributed at 5% S | | | <u> </u> | it 5 /0 Olymilledil | CG FGAGI | |
| 39 | | | | | | | | | | |
| 40 41 | 1.1 4 | /N/I =\ | | Statistics | | L. | stor/hi== - | orrooted MI EVI | 1176 | |
| 42 | K hat Theta hat | (MLE) | 63.84 13.22 | | | Theta 9 | star (bias c | corrected MLE) | 44.76 18.86 | |
| 43 | | (MLE) | | | | | | bias corrected) | 895.1 | |
| 44 | MLE Mean (bias corr | ected) | 844.1 | | | | | bias corrected) | 126.2 | |
| 45 46 | Adjusted Level of Signifi | icance | 0.0267 | | | | | re Value (0.05) i Square Value | 826.7 815.2 | |
| 47 | Aujusteu Levet of Signiff | Carice | 0.0207 | 1 | | A | ijasi c a OII | . Oquale value | 010.2 | |
| 48 | | | | ma Distribution | | | | | | |
| 49 50 | 95% Approximate Gamma | a UCL | 914 | | | 95 | % Adjusted | d Gamma UCL | 926.8 | |
| 51 | | | Lognorma | I GOF Test | | | | | | |
| 52 | Shapiro Wilk Test St | tatistic | 0.922 | | Shapiro | Wilk Log | normal G | OF Test | | |
| 53 | 10% Shapiro Wilk Critical | | 0.869 | Data | | | | nificance Level | | |
| 54 55 | Lilliefors Test St 10% Lilliefors Critical | | 0.192 0.241 | Dat- | | | ormal GOF | | | |
| 56 | | | | ⊥ ⊃ata at 10% Significan | | ognomal a | at 10% SIG | nificance Level | | |
| 57 | Suita d | ا الله د در س | | | | | | | | |
| 58 59 | | 1 D · 1 | | I Statistics | | | | | 0.70 | |
| 60 | Minimum of Logged Maximum of Logged | | 6.469 6.886 | | | | | of logged Data of logged Data | 6.73 0.134 | |
| 61 | waxiiiuii oi Logget | u Dala | 0.000 | 1 | | | טט | o, logged Dald | U. 13 1 | |
| 62 | | | | ormal Distribution | n | | | | | |
| 63 64 | | H-UCL | 917 | | | | | v (MVUE) UCL | 951.9 | |
| 65 | 95% Chebyshev (MVUE 99% Chebyshev (MVUE | | 1001 1201 | | | 97.5% | onebysne) | v (MVUE) UCL | 1068 | |
| 66 | 33 /0 Chebyshev (MIVOL | ., 552 | | 1 | | | | I | | |
| 67 | | | | tion Free UCL St | | _ | | - | | |
| 68 69 | <u>Data</u> | appea | r to follow a | Discernible Distr | ribution | | | | | |
| 70 | | Nonnar | ametric Dis | tribution Free UC | CLs | | | | | |
| 71 | 95% CL | T UCL | 900.4 | | | | | Bootstrap UCL | 895.4 | |
| 72 | 95% Standard Bootstra | | | | | | | ootstrap-t UCL | 902.5 | |
| 73 74 | 95% Hall's Bootstra | | | | | | | Bootstrap UCL | 898.2 | |
| 75 | 90% Chebyshev(Mean, Sd 97.5% Chebyshev(Mean, Sd | | | | | | | /lean, Sd) UCL /lean, Sd) UCL | 993.4 1185 | |
| 76 | 57.5% Onebysitev(weatt, ou | ., JUL | 1000 | 1 | | 00 /0 OH | oby on ev (IV | | 1100 | |
| 77 | | | | UCL to Use | | | | | | |
| 78 79 | 95% Student's- | t UCL | 906.9 | | | | | | | |
| 80 | Note: Suggestions regarding the selection of | f a 95% | UCL are pr | ovided to help the | e user to se | elect the m | ost appror | oriate 95% LICI | | |
| 81 | Recommendations are based upon da | ta size, | data distrib | ution, and skewne | ess using r | esults fror | n simulatio | on studies. | | |
| 82 | However, simulations results will not cover all l | Real W | orld data se | ts; for additional in | insight the | user may | want to co | nsult a statistici | an. | |
| _ | | _ | | | | | | | | |

| | Α | В | С | D | E | F | G | Н | | J | K | L |
|----|---|-----------|--------------|--------------|---------------|--------------|--------------|----------------|--------------|-------------|------------|---|
| 83 | | | | | | | | | | | | |
| 84 | | Note: For | highly negat | ively-skewed | d data, confi | dence limits | (e.g., Chen, | Johnson, Lo | ognormal, an | id Gamma) r | nay not be | |
| 85 | | | reliable. (| Chen's and J | lohnson's me | ethods provi | de adjustme | nts for posity | vely skewed | data sets. | | |
| 86 | | | | | | | | | | | | |
| | | | | | | | | | | | | |

| 4 | A B C D E | F | G H I J K | L |
|----------|--|--------------------------------|---|----------------|
| 2 | | Stics for Unc | ensored Full Data Sets | |
| 3 | User Selected Options Date/Time of Computation ProUCL 5.2 10/28/2024 | 4.20.27 DM | | |
| 5 | From File WorkSheet.xls | 4.39.27 PIVI | | |
| 6 7 | Full Precision OFF Confidence Coefficient 95% | | | |
| 8 | Number of Bootstrap Operations 2000 | | | |
| 9 | | | | |
| 11 | LMM-WRB-0.5-2 | | | |
| 12 13 | | General | Statistics | |
| 14 15 | Total Number of Observations | 10 | Number of Distinct Observations | 10 |
| 16 | Minimum | 142 | Number of Missing Observations Mean | 0 195.3 |
| 17 18 | Maximum | 284 | Median | 185 |
| 19 | SD Coefficient of Variation | 42.31 0.217 | Std. Error of Mean Skewness | 13.38 0.937 |
| 20 21 | | | | |
| 22 | Shapiro Wilk Test Statistic | GOF Test Shapiro Wilk GOF Test | | |
| 23 24 | 1% Shapiro Wilk Critical Value | 0.929 0.781 | Data appear Normal at 1% Significance Level | |
| 25 | Lilliefors Test Statistic 1% Lilliefors Critical Value | 0.193 0.304 | Lilliefors GOF Test Data appear Normal at 1% Significance Level | |
| 26 27 | | | 1% Significance Level | |
| 28 | As: | suming Nor | mal Distribution | |
| 29 30 | 95% Normal UCL | | 95% UCLs (Adjusted for Skewness) | 221.5 |
| 31 | 95% Student's-t UCL | 219.8 | 95% Adjusted-CLT UCL (Chen-1995) 95% Modified-t UCL (Johnson-1978) | 221.5 220.5 |
| 32 33 | | Comme | | |
| 34 | A-D Test Statistic | 0.285 | GOF Test Anderson-Darling Gamma GOF Test | |
| 35 36 | 5% A-D Critical Value | 0.725 | Detected data appear Gamma Distributed at 5% Significance Kolmogorov-Smirnov Gamma GOF Test | e Level |
| 37 | K-S Test Statistic 5% K-S Critical Value | 0.17 0.266 | Detected data appear Gamma Distributed at 5% Significance | e Level |
| 38 39 | Detected data appear | r Gamma Di | stributed at 5% Significance Level | |
| 40 | | Gamma | Statistics | |
| 41 42 | k hat (MLE) Theta hat (MLE) | 25.23 7.741 | k star (bias corrected MLE) Theta star (bias corrected MLE) | 17.73 11.02 |
| 43 | nu hat (MLE) | 504.6 | nu star (bias corrected) | 354.5 |
| 44 45 | MLE Mean (bias corrected) | 195.3 | MLE Sd (bias corrected) Approximate Chi Square Value (0.05) | 46.39 311.9 |
| 46 | Adjusted Level of Significance | 0.0267 | Approximate crit Square Value Adjusted Chi Square Value | |
| 47 48 | | suming Gam | nma Distribution | |
| 49 | 95% Approximate Gamma UCL | | 95% Adjusted Gamma UCL | 227.1 |
| 50 51 | | Lognorma | GOF Test | |
| 52 | Shapiro Wilk Test Statistic | 0.96 | Shapiro Wilk Lognormal GOF Test | |
| 53 54 | 10% Shapiro Wilk Critical Value Lilliefors Test Statistic | 0.869 0.155 | Data appear Lognormal at 10% Significance Level Lilliefors Lognormal GOF Test | |
| 55 56 | 10% Lilliefors Critical Value | 0.241 | Data appear Lognormal at 10% Significance Level | |
| 57 | Data appear | Lognormal a | at 10% Significance Level | |
| 58 59 | Minimum of the state of the sta | | Statistics | E OFF |
| 60 | Minimum of Logged Data Maximum of Logged Data | 4.956 5.649 | Mean of logged Data SD of logged Data | 5.255 0.208 |
| 61 62 | | uming Lagra | | |
| 63 | ASSU 95% H-UCL | uming Logno 223 | prmal Distribution 90% Chebyshev (MVUE) UCL | 233.9 |
| 64 65 | 95% Chebyshev (MVUE) UCL | 251.4 | 97.5% Chebyshev (MVUE) UCL | 275.7 |
| 66 | 99% Chebyshev (MVUE) UCL | 323.5 | <u> </u> | |
| 67 68 | | | tion Free UCL Statistics Discernible Distribution | |
| 69 | | | | |
| 70 71 | Nonpar 95% CLT UCL | | tribution Free UCLs 95% BCA Bootstrap UCL | 220.6 |
| 72 | 95% Standard Bootstrap UCL | 216.3 | 95% Bootstrap-t UCL | 228.4 |
| 73 74 | 95% Hall's Bootstrap UCL 90% Chebyshev(Mean, Sd) UCL | 241.4 235.4 | 95% Percentile Bootstrap UCL 95% Chebyshev(Mean, Sd) UCL | 216.4 253.6 |
| 75 | 97.5% Chebyshev(Mean, Sd) UCL | 278.8 | 95% Chebyshev(Mean, Sd) UCL | 328.4 |
| 76 77 | | Suggested | UCL to Use | |
| 78 | 95% Student's-t UCL | | 00E 10 000 | |
| 79 80 | Note: Suggestions regarding the selection of a 05% | CIICL are pr | ovided to help the user to select the most appropriate 95% UCL. | |
| 81 | Recommendations are based upon data size, | , data distrib | ution, and skewness using results from simulation studies. | |
| 82 | However, simulations results will not cover all Real W | orld data se | ts; for additional insight the user may want to consult a statisticia | n. |

| | G H I J K L | | | | | | | | | |
|--|--|--|--|--|--|--|--|--|--|--|
| UCL Statistics for Uncensor | ed Full Data Sets | | | | | | | | | |
| 3 User Selected Options | | | | | | | | | | |
| 4 Date/Time of Computation ProUCL 5.2 10/28/2024 3:27:22 PM 5 From File WorkSheet.xls | | | | | | | | | | |
| 6 Full Precision OFF | | | | | | | | | | |
| 7 Confidence Coefficient 95% | | | | | | | | | | |
| 8 Number of Bootstrap Operations 2000 | | | | | | | | | | |
| 10 | | | | | | | | | | |
| 11 LMM-WRB-0.5-3-DS | | | | | | | | | | |
| 12 13 General Statis | tice | | | | | | | | | |
| Total Number of Observations 4 | Number of Distinct Observations 3 | | | | | | | | | |
| 15 16 Minimum 14 | Number of Missing Observations 0 | | | | | | | | | |
| 16 Minimum 14 | Mean 17.5 Median 18.5 | | | | | | | | | |
| 18 SD 2.38 | Std. Error of Mean 1.19 | | | | | | | | | |
| 19 Coefficient of Variation 0.136 | Skewness -1.779 | | | | | | | | | |
| Note: Sample size is small (e.g., <10), if data are collected using | incremental sampling methodology (ISM) approach. | | | | | | | | | |
| 22 refer also to ITRC Tech Reg Guide on ISM (ITRC 202 | 0 and ITRC 2012) for additional guidance, | | | | | | | | | |
| but note that ITRC may recommend the t-UCL or the Chebyshev UCL often results in gro | | | | | | | | | | |
| Refer to the ProUCL 5.2 Technical Guide for a | | | | | | | | | | |
| 26 | • | | | | | | | | | |
| 27 Normal GOF 7 28 Shapiro Wilk Test Statistic 0.764 | Shapiro Wilk GOF Test | | | | | | | | | |
| 29 1% Shapiro Wilk Critical Value 0.687 | Data appear Normal at 1% Significance Level | | | | | | | | | |
| 30 Lilliefors Test Statistic 0.333 31 1% Lilliefors Critical Value 0.413 | Lilliefors GOF Test | | | | | | | | | |
| 32 Data appear Normal at 1% 5 | Data appear Normal at 1% Significance Level | | | | | | | | | |
| Note GOF tests may be unreliable | | | | | | | | | | |
| | | | | | | | | | | |
| 36 95% Normal UCL | 95% UCLs (Adjusted for Skewness) | | | | | | | | | |
| 95% Student's-t UCL 20.3 | 95% Adjusted-CLT UCL (Chen-1995) 18.33 | | | | | | | | | |
| 38 39 | 95% Modified-t UCL (Johnson-1978) 20.12 | | | | | | | | | |
| 40 Gamma GOF | Fest | | | | | | | | | |
| A-D Test Statistic 0.651 | Anderson-Darling Gamma GOF Test | | | | | | | | | |
| 42 5% A-D Critical Value 0.656 D 43 K-S Test Statistic 0.357 | etected data appear Gamma Distributed at 5% Significance Level Kolmogorov-Smirnov Gamma GOF Test | | | | | | | | | |
| 44 5% K-S Critical Value 0.394 D | etected data appear Gamma Distributed at 5% Significance Level | | | | | | | | | |
| 45 Detected data appear Gamma Distribu | ted at 5% Significance Level | | | | | | | | | |
| 47 | ioi smail sample sizes | | | | | | | | | |
| 48 Gamma Statis | | | | | | | | | | |
| 49 k hat (MLE) 65.75 50 Theta hat (MLE) 0.266 | k star (bias corrected MLE) 16.6 Theta star (bias corrected MLE) 1.054 | | | | | | | | | |
| 51 nu hat (MLE) 526 | nu star (bias corrected MLE) 1.054 | | | | | | | | | |
| 52 MLE Mean (bias corrected) 17.5 | MLE Sd (bias corrected) 4.295 | | | | | | | | | |
| 53 54 Adjusted Level of Significance N/A | Approximate Chi Square Value (0.05) 107.2 Adjusted Chi Square Value N/A | | | | | | | | | |
| 55 | | | | | | | | | | |
| 56 Assuming Gamma D 57 95% Approximate Gamma UCL 21 68 | | | | | | | | | | |
| 58 | 95% Adjusted Gamma UCL N/A | | | | | | | | | |
| 59 Lognormal GOF | | | | | | | | | | |
| 60 Shapiro Wilk Test Statistic 0.75 61 10% Shapiro Wilk Critical Value 0.792 | Shapiro Wilk Lognormal GOF Test Data Not Lognormal at 10% Significance Level | | | | | | | | | |
| 62 Lilliefors Test Statistic 0.347 | Lilliefors Lognormal GOF Test | | | | | | | | | |
| 63 10% Lilliefors Critical Value 0.346 | Data Not Lognormal at 10% Significance Level | | | | | | | | | |
| 64 Data Not Lognormal at 10% | Significance Level | | | | | | | | | |
| 66 Lognormal Stat | | | | | | | | | | |
| Minimum of Logged Data 2.639 | Mean of logged Data 2.855 | | | | | | | | | |
| 69 | SD of logged Data 0.146 | | | | | | | | | |
| 70 Assuming Lognormal | | | | | | | | | | |
| 71 95% H-UCL 21.35 72 95% Chebyshey (MVUE) UCL 23.06 | 90% Chebyshev (MVUE) UCL 21.33 | | | | | | | | | |
| 73 99% Chebyshey (MVUE) UCL 30.19 | 97.5% Chebyshev (MVUE) UCL 25.47 | | | | | | | | | |
| 74 | | | | | | | | | | |
| 75 Nonparametric Distribution F 76 Data appear to follow a Discr | | | | | | | | | | |
| 77 | MINIO DISUIDUUOII | | | | | | | | | |
| 78 Nonparametric Distributi | | | | | | | | | | |
| 79 95% CLT UCL 19.46 80 95% Standard Bootstrap UCL N/A | 95% BCA Bootstrap UCL N/A 95% Bootstrap-t UCL N/A | | | | | | | | | |
| 0070 014111441 4 20010114 2001 11771 | 95% Percentile Bootstrap UCL N/A | | | | | | | | | |
| 81 95% Hall's Bootstrap UCL N/A 82 90% Chebyshev(Mean, Sd) UCL 21.07 | 30701 Crecitate Bootstrap CCE 14/71 | | | | | | | | | |

| | Α | В | С | D | Е | F | G | Н | | J | K | L | |
|----|----------------------|---|----------------|----------------|---------------|----------------|--------------------|----------------|----------------|--------------|-----------------|-------|--|
| 83 | | | 97.5% Ch | ebyshev(Mea | an, Sd) UCL | 24.93 | | | 99% Ch | ebyshev(Me | an, Sd) UCL | 29.34 | |
| 84 | | | | | | | - | | | | | | |
| 85 | Suggested UCL to Use | | | | | | | | | | | | |
| 86 | | 95% Student's-t UCL 20.3 | | | | | | | | | | | |
| 87 | | Recommended UCL exceeds the maximum observation | | | | | | | | | | | |
| 88 | | | | | | | | | | | | | |
| 89 | | Note: Sugge | stions regard | ing the selec | tion of a 95% | 6 UCL are pr | ovided to hel | p the user to | select the m | ost appropri | ate 95% UCL | | |
| 90 | | Recom | mendations | are based up | on data size | , data distrib | ution, and sk | ewness usin | g results fror | n simulation | studies. | | |
| 91 | Ho | wever, simu | lations result | s will not cov | er all Real V | orld data se | ts; for addition | nal insight th | ne user may | want to cons | ult a statistic | ian. | |
| 92 | | | | | | | | | | | | | |
| 93 | | Note: For | highly negat | ively-skewe | d data, confi | dence limits | (e.g., Chen, | Johnson, Lo | ognormal, ar | nd Gamma) i | may not be | | |
| 94 | | | reliable. | Chen's and J | ohnson's m | ethods provi | <u>de adjustme</u> | nts for posit | vely skewed | data sets. | | | |
| 95 | | | | | | | | | | | | | |

| UCL Statistics for Uncensored Full Data Sets User Selected Options ProUCL 5.2 10/28/2024 3:22:06 PM User Selected Options User Sele | ct Observations g Observations Mean Median | 4 | | | | | | | | |
|--|---|----------------|--|--|--|--|--|--|--|--|
| 4 Date/Time of Computation 5 From File WorkSheet.xls 6 Full Precision OFF 7 Confidence Coefficient 95% 8 Number of Bootstrap Operations 2000 9 10 11 LMM-WRB-0.5-3 12 General Statistics | g Observations Mean | | | | | | | | | |
| 5 From File WorkSheet.xls 6 Full Precision OFF 7 Confidence Coefficient 95% 8 Number of Bootstrap Operations 2000 9 10 11 LMM-WRB-0.5-3 12 General Statistics | g Observations Mean | | | | | | | | | |
| 7 | g Observations Mean | | | | | | | | | |
| 8 Number of Bootstrap Operations 2000 9 10 11 LMM-WRB-0.5-3 12 13 General Statistics | g Observations Mean | | | | | | | | | |
| 9 | g Observations Mean | | | | | | | | | |
| 11 LMM-WRB-0.5-3 12 General Statistics | g Observations Mean | | | | | | | | | |
| 12 General Statistics | g Observations Mean | | | | | | | | | |
| | g Observations Mean | | | | | | | | | |
| | g Observations Mean | | | | | | | | | |
| 15 Number of Missin | | 0 | | | | | | | | |
| 16 Minimum 92 17 Maximum 149 | iviediani | 112.5 104.5 | | | | | | | | |
| 18 SD 25.77 Std | I. Error of Mean | 12.89 | | | | | | | | |
| Coefficient of Variation 0.229 | Skewness | 1.413 | | | | | | | | |
| 20 21 Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISI | M) approach | | | | | | | | | |
| refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance | e, | | | | | | | | | |
| but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n The Chebyshev UCL often results in gross overestimates of the mean. | < 7). | | | | | | | | | |
| Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshey UCL. | | | | | | | | | | |
| 26 27 Normal GOF Test | | | | | | | | | | |
| 28 Shapiro Wilk Test Statistic 0.872 Shapiro Wilk GOF Te | est | | | | | | | | | |
| 29 1% Shapiro Wilk Critical Value 0.687 Data appear Normal at 1% Signi | ificance Level | | | | | | | | | |
| 30 Lilliefors Test Statistic 0.258 Lilliefors GOF Test 31 1% Lilliefors Critical Value 0.413 Data appear Normal at 1% Signi | | | | | | | | | | |
| Data appear Normal at 1% Significance Level | | | | | | | | | | |
| Note GOF tests may be unreliable for small sample sizes 34 | | | | | | | | | | |
| 35 Assuming Normal Distribution | | | | | | | | | | |
| 95% Normal UCL 95% UCLs (Adjusted for Skewness) | | | | | | | | | | |
| 37 95% Student's-t UCL 142.8 95% Adjusted-CLT UCL 38 95% Modified-t UCL (| | 143.4 144.3 | | | | | | | | |
| 39 | | | | | | | | | | |
| 40 Gamma GOF Test 41 A-D Test Statistic 0.376 Anderson-Darling Gamma G | 30F Test | | | | | | | | | |
| 42 5% A-D Critical Value 0.657 Detected data appear Gamma Distributed a | at 5% Significand | ce Level | | | | | | | | |
| K-S Test Statistic 0.257 Kolmogorov-Smirnov Gamma K-S Test Statistic 0.257 Kolmogorov-Smirnov Gamma S% K-S Critical Value 0.394 Detected data appear Gamma Distributed a | | ne l evel | | | | | | | | |
| 45 Detected data appear Gamma Distributed at 5% Significance Level | 3t 5 % Significant | e reaei | | | | | | | | |
| Note GOF tests may be unreliable for small sample sizes | | | | | | | | | | |
| 48 Gamma Statistics | | | | | | | | | | |
| 49 k hat (MLE) 27.61 k star (bias | corrected MLE) | 7.07 | | | | | | | | |
| mota nat (m22) non | (bias corrected) | 15.91 56.56 | | | | | | | | |
| 52 MLE Mean (bias corrected) 112.5 MLE Sd (| bias corrected) | 42.31 | | | | | | | | |
| 53 Approximate Chi Squa 54 Adjusted Level of Significance N/A Adjusted Ch | re Value (0.05) ni Square Value | 40.27 N/A | | | | | | | | |
| 55 | oquale value | 13/73 | | | | | | | | |
| Assuming Gamma Distribution 95% Approximate Gamma UCI 158 95% Adjuste | d Gamma UCL | N/A | | | | | | | | |
| 58 | u Ganiina UCL | IN/A | | | | | | | | |
| Lognormal GOF Test Shapiro Wilk Test Statistic 0.902 Shapiro Wilk Lognormal G | OF Toot | | | | | | | | | |
| 60 Shapiro Wilk Test Statistic 0.902 Shapiro Wilk Lognormal G 61 10% Shapiro Wilk Critical Value 0.792 Data appear Lognormal at 10% Signormal | | | | | | | | | | |
| 62 Lilliefors Test Statistic 0.226 Lilliefors Lognormal GO | F Test | | | | | | | | | |
| 63 10% Lilliefors Critical Value 0.346 Data appear Lognormal at 10% Significance Level | ınıtıcance Level | | | | | | | | | |
| Note GOF tests may be unreliable for small sample sizes | | | | | | | | | | |
| 66 67 Lognormal Statistics | | | | | | | | | | |
| 68 Minimum of Logged Data 4.522 Mean | of logged Data | 4.705 | | | | | | | | |
| | of logged Data | 0.216 | | | | | | | | |
| 71 Assuming Lognormal Distribution | | | | | | | | | | |
| 72 95% H-UCL 154.6 90% Chebyshe | | 148.7 | | | | | | | | |
| 73 95% Chebyshev (MVUE) UCL 165.2 97.5% Chebyshe 74 99% Chebyshev (MVUE) UCL 232.8 | v (MVUE) UCL | 188 | | | | | | | | |
| 75 | | | | | | | | | | |
| 76 Nonparametric Distribution Free UCL Statistics 77 Data appear to follow a Discernible Distribution | | | | | | | | | | |
| 78 | | | | | | | | | | |
| 79 Nonparametric Distribution Free UCLs | D4-1 1101 | NI/A | | | | | | | | |
| | Bootstrap UCL Bootstrap-t UCL | N/A N/A | | | | | | | | |
| 82 95% Hall's Bootstrap UCL N/A 95% Percentile | | N/A | | | | | | | | |

| | Α | В | С | D | E | F | G | Н | ı | J | K | L | |
|----|----------------------|---|---------------|---------------|---------------|--------------|-----------------------------------|-----------------------------------|--------------|----------------|-------------|---|--|
| 83 | | | 90% Ch | ebyshev(Me | an, Sd) UCL | 151.2 | | 95% Chebyshev(Mean, Sd) UCL 168.7 | | | | | |
| 84 | | | 97.5% Ch | ebyshev(Me | an, Sd) UCL | 193 | 99% Chebyshev(Mean, Sd) UCL 240.7 | | | | | | |
| 85 | | | | | | | | | | | | | |
| 86 | Suggested UCL to Use | | | | | | | | | | | | |
| 87 | | | | 95% Stu | dent's-t UCL | 142.8 | | | | | | | |
| 88 | | | | | | | • | | | | | - | |
| 89 | | Note: Sugges | stions regard | ing the selec | tion of a 95% | 6 UCL are pr | ovided to hel | p the user to | select the m | nost appropria | ate 95% UCL | | |
| 90 | | | | | | | | | | | | | |
| 91 | Но | However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician. | | | | | | | | | | | |
| 92 | | | | | | | | | | | | | |

| | A B C D E | F | G H I J K | L |
|----------|--|----------------|--|----------------|
| 2 | UCL Statis | stics for Unc | ensored Full Data Sets | |
| 3 | User Selected Options | | | |
| 4 5 | Date/Time of Computation ProUCL 5.2 10/31/2024 From File ProUCL Input.xls | 1:55:18 PM | | |
| 6 | Full Precision OFF | | | |
| 7 | Confidence Coefficient 95% | | | |
| 8 | Number of Bootstrap Operations 2000 | | | |
| 10 | | | | |
| 11 | SH-WRA-0.5-1 | | | |
| 12 13 | | General | Statistics | |
| 14 | Total Number of Observations | 4 | | 3 |
| 15 16 | Minimum | 0 | | 0 |
| 17 | Minimum Maximum | 9 13 | | 11.5 12 |
| 18 | SD | 1.732 | Std. Error of Mean | 0.866 |
| 19 20 | Coefficient of Variation | 0.151 | Skewness - | 1.54 |
| 21 | Note: Sample size is small (e.g., <10), if data a | are collected | using incremental sampling methodology (ISM) approach, | |
| 22 | refer also to ITRC Tech Reg Guide | on ISM (ITR | C 2020 and ITRC 2012) for additional guidance, | |
| 23 24 | | | he Chebyshev UCL for small sample sizes (n < 7). | |
| 25 | | | in gross overestimates of the mean. e for a discussion of the Chebyshev UCL. | |
| 26 | 110101 10 110 1 10002 0.2 100 | | · | |
| 27 28 | Observed MPRITE COLUMN | | GOF Test | |
| 28 | Shapiro Wilk Test Statistic 1% Shapiro Wilk Critical Value | | Shapiro Wilk GOF Test Data appear Normal at 1% Significance Level | |
| 30 | Lilliefors Test Statistic | 0.364 | Lilliefors GOF Test | |
| 31 32 | 1% Lilliefors Critical Value | | Data appear Normal at 1% Significance Level | |
| 33 | | | : 1% Significance Level eliable for small sample sizes | |
| 34 | | | | |
| 35 36 | | suming Nor | mal Distribution | |
| 37 | 95% Normal UCL 95% Student's-t UCL | 13.54 | 95% UCLs (Adjusted for Skewness) 95% Adjusted-CLT UCL (Chen-1995) | 12.21 |
| 38 | 30% Stadonts 1902 | 10.01 | · | 13.43 |
| 39 | | | | |
| 40 41 | A-D Test Statistic | 0.554 | GOF Test Anderson-Darling Gamma GOF Test | |
| 42 | 5% A-D Critical Value | | Detected data appear Gamma Distributed at 5% Significance L | _evel |
| 43 | K-S Test Statistic | | Kolmogorov-Smirnov Gamma GOF Test | |
| 44 45 | 5% K-S Critical Value | | Detected data appear Gamma Distributed at 5% Significance Level | _evel |
| 46 | | | eliable for small sample sizes | |
| 47 48 | | • | OLD BUILDING | |
| 48 | k hat (MLE) | 53.64 | Statistics k star (bias corrected MLE) | 13.58 |
| 50 | Theta hat (MLE) | 1 | Theta star (bias corrected MLE) | 0.847 |
| 51 52 | nu hat (MLE) | | | 08.6 |
| 53 | MLE Mean (bias corrected) | 11.5 | | 3.121 85.56 |
| 54 | Adjusted Level of Significance | N/A | | N/A |
| 55 56 | | | | |
| 56 | Ase 95% Approximate Gamma UCL | | ma Distribution 95% Adjusted Gamma UCL N | N/A |
| 58 | 30 % Approximate damind OCL | 17.0 | 30 /0 Adjusted Gaillina OCL | W/T\ |
| 59 60 | | | GOF Test | |
| 60 61 | Shapiro Wilk Test Statistic 10% Shapiro Wilk Critical Value | | Shapiro Wilk Lognormal GOF Test Data appear Lognormal at 10% Significance Level | |
| 62 | Lilliefors Test Statistic | | Lilliefors Lognormal GOF Test | |
| 63 | 10% Lilliefors Critical Value | 0.346 | Data Not Lognormal at 10% Significance Level | |
| 64 65 | | | ormal at 10% Significance Level | |
| 66 | Note GOF tests | may be unife | manie ivi sitiali sattipie sižes | |
| 67 | | | Statistics | |
| 68 69 | Minimum of Logged Data Maximum of Logged Data | | | 2.433 0.162 |
| 70 | waximum oi Logged Data | 2.000 | SD OI logged Data | U. 1UZ |
| 71 | Assı | | rmal Distribution | |
| 72 73 | 95% H-UCL 95% Chebyshev (MVUE) UCL | 14.39 15.55 | | 14.29 17.3 |
| 74 | 95% Chebyshev (MVUE) UCL | 20.74 | 37.3% Chebyshev (MVUE) UCL | 17.3 |
| 75 | | • | | |
| 76 77 | | | tion Free UCL Statistics | |
| 78 | | ai to lollow a | Discernible Distribution | |
| 79 | | | tribution Free UCLs | |
| 80 81 | 95% CLT UCL 95% Standard Bootstrap UCL | | | N/A |
| | 95% Standard Bootstrap UCL 95% Hall's Bootstrap UCL | 1 | | N/A N/A |
| 82 | 90 /0 Hall'S DUDISHAD OCA | | | |

| | Α | В | С | D | Е | F | G | Н | I | J | K | L | |
|----|----|--------------|----------------|----------------|---------------|-------------------|--------------------|----------------|----------------|--------------|-----------------|-------|--|
| 83 | | | 90% Ch | ebyshev(Me | an, Sd) UCL | 14.1 | | | 95% Ch | ebyshev(Me | an, Sd) UCL | 15.27 | |
| 84 | | | 97.5% Ch | ebyshev(Me | an, Sd) UCL | 16.91 | | | 99% Ch | ebyshev(Me | an, Sd) UCL | 20.12 | |
| 85 | | | | | | | | | | | | | |
| 86 | | | | | | Suggested | UCL to Use | | | | | | |
| 87 | | | | 95% Stu | dent's-t UCL | 13.54 | | | | | | | |
| 88 | | | | Red | commended | UCL exceed | is the maxim | num observa | ition | | | | |
| 89 | | | | | | | | | | | | | |
| 90 | 1 | Note: Sugges | stions regard | ing the selec | tion of a 95% | UCL are pr | ovided to hel | p the user to | select the m | ost appropri | ate 95% UCL | | |
| 91 | | Recom | mendations | are based up | on data size | , data distrib | ution, and sk | ewness usin | g results fror | n simulation | studies. | | |
| 92 | Ho | wever, simu | lations result | s will not cov | er all Real W | orld data se | ts; for addition | nal insight th | ne user may | want to cons | ult a statistic | ian. | |
| 93 | | | | | | | | | | | | | |
| 94 | | Note: For | highly negat | ively-skewe | d data, confi | dence limits | (e.g., Chen, | Johnson, Lo | ognormal, ar | nd Gamma) ı | may not be | | |
| 95 | | | reliable. | Chen's and J | ohnson's me | ethods provi | <u>de adjustme</u> | nts for posit | vely skewed | data sets. | | | |
| 96 | | | | | | | | | | | | | |

| 1 | A B C D E | F | G H I J K | L |
|----------|--|----------------------|---|----------------|
| 2 | UCL Stati | istics for Unc | ensored Full Data Sets | |
| 3 | User Selected Options | | | |
| 4 5 | Date/Time of Computation ProUCL 5.2 10/31/2024 From File ProUCL Input.xls | 1:56:58 PM | | |
| 6 | Full Precision OFF | | | |
| 7 | Confidence Coefficient 95% Number of Bootstrap Operations 2000 | | | |
| 9 | Number of Bootstrap Operations 2000 | | | |
| 10 | | | | |
| 12 | SH-WRA-0.5-2 | | | |
| 13 | | | Statistics | |
| 14 15 | Total Number of Observations | 4 | Number of Distinct Observations Number of Missing Observations | 0 |
| 16 | Minimum | 12 | Mean | 15.25 |
| 17 18 | Maximum | | Median | 14 |
| 19 | SD Coefficient of Variation | | Std. Error of Mean Skewness | 2.016 1.469 |
| 20 | | , | | |
| 21 22 | | | using incremental sampling methodology (ISM) approach, C 2020 and ITRC 2012) for additional guidance, | |
| 23 | but note that ITRC may recommend t | he t-UCL or t | he Chebyshev UCL for small sample sizes (n < 7). | |
| 24 25 | | | in gross overestimates of the mean. | |
| 26 | Reier to the Prouct 5.2 Te | cillical Guid | e for a discussion of the Chebyshev UCL. | |
| 27 | | | OF Test | |
| 28 29 | Shapiro Wilk Test Statistic 1% Shapiro Wilk Critical Value | | Shapiro Wilk GOF Test Data appear Normal at 1% Significance Level | |
| 30 | Lilliefors Test Statistic | | Lilliefors GOF Test | |
| 31 32 | 1% Lilliefors Critical Value | | Data appear Normal at 1% Significance Level | |
| 33 | | | t 1% Significance Level Bliable for small sample sizes | |
| 34 | | | | |
| 35 36 | 95% Normal UCL | ssuming Nor | mal Distribution 95% UCLs (Adjusted for Skewness) | |
| 37 | 95% Student's-t UCL | 19.99 | 95% Adjusted for Skewness) 95% Adjusted-CLT UCL (Chen-1995) | 20.15 |
| 38 39 | | | 95% Modified-t UCL (Johnson-1978) | 20.24 |
| 40 | | Gamma | GOF Test | |
| 41 | A-D Test Statistic | 0.368 | Anderson-Darling Gamma GOF Test | |
| 42 43 | 5% A-D Critical Value K-S Test Statistic | | Detected data appear Gamma Distributed at 5% Significance Kolmogorov-Smirnov Gamma GOF Test | e Level |
| 44 | 5% K-S Critical Value | | Detected data appear Gamma Distributed at 5% Significance | Level |
| 45 | Detected data appea | r Gamma Di | stributed at 5% Significance Level | |
| 46 47 | Note GOF tests | may be unre | eliable for small sample sizes | |
| 48 | | | Statistics | |
| 49 50 | k hat (MLE) | | k star (bias corrected MLE) | 5.422 |
| 51 | Theta hat (MLE) nu hat (MLE) | _ | Theta star (bias corrected MLE) nu star (bias corrected) | 2.812 43.38 |
| 52 | MLE Mean (bias corrected) | 15.25 | MLE Sd (bias corrected) | 6.549 |
| 53 54 | Adjusted Level of Significance | N/A | Approximate Chi Square Value (0.05) Adjusted Chi Square Value | 29.28 N/A |
| 55 | Aujusteu Level of Signification | / IN//N | Aujusteu Cili Squale Value | 13/73 |
| 56 57 | | | ma Distribution | NI/A |
| 58 | 95% Approximate Gamma UCL | _ 22.6 | 95% Adjusted Gamma UCL | N/A |
| 59 | <u> </u> | | GOF Test | |
| 60 61 | Shapiro Wilk Test Statistic 10% Shapiro Wilk Critical Value | | Shapiro Wilk Lognormal GOF Test Data appear Lognormal at 10% Significance Level | |
| 62 | Lilliefors Test Statistic | | Lilliefors Lognormal GOF Test | |
| 63 64 | 10% Lilliefors Critical Value | 0.346 | Data appear Lognormal at 10% Significance Level | |
| 64 65 | | | at 10% Significance Level Bliable for small sample sizes | |
| 66 | Hote GOT lests | | | |
| 67 68 | Mining on all and ID | | I Statistics | 2 701 |
| 69 | Minimum of Logged Data Maximum of Logged Data | | Mean of logged Data SD of logged Data | 2.701 0.247 |
| 70 | | , | | |
| 71 72 | | uming Logno 22.25 | prmal Distribution 90% Chebyshev (MVUE) UCL | 20.85 |
| 73 | 95% Chebyshev (MVUE) UCL | | 90% Chebyshev (MVUE) UCL | 26.93 |
| 74 75 | 99% Chebyshev (MVUE) UCL | | | |
| 75 76 | Nonnaram | etric Distribu | tion Free UCL Statistics | |
| 77 | | | Discernible Distribution | |
| | | | | |
| 78 | | | | |
| | | | tribution Free UCLs 95% BCA Bootstrap UCL | N/A |
| 78 79 | Nonpa 95% CLT UCL 95% Standard Bootstrap UCL 95% Hall's Bootstrap UCL | 18.57 N/A | ### 15% BCA Bootstrap UCL 95% BCA Bootstrap UCL 95% Bootstrap-t UCL 95% Percentile Bootstrap UCL | N/A N/A |

| | Α | В | С | D | E | F | G | Н | I | J | K | L |
|----|----|--------------|----------------|----------------|---------------|----------------|-------------------|----------------|----------------|---------------|------------------|-------|
| 83 | | | 90% Ch | ebyshev(Me | an, Sd) UCL | 21.3 | | | 95% Ch | ebyshev(Me | an, Sd) UCL | 24.04 |
| 84 | | | 97.5% Ch | ebyshev(Me | an, Sd) UCL | 27.84 | | | 99% Ch | ebyshev(Me | an, Sd) UCL | 35.3 |
| 85 | | | | | | | | | | | | |
| 86 | | | | | | Suggested | UCL to Use | | | | | |
| 87 | | | | 95% Stu | dent's-t UCL | 19.99 | | | | | | |
| 88 | | | | | | | • | | | | | |
| 89 | ľ | Note: Sugges | stions regard | ing the selec | tion of a 95% | 6 UCL are pr | ovided to hel | p the user to | select the m | ost appropria | ate 95% UCL | |
| 90 | | Recom | mendations | are based up | on data size | , data distrib | ution, and sk | ewness usin | g results fror | n simulation | studies. | |
| 91 | Но | wever, simul | lations result | s will not cov | er all Real W | orld data se | ts; for addition | nal insight th | ne user may | want to cons | ult a statistici | ian. |
| 92 | | | | | | | | | | | | |

| | A B C D E | F | G H I J K | L |
|----------|---|----------------------|---|----------------|
| 2 | UCL Statis | stics for Unc | ensored Full Data Sets | |
| 3 | User Selected Options | | | |
| 4 5 | Date/Time of Computation ProUCL 5.2 10/31/2024 2 From File ProUCL Input.xls | 2:02:01 PM | | |
| 6 | Full Precision OFF | | | |
| 7 8 | Confidence Coefficient 95% Number of Bootstrap Operations 2000 | | | |
| 9 | Number of Bootstrap Operations 2000 | | | |
| 10 | OLL WIDD OF 4 | | | |
| 12 | SH-WRB-0.5-1 | | | |
| 13 | | | Statistics | |
| 14 15 | Total Number of Observations | 4 | Number of Distinct Observations Number of Missing Observations | 0 |
| 16 | Minimum | 19 | Mean | 24.5 |
| 17 18 | Maximum | 30 | Median Std. Error of Mean | 24.5 |
| 19 | SD Coefficient of Variation | 4.655 0.19 | Sta. Error of Mean Skewness | 2.327 |
| 20 | - | | | |
| 21 22 | | | I using incremental sampling methodology (ISM) approach, C 2020 and ITRC 2012) for additional guidance, | |
| 23 | but note that ITRC may recommend th | e t-UCL or t | the Chebyshev UCL for small sample sizes (n < 7). | |
| 24 25 | | | in gross overestimates of the mean. | |
| 26 | Neier to the Prouct 5.2 Tec | annear Guid | e for a discussion of the Chebyshev UCL. | |
| 27 | <u> </u> | | GOF Test | |
| 28 29 | Shapiro Wilk Test Statistic 1% Shapiro Wilk Critical Value | N/A 0.687 | Shapiro Wilk GOF Test Data Not Normal at 1% Significance Level | |
| 30 | Lilliefors Test Statistic | 0.131 | Lilliefors GOF Test | |
| 31 32 | 1% Lilliefors Critical Value | | Data appear Normal at 1% Significance Level rmal at 1% Significance Level | |
| 33 | | | rmai at 1% Significance Level Bliable for small sample sizes | |
| 34 | | | | |
| 35 36 | Ass 95% Normal UCL | suming Nor | mal Distribution 95% UCLs (Adjusted for Skewness) | |
| 37 | 95% Normal OCE 95% Student's-t UCL | 29.98 | 95% Adjusted for Skewness) | 28.33 |
| 38 | | | 95% Modified-t UCL (Johnson-1978) | 29.98 |
| 39 40 | | Gamma | GOF Test | |
| 41 | A-D Test Statistic | 0.194 | Anderson-Darling Gamma GOF Test | |
| 42 43 | 5% A-D Critical Value K-S Test Statistic | 0.656 0.171 | Detected data appear Gamma Distributed at 5% Significance Kolmogorov-Smirnov Gamma GOF Test | e Level |
| 44 | 5% K-S Critical Value | 0.171 | Detected data appear Gamma Distributed at 5% Significance | e Level |
| 45 | | | stributed at 5% Significance Level | |
| 46 47 | Note GOF tests i | may be unre | eliable for small sample sizes | |
| 48 | | | Statistics | |
| 49 50 | k hat (MLE) Theta hat (MLE) | 36.22 0.676 | k star (bias corrected MLE) Theta star (bias corrected MLE) | 9.223 2.656 |
| 51 | nu hat (MLE) | 289.8 | nu star (bias corrected) | 73.78 |
| 52 53 | MLE Mean (bias corrected) | 24.5 | MLE Sd (bias corrected) | 8.067 |
| 54 | Adjusted Level of Significance | N/A | Approximate Chi Square Value (0.05) Adjusted Chi Square Value | 55 N/A |
| 55 | | | | |
| 56 57 | Ass 95% Approximate Gamma UCL | | ma Distribution 95% Adjusted Gamma UCL | N/A |
| 58 | 95 % Approximate Gamina UCL | JZ.0/ | 35 % Aujusteu Gamma UCL | IN/A |
| 59 60 | Objection WEB To a Control | | I GOF Test | |
| 61 | Shapiro Wilk Test Statistic 10% Shapiro Wilk Critical Value | 0.995 0.792 | Shapiro Wilk Lognormal GOF Test Data appear Lognormal at 10% Significance Level | |
| 62 | Lilliefors Test Statistic | 0.149 | Lilliefors Lognormal GOF Test | |
| 63 64 | 10% Lilliefors Critical Value | | Data appear Lognormal at 10% Significance Level at 10% Significance Level | |
| 65 | | | at 10% Significance Level Bliable for small sample sizes | |
| 66 | | • | • | |
| 67 68 | Minimum of Logged Data | Lognorma 2.944 | Il Statistics Mean of logged Data | 3.185 |
| 69 | Maximum of Logged Data | 3.401 | SD of logged Data | 0.194 |
| 70 71 | | | | |
| 71 72 | Assu 95% H-UCL | uming Logno 32.36 | prmal Distribution 90% Chebyshev (MVUE) UCL | 31.6 |
| 73 | 95% Chebyshev (MVUE) UCL | 34.81 | 97.5% Chebyshev (MVUE) UCL | 39.27 |
| 74 75 | 99% Chebyshev (MVUE) UCL | 48.03 | | |
| 76 | Nonparame | etric Distribu | tion Free UCL Statistics | |
| 77 | | | Discernible Distribution | |
| 78 79 | Namo | rametric Dic | tribution Free UCLs | |
| 80 | 95% CLT UCL | 28.33 | 95% BCA Bootstrap UCL | N/A |
| 81 | 95% Standard Bootstrap UCL | N/A | 95% Bootstrap-t UCL | N/A |
| 82 | 95% Hall's Bootstrap UCL | N/A | 95% Percentile Bootstrap UCL | N/A |

| | Α | В | С | D | E | F | G | Н | | J | K | L |
|----|----|---|----------------|----------------|---------------|----------------|-------------------|----------------|---------------|----------------|-----------------|-------|
| 83 | | | 90% Ch | ebyshev(Me | an, Sd) UCL | 31.48 | | | 95% Ch | nebyshev(Me | an, Sd) UCL | 34.64 |
| 84 | | 97.5% Chebyshev(Mean, Sd) UCL 39.03 99% Chebyshev(Mean, Sd) UCL 4 | | | | | | | 47.66 | | | |
| 85 | | | | | | | | | | | | |
| 86 | | | | | | Suggested | UCL to Use | | | | | |
| 87 | | | | 95% Stu | dent's-t UCL | 29.98 | | | | | | |
| 88 | | | | | | | | | | | | |
| 89 | | | Wher | a data set fo | ollows an app | oroximate dis | stribution pas | sing only on | e of the GOF | tests, | | |
| 90 | | | it is su | ggested to us | se a UCL bas | sed upon a d | istribution pa | ssing both G | OF tests in | ProUCL | | |
| 91 | | | | | | | | | | | | |
| 92 | 1 | Note: Sugges | stions regard | ing the selec | tion of a 95% | UCL are pr | ovided to hel | p the user to | select the m | nost appropria | ate 95% UCI | |
| 93 | | Recom | mendations | are based up | on data size | , data distrib | ution, and sk | ewness usin | g results fro | m simulation | studies. | |
| 94 | Но | wever, simu | lations result | s will not cov | er all Real W | orld data se | ts; for addition | nal insight th | ne user may | want to cons | ult a statistic | ian. |
| 95 | | | | | | | | | | | | |

| | A B C D E | F | G H I J K | L |
|----------|---|----------------|--|----------------|
| 2 | UCL Statis | stics for Unc | ensored Full Data Sets | |
| 3 | User Selected Options | | | |
| 4 5 | Date/Time of Computation ProUCL 5.2 10/31/2024 From File ProUCL Input.xls | 2:03:41 PM | | |
| 6 | Full Precision OFF | | | |
| 7 | Confidence Coefficient 95% Number of Bootstrap Operations 2000 | | | |
| 9 | Number of Bootstrap Operations 2000 | | | |
| 10 | | | | |
| 12 | SH-WRB-0.5-2 | | | |
| 13 | | | Statistics | |
| 14 15 | Total Number of Observations | 4 | Number of Distinct Observations 4 Number of Missing Observations 0 | 1 |
| 16 | Minimum | 59 | | 3 |
| 17 18 | Maximum | | | 3.5 |
| 19 | SD Coefficient of Variation | | | 1.581).632 |
| 20 | | • | | |
| 21 | | | l using incremental sampling methodology (ISM) approach, C 2020 and ITRC 2012) for additional guidance, | |
| 23 | but note that ITRC may recommend the | he t-UCL or t | he Chebyshev UCL for small sample sizes (n < 7). | |
| 24 25 | | | in gross overestimates of the mean. | |
| 26 | Reler to the Prouct 5.2 190 | ciiiicai Guid | e for a discussion of the Chebyshev UCL. | |
| 27 | | | OF Test | |
| 28 29 | Shapiro Wilk Test Statistic 1% Shapiro Wilk Critical Value | | Shapiro Wilk GOF Test Data appear Normal at 1% Significance Level | |
| 30 | Lilliefors Test Statistic | | Lilliefors GOF Test | |
| 31 32 | 1% Lilliefors Critical Value | 0.413 | Data appear Normal at 1% Significance Level | |
| 33 | | | t 1% Significance Level Bliable for small sample sizes | |
| 34 | | | | |
| 35 36 | As 95% Normal UCL | suming Nor | mal Distribution 95% UCLs (Adjusted for Skewness) | |
| 37 | 95% Normal OCL 95% Student's-t UCL | 66.72 | | 5.07 |
| 38 | | | · | 6.64 |
| 39 40 | | Gamma | GOF Test | |
| 41 | A-D Test Statistic | | Anderson-Darling Gamma GOF Test | |
| 42 43 | 5% A-D Critical Value | | Detected data appear Gamma Distributed at 5% Significance Le | evel |
| 43 | K-S Test Statistic 5% K-S Critical Value | | Kolmogorov-Smirnov Gamma GOF Test Detected data appear Gamma Distributed at 5% Significance Le | evel |
| 45 | Detected data appea | r Gamma Di | stributed at 5% Significance Level | 5701 |
| 46 47 | Note GOF tests | may be unre | eliable for small sample sizes | |
| 48 | | Gamma | Statistics | |
| 49 | k hat (MLE) | 523 | k star (bias corrected MLE) 13 | 0.9 |
| 50 51 | Theta hat (MLE) nu hat (MLE) | | Theta star (bias corrected MLE) 0 nu star (bias corrected) 104 | 0.481 |
| 52 | MLE Mean (bias corrected) | | | 5.506 |
| 53 | | | | 3.3 |
| 54 55 | Adjusted Level of Significance | N/A | Adjusted Chi Square Value N/ | /A |
| 56 | | | ma Distribution | |
| 57 58 | 95% Approximate Gamma UCL | | | /A |
| 59 | | Lognorma | GOF Test | |
| 60 | Shapiro Wilk Test Statistic | 0.938 | Shapiro Wilk Lognormal GOF Test | |
| 61 62 | 10% Shapiro Wilk Critical Value Lilliefors Test Statistic | | Data appear Lognormal at 10% Significance Level Lilliefors Lognormal GOF Test | |
| 63 | 10% Lilliefors Critical Value | | Data appear Lognormal at 10% Significance Level | |
| 64 | Data appear | Lognormal a | at 10% Significance Level | |
| 65 66 | Note GOF tests | may be unre | eliable for small sample sizes | |
| 67 | | | I Statistics | |
| 68 69 | Minimum of Logged Data | 4.078 | Mean of logged Data 4 | 4.142 |
| 70 | Maximum of Logged Data | 4.19 | SD of logged Data 0 | .0506 |
| 71 | Ass | uming Logno | rmal Distribution | |
| 72 73 | 95% H-UCL | | | 7.79 |
| 74 | 95% Chebyshev (MVUE) UCL 99% Chebyshev (MVUE) UCL | | 97.5% Chebyshev (MVUE) UCL 7. | 2.96 |
| 75 | | | | |
| 76 77 | | | tion Free UCL Statistics Discernible Distribution | |
| 78 | Data appea | ai to ioliow a | DISCOTTIBUTE DISCUDUTION | |
| 79 | | | tribution Free UCLs | |
| 80 81 | 95% CLT UCL 95% Standard Bootstrap UCL | | | /A /A |
| 82 | 95% Standard Bootstrap UCL 95% Hall's Bootstrap UCL | | 95% Percentile Bootstrap UCL N/ | |
| | | | | |

| | Α | В | С | D | E | F | G | Н | I | J | K | L |
|----|----|--------------|----------------|----------------|---------------|-------------------|------------------|----------------|----------------|--------------|-----------------|-------|
| 83 | | - | 90% Ch | ebyshev(Me | an, Sd) UCL | 67.74 | | - | 95% Ch | ebyshev(Me | an, Sd) UCL | 69.89 |
| 84 | | | 97.5% Ch | ebyshev(Me | an, Sd) UCL | 72.87 | | | 99% Ch | ebyshev(Me | an, Sd) UCL | 78.73 |
| 85 | | | | | | | | | | | | |
| 86 | | | | | | Suggested | UCL to Use | | | | | |
| 87 | | | | 95% Stu | dent's-t UCL | 66.72 | | | | | | |
| 88 | | | | Red | commended | UCL exceed | ds the maxim | num observa | ition | | | |
| 89 | | | | | | | | | | | | |
| 90 | | Note: Sugges | stions regard | ing the selec | tion of a 95% | 6 UCL are pr | ovided to hel | p the user to | select the m | ost appropri | ate 95% UCL | |
| 91 | | Recom | mendations | are based up | on data size | , data distrib | ution, and sk | ewness usin | g results fror | m simulation | studies. | |
| 92 | Но | wever, simu | lations result | s will not cov | er all Real V | Vorld data se | ts; for addition | nal insight th | ne user may | want to cons | ult a statistic | ian. |
| 93 | | | | | | | | | | | | |
| 94 | | Note: For | highly negat | ively-skewe | d data, confi | dence limits | (e.g., Chen, | Johnson, Lo | ognormal, ar | nd Gamma) ı | may not be | |
| 95 | | | reliable. | Chen's and J | ohnson's m | ethods provi | de adjustme | nts for posit | vely skewed | data sets. | | |
| 96 | | | | | | | | | | | | |

| | A B C D E | F | G H I J K | L |
|----------|---|-------------------|--|---------------|
| 2 | UCL Statis | stics for Unc | ensored Full Data Sets | |
| 3 | User Selected Options | 0.0E.E0 DM | | |
| 5 | Date/Time of Computation ProUCL 5.2 10/31/2024 : From File ProUCL Input.xls | 2:05:52 PM | | |
| 6 | Full Precision OFF | | | |
| 7 8 | Confidence Coefficient 95% Number of Bootstrap Operations 2000 | | | |
| 9 | Number of Bootstrap Operations (2000 | | | |
| 10 11 | SH-WRC-0.5-1 | | | |
| 12 | 01-W10-0.5-1 | | | |
| 13 14 | Total Number of Observations | General 4 | Statistics Number of Distinct Observations | 3 |
| 15 | Total Nulliber of Observations | 4 | Number of Missing Observations | 0 |
| 16 17 | Minimum | 12 21 | Mean | 17 17.5 |
| 18 | Maximum SD | 4.69 | Median Std. Error of Mean | 2.345 |
| 19 | Coefficient of Variation | 0.276 | Skewness | -0.155 |
| 20 21 | Note: Sample size is small (e.g., <10), if data a | are collected | using incremental sampling methodology (ISM) approach, | |
| 22 | refer also to ITRC Tech Reg Guide | on ISM (ITR | C 2020 and ITRC 2012) for additional guidance, | |
| 23 24 | | | he Chebyshev UCL for small sample sizes (n < 7). in gross overestimates of the mean. | |
| 25 | | | e for a discussion of the Chebyshev UCL. | |
| 26 27 | | Normal | POE Toet | |
| 28 | Shapiro Wilk Test Statistic | | GOF Test Shapiro Wilk GOF Test | |
| 29 30 | 1% Shapiro Wilk Critical Value | | Data appear Normal at 1% Significance Level | |
| 31 | Lilliefors Test Statistic 1% Lilliefors Critical Value | | Lilliefors GOF Test Data appear Normal at 1% Significance Level | |
| 32 | Data appe | ar Normal at | 1% Significance Level | |
| 33 34 | Note GOF tests | may be unre | eliable for small sample sizes | |
| 35 | | suming Nor | mal Distribution | |
| 36 37 | 95% Normal UCL 95% Student's-t UCL | T | 95% UCLs (Adjusted for Skewness) 95% Adjusted-CLT UCL (Chen-1995) | 20.66 |
| 38 | 95% Students-t UCL | 22.52 | 95% Adjusted-CLT UCL (Chen-1995) 95% Modified-t UCL (Johnson-1978) | 20.66 |
| 39 40 | | 0 | | |
| 41 | A-D Test Statistic | Gamma 0.51 | GOF Test Anderson-Darling Gamma GOF Test | |
| 42 | 5% A-D Critical Value | 0.657 | Detected data appear Gamma Distributed at 5% Significance | Level |
| 43 44 | K-S Test Statistic 5% K-S Critical Value | | Kolmogorov-Smirnov Gamma GOF Test Detected data appear Gamma Distributed at 5% Significance | e Level |
| 45 | Detected data appear | r Gamma Di | stributed at 5% Significance Level | |
| 46 47 | Note GOF tests | may be unre | eliable for small sample sizes | |
| 48 | | | Statistics | |
| 49 50 | k hat (MLE) Theta hat (MLE) | 16.85 1.009 | k star (bias corrected MLE) Theta star (bias corrected MLE) | 4.38 3.881 |
| 51 | nu hat (MLE) | 134.8 | nu star (bias corrected MLE) | 35.04 |
| 52 53 | MLE Mean (bias corrected) | 17 | MLE Sd (bias corrected) | 8.123 |
| 54 | Adjusted Level of Significance | N/A | Approximate Chi Square Value (0.05) Adjusted Chi Square Value | 22.5 N/A |
| 55 | | ! | | |
| 56 57 | Ase 95% Approximate Gamma UCL | | ma Distribution 95% Adjusted Gamma UCL | N/A |
| 58 | CONTRACTOR | | | |
| 59 60 | Shapiro Wilk Test Statistic | | GOF Test Shapiro Wilk Lognormal GOF Test | |
| 61 | 10% Shapiro Wilk Critical Value | 0.792 | Data appear Lognormal at 10% Significance Level | |
| 62 63 | Lilliefors Test Statistic | | Lilliefors Lognormal GOF Test | |
| 64 | 10% Lilliefors Critical Value Data appear | | Data appear Lognormal at 10% Significance Level at 10% Significance Level | |
| 65 66 | | | liable for small sample sizes | |
| 66 67 | | Lognorma | I Statistics | |
| 68 | Minimum of Logged Data | 2.485 | Mean of logged Data | 2.803 |
| 69 70 | Maximum of Logged Data | 3.045 | SD of logged Data | 0.286 |
| 71 | Assu | uming Logno | ormal Distribution | |
| 72 73 | 95% H-UCL | 26.94 | 90% Chebyshev (MVUE) UCL | 24.25 |
| 74 | 95% Chebyshev (MVUE) UCL 99% Chebyshev (MVUE) UCL | 27.53 41.03 | 97.5% Chebyshev (MVUE) UCL | 32.08 |
| 75 | | • | | |
| 76 77 | | | tion Free UCL Statistics Discernible Distribution | |
| 78 | | | | |
| 79 80 | | | tribution Free UCLs | NI/A |
| 81 | 95% CLT UCL 95% Standard Bootstrap UCL | | 95% BCA Bootstrap UCL 95% Bootstrap-t UCL | N/A N/A |
| 82 | 95% Hall's Bootstrap UCL | | 95% Percentile Bootstrap UCL | N/A |

| | Α | В | С | D | E | F | G | Н | I | J | K | L |
|----|----|--------------|----------------|----------------|---------------|----------------|------------------|----------------|----------------|--------------|-----------------|-------|
| 83 | | - | 90% Ch | ebyshev(Me | an, Sd) UCL | 24.04 | | - | 95% Ch | ebyshev(Me | an, Sd) UCL | 27.22 |
| 84 | | | 97.5% Ch | ebyshev(Me | an, Sd) UCL | 31.65 | | | 99% Ch | ebyshev(Me | an, Sd) UCL | 40.33 |
| 85 | | | | | | | | | | | | |
| 86 | | | | | | Suggested | UCL to Use | | | | | |
| 87 | | | | 95% Stu | dent's-t UCL | 22.52 | | | | | | |
| 88 | | | | Red | commended | UCL exceed | ds the maxim | num observa | ition | | | |
| 89 | | | | | | | | | | | | |
| 90 | 1 | Note: Sugges | stions regard | ling the selec | tion of a 95% | 6 UCL are pr | ovided to hel | p the user to | select the m | ost appropri | ate 95% UCL | |
| 91 | | Recom | mendations | are based up | on data size | , data distrib | ution, and sk | ewness usin | g results fror | m simulation | studies. | |
| 92 | Но | wever, simul | lations result | s will not cov | er all Real V | orld data se | ts; for addition | nal insight th | ne user may | want to cons | ult a statistic | ian. |
| 93 | | | | | | | | | | | | |
| 94 | | Note: For | highly negat | ively-skewe | d data, confi | dence limits | (e.g., Chen, | Johnson, Lo | ognormal, ar | nd Gamma) ı | may not be | |
| 95 | | | reliable. | Chen's and J | lohnson's m | ethods provi | de adjustme | nts for posit | vely skewed | data sets. | | |
| 96 | | | | | | | | | | | | |

| | A B C D E | F | G H I J K | L |
|----------|---|----------------|---|----------------|
| 2 | UCL Statis | stics for Unc | ensored Full Data Sets | |
| 3 | User Selected Options | | | |
| 4 5 | Date/Time of Computation ProUCL 5.2 10/31/2024 2 From File ProUCL Input.xls | 2:10:09 PM | | |
| 6 | Full Precision OFF | | | |
| 7 8 | Confidence Coefficient 95% Number of Bootstrap Operations 2000 | | | |
| 9 | Number of Bootstrap Operations 2000 | | | |
| 10 | 011111000000 | | | |
| 12 | SH-WRC-0.5-2 | | | |
| 13 | | | Statistics | |
| 14 15 | Total Number of Observations | 4 | Number of Distinct Observations Number of Missing Observations | 0 |
| 16 | Minimum | 14 | Mean | 18 |
| 17 18 | Maximum | | Median Std. Error of Mean | 18.5 |
| 19 | SD Coefficient of Variation | | Sta. Error of Mean Skewness | 1.78 -0.266 |
| 20 | | , | | |
| 21 22 | | | using incremental sampling methodology (ISM) approach, C 2020 and ITRC 2012) for additional guidance, | |
| 23 | but note that ITRC may recommend th | ne t-UCL or t | he Chebyshev UCL for small sample sizes (n < 7). | |
| 24 25 | | | in gross overestimates of the mean. | |
| 26 | Refer to the Prouct 5.2 Tec | ATTICAL GUID | e for a discussion of the Chebyshev UCL. | |
| 27 | | | OF Test | |
| 28 29 | Shapiro Wilk Test Statistic 1% Shapiro Wilk Critical Value | | Shapiro Wilk GOF Test Data appear Normal at 1% Significance Level | |
| 30 | Lilliefors Test Statistic | 0.3 | Lilliefors GOF Test | |
| 31 32 | 1% Lilliefors Critical Value | | Data appear Normal at 1% Significance Level | |
| 33 | | | t 1% Significance Level Bliable for small sample sizes | |
| 34 | | | | |
| 35 36 | Ass 95% Normal UCL | suming Norr | mal Distribution 95% UCLs (Adjusted for Skewness) | |
| 37 | 95% Normal OCL 95% Student's-t UCL | 22.19 | 95% OCLS (Adjusted for Skewness) 95% Adjusted-CLT UCL (Chen-1995) | 20.67 |
| 38 | | | 95% Modified-t UCL (Johnson-1978) | 22.15 |
| 39 40 | | Gamma | GOF Test | |
| 41 | A-D Test Statistic | | Anderson-Darling Gamma GOF Test | |
| 42 43 | 5% A-D Critical Value | | Detected data appear Gamma Distributed at 5% Significance | Level |
| 43 | K-S Test Statistic 5% K-S Critical Value | | Kolmogorov-Smirnov Gamma GOF Test Detected data appear Gamma Distributed at 5% Significance | l evel |
| 45 | Detected data appear | r Gamma Dis | stributed at 5% Significance Level | , LCVCI |
| 46 47 | Note GOF tests | may be unre | eliable for small sample sizes | |
| 48 | | Gamma | Statistics | |
| 49 | k hat (MLE) | 33.06 | k star (bias corrected MLE) | 8.432 |
| 50 51 | Theta hat (MLE) nu hat (MLE) | | Theta star (bias corrected MLE) nu star (bias corrected) | 2.135 67.46 |
| 52 | MLE Mean (bias corrected) | 18 | MLE Sd (bias corrected) | 6.199 |
| 53 | | | Approximate Chi Square Value (0.05) | 49.56 |
| 54 55 | Adjusted Level of Significance | N/A | Adjusted Chi Square Value | N/A |
| 56 | | | ma Distribution | |
| 57 58 | 95% Approximate Gamma UCL | | 95% Adjusted Gamma UCL | N/A |
| 59 | | Lognorma | GOF Test | |
| 60 | Shapiro Wilk Test Statistic | 0.85 | Shapiro Wilk Lognormal GOF Test | |
| 61 62 | 10% Shapiro Wilk Critical Value Lilliefors Test Statistic | | Data appear Lognormal at 10% Significance Level Lilliefors Lognormal GOF Test | |
| 63 | 10% Lilliefors Critical Value | | Data appear Lognormal at 10% Significance Level | |
| 64 | Data appear | Lognormal a | at 10% Significance Level | |
| 65 66 | Note GOF tests | may be unre | eliable for small sample sizes | |
| 67 | | | I Statistics | |
| 68 69 | Minimum of Logged Data | 2.639 | Mean of logged Data | 2.875 |
| 70 | Maximum of Logged Data | 3.045 | SD of logged Data | 0.203 |
| 71 | Assı | uming Logno | rmal Distribution | |
| 72 73 | 95% H-UCL | | 90% Chebyshev (MVUE) UCL | 23.47 |
| 74 | 95% Chebyshev (MVUE) UCL 99% Chebyshev (MVUE) UCL | | 97.5% Chebyshev (MVUE) UCL | 29.38 |
| 75 | | | | |
| 76 77 | | | tion Free UCL Statistics | |
| 78 | Data appea | ir to follow a | Discernible Distribution | |
| 79 | | | tribution Free UCLs | |
| 80 81 | 95% CLT UCL 95% Standard Bootstrap UCL | | 95% BCA Bootstrap UCL 95% Bootstrap-t UCL | N/A |
| 82 | 95% Standard Bootstrap UCL 95% Hall's Bootstrap UCL | | 95% Bootstrap-t UCL 95% Percentile Bootstrap UCL | N/A N/A |
| | 22.0 | | | |

| | Α | В | С | D | E | F | G | Н | I | J | K | L |
|----|----|--------------|----------------|----------------|---------------|-------------------|------------------|----------------|----------------|--------------|-----------------|-------|
| 83 | | - | 90% Ch | ebyshev(Me | an, Sd) UCL | 23.34 | | | 95% Ch | ebyshev(Me | an, Sd) UCL | 25.76 |
| 84 | | | 97.5% Ch | ebyshev(Me | an, Sd) UCL | 29.11 | | | 99% Ch | ebyshev(Me | an, Sd) UCL | 35.71 |
| 85 | | | | | | | | | | | | |
| 86 | | | | | | Suggested | UCL to Use | | | | | |
| 87 | | | | 95% Stu | dent's-t UCL | 22.19 | | | | | | |
| 88 | | | | Red | commended | UCL exceed | ds the maxim | num observa | ation | | | |
| 89 | | | | | | | | | | | | |
| 90 | | Note: Sugges | stions regard | ing the selec | tion of a 95% | 6 UCL are pr | ovided to hel | p the user to | select the m | ost appropri | ate 95% UCL | |
| 91 | | Recom | mendations | are based up | on data size | , data distrib | ution, and sk | ewness usin | g results fror | m simulation | studies. | |
| 92 | Но | wever, simul | lations result | s will not cov | er all Real V | Vorld data se | ts; for addition | nal insight th | ne user may | want to cons | ult a statistic | ian. |
| 93 | | | | | | | | | | | | |
| 94 | | Note: For | highly negat | ively-skewe | d data, confi | dence limits | (e.g., Chen, | Johnson, Lo | ognormal, ar | nd Gamma) i | may not be | |
| 95 | | | reliable. | Chen's and J | lohnson's m | ethods provi | de adjustme | nts for posit | vely skewed | data sets. | | |
| 96 | | | | | | | | | | | | |

| | A B C D E | F | G H I J K L | | | | | | | |
|----------|---|---|---|--|--|--|--|--|--|--|
| 2 | UCL Statis | stics for Unc | ensored Full Data Sets | | | | | | | |
| 3 | User Selected Options | 0-44-20 DM | | | | | | | | |
| 5 | Date/Time of Computation ProUCL 5.2 10/31/2024 : From File ProUCL Input.xls | 2:44:38 PIVI | | | | | | | | |
| 6 | Full Precision OFF | | | | | | | | | |
| 7 8 | Confidence Coefficient 95% Number of Bootstrap Operations 2000 | | | | | | | | | |
| 9 | Number of Bootstrap Operations (2000 | | | | | | | | | |
| 10 11 | TL-WRA-0.5-1 | | | | | | | | | |
| 12 | 11-44174-0.3-1 | | | | | | | | | |
| 13 14 | Total Number of Observations | General 4 | Statistics Number of Distinct Observations 4 | | | | | | | |
| 15 | Total Number of Observations | 4 | Number of Missing Observations 0 | | | | | | | |
| 16 17 | Minimum | | Mean 153.5 Median 153.5 | | | | | | | |
| 18 | Maximum SD | 18.41 | Median 153.5 Std. Error of Mean 9.206 | | | | | | | |
| 19 | Coefficient of Variation | 0.12 | Skewness 0 | | | | | | | |
| 20 21 | Note: Sample size is small (e.g., <10), if data a | are collected | using incremental sampling methodology (ISM) approach, | | | | | | | |
| 22 | refer also to ITRC Tech Reg Guide | on ISM (ITR | C 2020 and ITRC 2012) for additional guidance, | | | | | | | |
| 23 24 | but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7). | | | | | | | | | |
| 25 | Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshey UCL. | | | | | | | | | |
| 26 27 | | Normal | POE Tost | | | | | | | |
| 28 | Shapiro Wilk Test Statistic | | GOF Test Shapiro Wilk GOF Test | | | | | | | |
| 29 30 | 1% Shapiro Wilk Critical Value | | Data appear Normal at 1% Significance Level | | | | | | | |
| 31 | Lilliefors Test Statistic 1% Lilliefors Critical Value | | Lilliefors GOF Test Data appear Normal at 1% Significance Level | | | | | | | |
| 32 | Data appe | ar Normal at | 1% Significance Level | | | | | | | |
| 33 34 | | | | | | | | | | |
| 35 | Assuming Normal Distribution | | | | | | | | | |
| 36 37 | 95% Normal UCL 95% Student's-t UCL | 175.2 | 95% UCLs (Adjusted for Skewness) 95% Adjusted-CLT UCL (Chen-1995) 168.6 | | | | | | | |
| 38 | 95% Student S-f UCL | 1/3.2 | 95% Adjusted-CLT UCL (Chen-1995) 168.6 95% Modified-t UCL (Johnson-1978) 175.2 | | | | | | | |
| 39 40 | | 0 | | | | | | | | |
| 41 | A-D Test Statistic | | | | | | | | | |
| 42 | 5% A-D Critical Value | 0.656 | 0.656 Detected data appear Gamma Distributed at 5% Significance Level | | | | | | | |
| 43 44 | K-S Test Statistic 5% K-S Critical Value | 0.226 Kolmogorov-Smirnov Gamma GOF Test 0.394 Detected data appear Gamma Distributed at 5% Significance Level | | | | | | | | |
| 45 | Detected data appear | r Gamma Di | stributed at 5% Significance Level | | | | | | | |
| 46 47 | Note GOF tests | may be unre | eliable for small sample sizes | | | | | | | |
| 48 | | | Statistics | | | | | | | |
| 49 50 | k hat (MLE) Theta hat (MLE) | 91.85 1.671 | k star (bias corrected MLE) 23.13 Theta star (bias corrected MLE) 6.637 | | | | | | | |
| 51 | nu hat (MLE) | | nu star (bias corrected) 185 | | | | | | | |
| 52 53 | MLE Mean (bias corrected) | | MLE Sd (bias corrected) 31.92 | | | | | | | |
| 54 | Adjusted Level of Significance | N/A | Approximate Chi Square Value (0.05) 154.6 Adjusted Chi Square Value N/A | | | | | | | |
| 55 | | ! | | | | | | | | |
| 56 57 | Ase 95% Approximate Gamma UCL | | ma Distribution 95% Adjusted Gamma UCL N/A | | | | | | | |
| 58 | CONTRACTOR | | | | | | | | | |
| 59 60 | Shapiro Wilk Test Statistic | | GOF Test Shapiro Wilk Lognormal GOF Test | | | | | | | |
| 61 | 10% Shapiro Wilk Critical Value | 0.792 | Data appear Lognormal at 10% Significance Level | | | | | | | |
| 62 63 | Lilliefors Test Statistic | | Lilliefors Lognormal GOF Test | | | | | | | |
| 64 | 10% Lilliefors Critical Value Data appear | | Data appear Lognormal at 10% Significance Level at 10% Significance Level | | | | | | | |
| 65 66 | | | liable for small sample sizes | | | | | | | |
| 66 67 | | Lognorma | I Statistics | | | | | | | |
| 68 | Minimum of Logged Data | 4.875 | Mean of logged Data 5.028 | | | | | | | |
| 69 70 | Maximum of Logged Data | 5.17 | SD of logged Data 0.121 | | | | | | | |
| 71 | | | ormal Distribution | | | | | | | |
| 72 73 | 95% H-UCL | 180.2 | 90% Chebyshev (MVUE) UCL 181.3 | | | | | | | |
| 74 | 95% Chebyshev (MVUE) UCL 99% Chebyshev (MVUE) UCL | 193.9 245.8 | 97.5% Chebyshev (MVUE) UCL 211.4 | | | | | | | |
| 75 | | | , , , , , , , , , , , , , , , , , , , | | | | | | | |
| 76 77 | | | tion Free UCL Statistics Discernible Distribution | | | | | | | |
| 78 | | | | | | | | | | |
| 79 80 | | | tribution Free UCLs | | | | | | | |
| 81 | 95% CLT UCL 95% Standard Bootstrap UCL | 168.6 N/A | 95% BCA Bootstrap UCL N/A 95% Bootstrap-t UCL N/A | | | | | | | |
| 82 | 95% Hall's Bootstrap UCL | | 95% Percentile Bootstrap UCL N/A | | | | | | | |

| | Α | В | С | D | E | F | G | Н | I | J | K | L | |
|----|----------------------|---------------------------|----------------|----------------|---------------|----------------|-----------------------------------|----------------|----------------|---------------|-----------------|-----|--|
| 83 | | | 90% Ch | ebyshev(Mea | n, Sd) UCL | 181.1 | 95% Chebyshev(Mean, Sd) UCL 193.6 | | | | | | |
| 84 | | | 97.5% Ch | ebyshev(Mea | an, Sd) UCL | 211 | 99% Chebyshev(Mean, Sd) UCL 245.1 | | | | | | |
| 85 | | | | | | | | | | | | | |
| 86 | Suggested UCL to Use | | | | | | | | | | | | |
| 87 | | 95% Student's-t UCL 175.2 | | | | | | | | | | | |
| 88 | | | | | | | | | | | | | |
| 89 | | Note: Sugges | stions regard | ing the selec | tion of a 95% | UCL are pr | ovided to hel | p the user to | select the m | nost appropri | ate 95% UCL | | |
| 90 | | Recom | mendations | are based up | on data size | , data distrib | ution, and sk | ewness usin | g results from | n simulation | studies. | | |
| 91 | Ho | wever, simul | lations result | s will not cov | er all Real W | orld data se | ts; for addition | nal insight th | ne user may | want to cons | ult a statistic | an. | |
| 92 | | | | | | | | | | | | | |

| | A B C D E | F | G H I J K L | | | | | | | | |
|----------|---|----------------|--|--|--|--|--|--|--|--|--|
| 2 | UCL Statis | stics for Unc | ensored Full Data Sets | | | | | | | | |
| 3 | User Selected Options Date/Time of Computation ProUCL 5.2 10/31/2024 | 0:40:0E DM | | | | | | | | | |
| 5 | Date/Time of Computation ProUCL 5.2 10/31/2024 : From File ProUCL Input.xls | 2:48:35 PIVI | | | | | | | | | |
| 6 7 | Full Precision OFF Confidence Coefficient 95% | | | | | | | | | | |
| 8 | Number of Bootstrap Operations 2000 | | | | | | | | | | |
| 9 | | | | | | | | | | | |
| 10 11 | TL-WRA-0.5-1-DS | | | | | | | | | | |
| 12 | 12 11111 0.5 1 50 | | | | | | | | | | |
| 13 14 | Total Number of Observations | | Statistics Number of Distinct Observations 4 | | | | | | | | |
| 15 | Total Number of Observations | | Number of Missing Observations 0 | | | | | | | | |
| 16 17 | Minimum Maximum | | Mean 166.5 Median 165.5 | | | | | | | | |
| 18 | SD | | Std. Error of Mean 8.15 | | | | | | | | |
| 19 20 | Coefficient of Variation | 0.0979 | Skewness 0.2 | | | | | | | | |
| 21 | Note: Sample size is small (e.g., <10), if data a | are collected | I using incremental sampling methodology (ISM) approach, | | | | | | | | |
| 22 | refer also to ITRC Tech Reg Guide | on ISM (ITR | C 2020 and ITRC 2012) for additional guidance, | | | | | | | | |
| 23 24 | but note that ITRC may recommend the t-UCL or the Chebyshey UCL for small sample sizes (n < 7). | | | | | | | | | | |
| 25 | | | e for a discussion of the Chebyshev UCL. | | | | | | | | |
| 26 27 | | Normal (| GOF Test | | | | | | | | |
| 28 | Shapiro Wilk Test Statistic | 0.931 | Shapiro Wilk GOF Test | | | | | | | | |
| 29 30 | 1% Shapiro Wilk Critical Value Lilliefors Test Statistic | | Data appear Normal at 1% Significance Level Lilliefors GOF Test | | | | | | | | |
| 31 | 1% Lilliefors Critical Value | - | Data appear Normal at 1% Significance Level | | | | | | | | |
| 32 33 | | | 1% Significance Level | | | | | | | | |
| 34 | 4 | | | | | | | | | | |
| 35 | Assuming Normal Distribution | | | | | | | | | | |
| 36 37 | 95% Normal UCL 95% Student's-t UCL | 185.7 | 95% UCLs (Adjusted for Skewness) 95% Adjusted-CLT UCL (Chen-1995) 180.8 | | | | | | | | |
| 38 | 50% Gladding (60E | 100.7 | 95% Modified-t UCL (Johnson-1978) 185.8 | | | | | | | | |
| 39 40 | | Gamma | GOF Test | | | | | | | | |
| 41 | A-D Test Statistic | | Anderson-Darling Gamma GOF Test | | | | | | | | |
| 42 43 | 5% A-D Critical Value K-S Test Statistic | | Detected data appear Gamma Distributed at 5% Significance Level Kolmogorov-Smirnov Gamma GOF Test | | | | | | | | |
| 44 | 5% K-S Critical Value | | Detected data appear Gamma Distributed at 5% Significance Level | | | | | | | | |
| 45 46 | | | stributed at 5% Significance Level | | | | | | | | |
| 47 | Note GOF tests | may be unre | eliable for small sample sizes | | | | | | | | |
| 48 49 | 11.045 | | Statistics | | | | | | | | |
| 50 | k hat (MLE) Theta hat (MLE) | | k star (bias corrected MLE) 35.06 Theta star (bias corrected MLE) 4.75 | | | | | | | | |
| 51 | nu hat (MLE) | 1116 | nu star (bias corrected) 280.4 | | | | | | | | |
| 52 53 | MLE Mean (bias corrected) | 166.5 | MLE Sd (bias corrected) 28.12 Approximate Chi Square Value (0.05) 242.7 | | | | | | | | |
| 54 | Adjusted Level of Significance | N/A | Adjusted Chi Square Value N/A | | | | | | | | |
| 55 56 | Δο | sumina Gar | nma Distribution | | | | | | | | |
| 57 | 95% Approximate Gamma UCL | | 95% Adjusted Gamma UCL N/A | | | | | | | | |
| 58 59 | | Loanormo | I GOF Test | | | | | | | | |
| 60 | Shapiro Wilk Test Statistic | 0.931 | Shapiro Wilk Lognormal GOF Test | | | | | | | | |
| 61 62 | 10% Shapiro Wilk Critical Value | | Data appear Lognormal at 10% Significance Level | | | | | | | | |
| 63 | Lilliefors Test Statistic 10% Lilliefors Critical Value | | Lilliefors Lognormal GOF Test Data appear Lognormal at 10% Significance Level | | | | | | | | |
| 64 65 | Data appear | Lognormal a | at 10% Significance Level | | | | | | | | |
| 66 | Note GOF tests | may be unre | eliable for small sample sizes | | | | | | | | |
| 67 | | | Statistics | | | | | | | | |
| 68 69 | Minimum of Logged Data Maximum of Logged Data | | Mean of logged Data 5.111 SD of logged Data 0.0977 | | | | | | | | |
| 70 | | • | | | | | | | | | |
| 71 72 | Ass i 95% H-UCL | uming Logno | ormal Distribution | | | | | | | | |
| 73 | 95% Chebyshev (MVUE) UCL | | 90% Chebyshev (MVUE) UCL 190.9 97.5% Chebyshev (MVUE) UCL 217.3 | | | | | | | | |
| 74 75 | 99% Chebyshev (MVUE) UCL | | ,, | | | | | | | | |
| 76 | Nonnarame | etric Distribu | tion Free UCL Statistics | | | | | | | | |
| 77 | | | Discernible Distribution | | | | | | | | |
| 78 79 | Nonno | rametric Dic | tribution Free UCLs | | | | | | | | |
| 80 | 95% CLT UCL | 179.9 | 95% BCA Bootstrap UCL N/A | | | | | | | | |
| 81 82 | 95% Standard Bootstrap UCL | N/A | 95% Bootstrap-t UCL N/A | | | | | | | | |
| 62 | 95% Hall's Bootstrap UCL | N/A | 95% Percentile Bootstrap UCL N/A | | | | | | | | |

| | Α | В | С | D | E | F | G | Н | I | J | K | L | |
|----|----|---------------------------|----------------|----------------|---------------|----------------|------------------|----------------|----------------|--------------|------------------|-------|---|
| 83 | | | 90% Ch | ebyshev(Me | an, Sd) UCL | 190.9 | | | 95% Ch | ebyshev(Me | an, Sd) UCL | 202 | 1 |
| 84 | | | 97.5% Ch | ebyshev(Me | an, Sd) UCL | 217.4 | | | 99% Ch | ebyshev(Me | an, Sd) UCL | 247.6 |] |
| 85 | | | | | | | | | | | |] | |
| 86 | | Suggested UCL to Use | | | | | | | | | |] | |
| 87 | | 95% Student's-t UCL 185.7 | | | | | | | | | | 1 | |
| 88 | | | | Red | commended | UCL exceed | ds the maxim | num observa | tion | | | | 1 |
| 89 | | | | | | | | | | | | | |
| 90 | 1 | Note: Sugges | stions regard | ling the selec | tion of a 95% | 6 UCL are pr | ovided to hel | p the user to | select the m | ost appropri | ate 95% UCL | | |
| 91 | | Recom | mendations | are based up | on data size | , data distrib | ution, and sk | ewness usin | g results fror | m simulation | studies. | | |
| 92 | Но | wever, simu | lations result | s will not cov | er all Real V | /orld data se | ts; for addition | nal insight th | ne user may | want to cons | ult a statistici | an. | |
| 93 | | - | • | | | • | | | | | | | 1 |

| | A B C D E | F | G H I J K L | | | | | | | |
|----------|--|-----------------|---|--|--|--|--|--|--|--|
| 2 | UCL Statis | stics for Unc | ensored Full Data Sets | | | | | | | |
| 3 | User Selected Options | 0.50.44.514 | | | | | | | | |
| 4 5 | Date/Time of Computation ProUCL 5.2 10/31/2024 : From File ProUCL Input.xls | 2:50:44 PM | | | | | | | | |
| 6 | Full Precision OFF | | | | | | | | | |
| 7 | Confidence Coefficient 95% Number of Bootstrap Operations 2000 | | | | | | | | | |
| 9 | Number of Bootstrap Operations 2000 | | | | | | | | | |
| 10 | TI WOA OF A DOO | | | | | | | | | |
| 12 | TL-WRA-0.5-1-DS-2 | | | | | | | | | |
| 13 | | | Statistics | | | | | | | |
| 14 15 | Total Number of Observations | 4 | Number of Distinct Observations 4 Number of Missing Observations 0 | | | | | | | |
| 16 | Minimum | 161 | Mean 175.3 | | | | | | | |
| 17 18 | Maximum | | Median 177.5 | | | | | | | |
| 19 | SD Coefficient of Variation | 10.14 0.0579 | Std. Error of Mean 5.072 Skewness -1.239 | | | | | | | |
| 20 | | | | | | | | | | |
| 21 | | | I using incremental sampling methodology (ISM) approach, C 2020 and ITRC 2012) for additional guidance, | | | | | | | |
| 23 | | | the Chebyshev UCL for small sample sizes (n < 7). | | | | | | | |
| 24 25 | The Chebyshev UCL o | ften results | in gross overestimates of the mean. | | | | | | | |
| 26 | Refer to the ProUCL 5.2 Led | chnical Guid | e for a discussion of the Chebyshev UCL. | | | | | | | |
| 27 | | | GOF Test | | | | | | | |
| 28 29 | Shapiro Wilk Test Statistic 1% Shapiro Wilk Critical Value | | Shapiro Wilk GOF Test Data appear Normal at 1% Significance Level | | | | | | | |
| 30 | 1% Snapiro Wilk Critical Value Lilliefors Test Statistic | | Lilliefors GOF Test | | | | | | | |
| 31 | 1% Lilliefors Critical Value | 0.413 | Data appear Normal at 1% Significance Level | | | | | | | |
| 32 33 | | | t 1% Significance Level | | | | | | | |
| 34 | | | | | | | | | | |
| 35 | Assuming Normal Distribution | | | | | | | | | |
| 36 37 | 95% Normal UCL 95% Student's-t UCL | 187.2 | 95% UCLs (Adjusted for Skewness) 95% Adjusted-CLT UCL (Chen-1995) 180.2 | | | | | | | |
| 38 | 3370 Ottacht 3-1 OOL | 107.2 | 95% Modified-t UCL (Johnson-1978) 186.7 | | | | | | | |
| 39 40 | | | | | | | | | | |
| 41 | A-D Test Statistic | 0.412 | GOF Test Anderson-Darling Gamma GOF Test | | | | | | | |
| 42 | 5% A-D Critical Value | | Detected data appear Gamma Distributed at 5% Significance Level | | | | | | | |
| 43 44 | K-S Test Statistic | | Kolmogorov-Smirnov Gamma GOF Test | | | | | | | |
| 45 | 5% K-S Critical Value Detected data appear | | Detected data appear Gamma Distributed at 5% Significance Level stributed at 5% Significance Level | | | | | | | |
| 46 | | | eliable for small sample sizes | | | | | | | |
| 47 48 | | Gamma | Statistics | | | | | | | |
| 49 | k hat (MLE) | | k star (bias corrected MLE) 97.1 | | | | | | | |
| 50 51 | Theta hat (MLE) | | Theta star (bias corrected MLE) 1.805 | | | | | | | |
| 52 | nu hat (MLE) MLE Mean (bias corrected) | | nu star (bias corrected) 776.8 MLE Sd (bias corrected) 17.79 | | | | | | | |
| 53 | | | Approximate Chi Square Value (0.05) 713.1 | | | | | | | |
| 54 55 | Adjusted Level of Significance | N/A | Adjusted Chi Square Value N/A | | | | | | | |
| 56 | As | suming Gam | nma Distribution | | | | | | | |
| 57 50 | 95% Approximate Gamma UCL | | 95% Adjusted Gamma UCL N/A | | | | | | | |
| 58 59 | | Lognorma | I GOF Test | | | | | | | |
| 60 | Shapiro Wilk Test Statistic | 0.889 | Shapiro Wilk Lognormal GOF Test | | | | | | | |
| 61 62 | 10% Shapiro Wilk Critical Value | | Data appear Lognormal at 10% Significance Level | | | | | | | |
| 63 | Lilliefors Test Statistic 10% Lilliefors Critical Value | | Lilliefors Lognormal GOF Test Data appear Lognormal at 10% Significance Level | | | | | | | |
| 64 | Data appear | Lognormal a | at 10% Significance Level | | | | | | | |
| 65 66 | Note GOF tests | may be unre | eliable for small sample sizes | | | | | | | |
| 67 | | Lognorma | I Statistics | | | | | | | |
| 68 | Minimum of Logged Data | 5.081 | Mean of logged Data 5.165 | | | | | | | |
| 69 70 | Maximum of Logged Data | 5.22 | SD of logged Data 0.059 | | | | | | | |
| 71 | Ass | uming Logno | ormal Distribution | | | | | | | |
| 72 73 | 95% H-UCL | N/A | 90% Chebyshev (MVUE) UCL 190.8 | | | | | | | |
| 74 | 95% Chebyshev (MVUE) UCL 99% Chebyshev (MVUE) UCL | 197.8 226.7 | 97.5% Chebyshev (MVUE) UCL 207.6 | | | | | | | |
| 75 | | | | | | | | | | |
| 76 77 | | | tion Free UCL Statistics | | | | | | | |
| 78 | Data appea | ar to follow a | Discernible Distribution | | | | | | | |
| 79 | | | tribution Free UCLs | | | | | | | |
| 80 81 | 95% CLT UCL | 183.6 | 95% BCA Bootstrap UCL N/A | | | | | | | |
| 82 | 95% Standard Bootstrap UCL 95% Hall's Bootstrap UCL | 1 | 95% Bootstrap-t UCL N/A 95% Percentile Bootstrap UCL N/A | | | | | | | |
| | 35 /0 Hall 5 DOUISHAP UCL | 1107 | 35 /0 1 GICCHILIC DOUGLIAP OCE 14/A | | | | | | | |

| | Α | В | С | D | E | F | G | Н | I | J | K | L |
|----|---|--------------|----------------|----------------|---------------|----------------|------------------|----------------|----------------|--------------|-----------------|-------|
| 83 | | - | 90% Ch | ebyshev(Me | an, Sd) UCL | 190.5 | | | 95% Ch | ebyshev(Me | an, Sd) UCL | 197.4 |
| 84 | | | 97.5% Ch | ebyshev(Me | an, Sd) UCL | 206.9 | | | 99% Ch | ebyshev(Me | an, Sd) UCL | 225.7 |
| 85 | | | | | | | | | | | | |
| 86 | Suggested UCL to Use | | | | | | | | | | | |
| 87 | 95% Student's-t UCL 187.2 | | | | | | | | | | | |
| 88 | Recommended UCL exceeds the maximum observation | | | | | | | | | | | |
| 89 | | | | | | | | | | | | |
| 90 | 1 | Note: Sugges | stions regard | ling the selec | tion of a 95% | 6 UCL are pr | ovided to hel | p the user to | select the m | ost appropri | ate 95% UCL | |
| 91 | | Recom | mendations | are based up | on data size | , data distrib | ution, and sk | ewness usin | g results fror | n simulation | studies. | |
| 92 | Но | wever, simul | lations result | s will not cov | er all Real V | Vorld data se | ts; for addition | nal insight th | ne user may | want to cons | ult a statistic | ian. |
| 93 | | | | | | | | | | | | |
| 94 | | Note: For | highly negat | ively-skewe | d data, confi | dence limits | (e.g., Chen, | Johnson, Lo | ognormal, ar | nd Gamma) i | may not be | |
| 95 | | | reliable. | Chen's and J | lohnson's m | ethods provi | de adjustme | nts for posit | vely skewed | data sets. | | |
| 96 | | | | | | | | | | | | |

| | A B C D E | F | G H I J K L | | | | | | | | |
|----------|---|---|---|--|--|--|--|--|--|--|--|
| 2 | UCL Statis | stics for Unc | ensored Full Data Sets | | | | | | | | |
| 3 | User Selected Options | 0.40.04.504 | | | | | | | | | |
| 4 5 | Date/Time of Computation ProUCL 5.2 10/31/2024 ProUCL Input.xls | 2:46:21 PM | | | | | | | | | |
| 6 | Full Precision OFF | | | | | | | | | | |
| 7 8 | Confidence Coefficient 95% Number of Bootstrap Operations 2000 | | | | | | | | | | |
| 9 | Number of Bootstrap Operations 2000 | | | | | | | | | | |
| 10 | TL-WRA-0.5-1-DUP | | | | | | | | | | |
| 12 | IL-WRA-0.5-1-DUP | | | | | | | | | | |
| 13 14 | T. IN 1 (0) | | Statistics | | | | | | | | |
| 15 | Total Number of Observations | 4 | Number of Distinct Observations 4 Number of Missing Observations 0 | | | | | | | | |
| 16 | Minimum | | Mean 159 | | | | | | | | |
| 17 18 | Maximum SD | | Median 161 Std. Error of Mean 10 | | | | | | | | |
| 19 | Coefficient of Variation | | Skewness -0.56 | | | | | | | | |
| 20 21 | Note: Comple size is small (a.g. <10) if date | ara callacted | Lucing incremental compling methodology (ICM) approach | | | | | | | | |
| 22 | | | I using incremental sampling methodology (ISM) approach, C 2020 and ITRC 2012) for additional guidance, | | | | | | | | |
| 23 | but note that ITRC may recommend the | ne t-UCL or t | he Chebyshev UCL for small sample sizes (n < 7). | | | | | | | | |
| 24 25 | The Chebyshey UCL often results in gross overestimates of the mean. | | | | | | | | | | |
| 26 | 1,000, 10 110 1 1000 2 0.2 100 | | • | | | | | | | | |
| 27 28 | Shapiro Wilk Test Statistic | | GOF Test Shapiro Wilk GOF Test | | | | | | | | |
| 29 | 1% Shapiro Wilk Critical Value | 0.687 | Data appear Normal at 1% Significance Level | | | | | | | | |
| 30 31 | Lilliefors Test Statistic | | Lilliefors GOF Test | | | | | | | | |
| 32 | 1% Lilliefors Critical Value Data appe | | Data appear Normal at 1% Significance Level t 1% Significance Level | | | | | | | | |
| 33 | | | eliable for small sample sizes | | | | | | | | |
| 34 35 | | | | | | | | | | | |
| 36 | 95% Normal UCL | | 95% UCLs (Adjusted for Skewness) | | | | | | | | |
| 37 38 | 95% Student's-t UCL | 182.5 | 95% Adjusted-CLT UCL (Chen-1995) 172.5 | | | | | | | | |
| 39 | | 95% Modified-t UCL (Johnson-1978) 182.1 | | | | | | | | | |
| 40 41 | ABTIONS | | GOF Test | | | | | | | | |
| 42 | A-D Test Statistic 5% A-D Critical Value | 0.656 Detected data appear Gamma Distributed at 5% Significance Level | | | | | | | | | |
| 43 | K-S Test Statistic | 0.219 | 0.219 Kolmogorov-Smirnov Gamma GOF Test | | | | | | | | |
| 44 45 | 5% K-S Critical Value Detected data appea | | Detected data appear Gamma Distributed at 5% Significance Level stributed at 5% Significance Level | | | | | | | | |
| 46 | | | eliable for small sample sizes | | | | | | | | |
| 47 48 | | Cammo | Statistics | | | | | | | | |
| 49 | k hat (MLE) | 81.54 | k star (bias corrected MLE) 20.55 | | | | | | | | |
| 50 51 | Theta hat (MLE) | 1.95 | Theta star (bias corrected MLE) 7.737 | | | | | | | | |
| 52 | nu hat (MLE) MLE Mean (bias corrected) | | nu star (bias corrected) 164.4 MLE Sd (bias corrected) 35.07 | | | | | | | | |
| 53 | | | Approximate Chi Square Value (0.05) 135.8 | | | | | | | | |
| 54 55 | Adjusted Level of Significance | N/A | Adjusted Chi Square Value N/A | | | | | | | | |
| 56 | | | ma Distribution | | | | | | | | |
| 57 58 | 95% Approximate Gamma UCL | 192.6 | 95% Adjusted Gamma UCL N/A | | | | | | | | |
| 59 | | | GOF Test | | | | | | | | |
| 60 61 | Shapiro Wilk Test Statistic | 0.968 | Shapiro Wilk Lognormal GOF Test | | | | | | | | |
| 62 | 10% Shapiro Wilk Critical Value Lilliefors Test Statistic | | Data appear Lognormal at 10% Significance Level Lilliefors Lognormal GOF Test | | | | | | | | |
| 63 | 10% Lilliefors Critical Value | 0.346 | Data appear Lognormal at 10% Significance Level | | | | | | | | |
| 64 65 | Data appear Note GOF tests | may be upre | at 10% Significance Level eliable for small sample sizes | | | | | | | | |
| 66 | Hote GOT tests | | | | | | | | | | |
| 67 68 | Minimum of Logged Data | | I Statistics Mean of logged Data 5.063 | | | | | | | | |
| 69 | Maximum of Logged Data Maximum of Logged Data | | SD of logged Data 0.129 | | | | | | | | |
| 70 71 | | • | | | | | | | | | |
| 71 72 | Assi 95% H-UCL | uming Logno 189 | prmal Distribution 90% Chebyshev (MVUE) UCL 189.8 | | | | | | | | |
| 73 | 95% Chebyshev (MVUE) UCL | 203.7 | 97.5% Chebyshev (MVUE) UCL 223.1 | | | | | | | | |
| 74 75 | 99% Chebyshev (MVUE) UCL | 261.1 | | | | | | | | | |
| 76 | Nonparame | etric Distribu | tion Free UCL Statistics | | | | | | | | |
| 77 78 | Data appea | ar to follow a | Discernible Distribution | | | | | | | | |
| 78 79 | Nonna | rametric Dis | tribution Free UCLs | | | | | | | | |
| 80 | 95% CLT UCL | 175.4 | 95% BCA Bootstrap UCL N/A | | | | | | | | |
| 81 82 | 95% Standard Bootstrap UCL 95% Hall's Bootstrap UCL | | 95% Bootstrap-t UCL N/A 95% Percentile Bootstrap UCL N/A | | | | | | | | |
| υŁ | 95% Hall'S BOOISTIAD UCL | IN/A | 95% Percentile Bootstrap UCL N/A | | | | | | | | |

| | Α | В | С | D | E | F | G | Н | I | J | K | L |
|----|----------------------|--------------|----------------|----------------|---------------|----------------|------------------|----------------|----------------|--------------|-----------------|-------|
| 83 | | | 90% Ch | ebyshev(Mea | an, Sd) UCL | 189 | | | 95% Ch | ebyshev(Me | an, Sd) UCL | 202.6 |
| 84 | | | 97.5% Ch | ebyshev(Mea | an, Sd) UCL | 221.4 | | | 99% Ch | ebyshev(Me | an, Sd) UCL | 258.5 |
| 85 | | | | | | | | | | | | |
| 86 | Suggested UCL to Use | | | | | | | | | | | |
| 87 | 95% Student's-t UCL | | | | | | | | | | | |
| 88 | | | | Red | commended | UCL exceed | ds the maxim | num observa | ition | | | |
| 89 | | | | | | | | | | | | |
| 90 | 1 | Note: Sugges | stions regard | ing the selec | tion of a 95% | 6 UCL are pr | ovided to hel | p the user to | select the m | ost appropri | ate 95% UCL | |
| 91 | | Recom | mendations | are based up | on data size | , data distrib | ution, and sk | ewness usin | g results fror | n simulation | studies. | |
| 92 | Ho | wever, simu | lations result | s will not cov | er all Real W | Vorld data se | ts; for addition | nal insight th | ne user may | want to cons | ult a statistic | ian. |
| 93 | | | | | | | | | | | | |
| 94 | | Note: For | highly negat | ively-skewe | d data, confi | dence limits | (e.g., Chen, | Johnson, Lo | ognormal, ar | nd Gamma) ı | may not be | |
| 95 | | | reliable. | Chen's and J | ohnson's m | ethods provi | de adjustme | nts for posit | vely skewed | data sets. | | |
| 96 | | | | | | | | | | | | |

| \Box | A B C D E | F | G H I J K L | | | | | | | | |
|----------|---|----------------|--|--|--|--|--|--|--|--|--|
| 2 | UCL Statis | stics for Unc | ensored Full Data Sets | | | | | | | | |
| 3 | User Selected Options | 0 F0 00 DM | | | | | | | | | |
| 5 | Date/Time of Computation ProUCL 5.2 10/31/2024 : From File ProUCL Input.xls | 2:52:38 PIVI | | | | | | | | | |
| 6 | Full Precision OFF | | | | | | | | | | |
| 7 8 | Confidence Coefficient 95% Number of Bootstrap Operations 2000 | | | | | | | | | | |
| 9 | Number of Bootstrap Operations 2000 | | | | | | | | | | |
| 10 | TL-WRA-0.5-2 | | | | | | | | | | |
| 12 | IL-WRA-0.5-2 | | | | | | | | | | |
| 13 | | | Statistics | | | | | | | | |
| 14 15 | Total Number of Observations | 4 | Number of Distinct Observations 3 Number of Missing Observations 0 | | | | | | | | |
| 16 | Minimum | | Mean 278 | | | | | | | | |
| 17 18 | Maximum | 299 24.47 | Median 280 Std. Error of Mean 12.23 | | | | | | | | |
| 19 | SD Coefficient of Variation | | Sta. Error of Mean 12.23 Skewness -0.0918 | | | | | | | | |
| 20 | | • | | | | | | | | | |
| 21 22 | I using incremental sampling methodology (ISM) approach, C 2020 and ITRC 2012) for additional guidance, | | | | | | | | | | |
| 23 | | | the Chebyshev UCL for small sample sizes (n < 7). | | | | | | | | |
| 24 25 | | | in gross overestimates of the mean. | | | | | | | | |
| 26 | Refer to the ProucL 5.2 Tec | cnnicai Guid | e for a discussion of the Chebyshev UCL. | | | | | | | | |
| 27 | | | GOF Test | | | | | | | | |
| 28 29 | Shapiro Wilk Test Statistic 1% Shapiro Wilk Critical Value | | Shapiro Wilk GOF Test | | | | | | | | |
| 30 | 1% Snapiro Wilk Critical Value Lilliefors Test Statistic | | Data appear Normal at 1% Significance Level Lilliefors GOF Test | | | | | | | | |
| 31 | 1% Lilliefors Critical Value | 0.413 | Data appear Normal at 1% Significance Level | | | | | | | | |
| 32 33 | | | t 1% Significance Level | | | | | | | | |
| 34 | Note GOF tests may be unreliable for small sample sizes | | | | | | | | | | |
| 35 | Assuming Normal Distribution | | | | | | | | | | |
| 36 37 | 95% Normal UCL 95% Student's-t UCL | 306.8 | 95% UCLs (Adjusted for Skewness) 95% Adjusted-CLT UCL (Chen-1995) 297.5 | | | | | | | | |
| 38 | 95 % Students-t OCL | 300.6 | 95% Adjusted-CET OCE (Cheri-1993) 297.3 95% Modified-t UCL (Johnson-1978) 306.7 | | | | | | | | |
| 39 | | | | | | | | | | | |
| 40 41 | A-D Test Statistic | 0.564 | GOF Test Anderson-Darling Gamma GOF Test | | | | | | | | |
| 42 | 5% A-D Critical Value | | Detected data appear Gamma Distributed at 5% Significance Level | | | | | | | | |
| 43 | K-S Test Statistic | | Kolmogorov-Smirnov Gamma GOF Test | | | | | | | | |
| 44 45 | 5% K-S Critical Value | | Detected data appear Gamma Distributed at 5% Significance Level stributed at 5% Significance Level | | | | | | | | |
| 46 | | | eliable for small sample sizes | | | | | | | | |
| 47 48 | | • | OLUMBIA. | | | | | | | | |
| 49 | k hat (MLE) | 171.3 | Statistics k star (bias corrected MLE) 42.99 | | | | | | | | |
| 50 | Theta hat (MLE) | 1.623 | Theta star (bias corrected MLE) 6.467 | | | | | | | | |
| 51 52 | nu hat (MLE) MLE Mean (bias corrected) | | nu star (bias corrected) 343.9 MLE Sd (bias corrected) 42.4 | | | | | | | | |
| 53 | MLE Mean (bias corrected) | 270 | Approximate Chi Square Value (0.05) 301.9 | | | | | | | | |
| 54 | Adjusted Level of Significance | N/A | Adjusted Chi Square Value N/A | | | | | | | | |
| 55 56 | Ac | sumina Gam | nma Distribution | | | | | | | | |
| 57 | 95% Approximate Gamma UCL | | 95% Adjusted Gamma UCL N/A | | | | | | | | |
| 58 59 | | | | | | | | | | | |
| 60 | Shapiro Wilk Test Statistic | | GOF Test Shapiro Wilk Lognormal GOF Test | | | | | | | | |
| 61 | 10% Shapiro Wilk Critical Value | 0.792 | Data appear Lognormal at 10% Significance Level | | | | | | | | |
| 62 63 | Lilliefors Test Statistic | | Lilliefors Lognormal GOF Test | | | | | | | | |
| 64 | 10% Lilliefors Critical Value Data appear | | Data appear Lognormal at 10% Significance Level at 10% Significance Level | | | | | | | | |
| 65 | | | eliable for small sample sizes | | | | | | | | |
| 66 67 | | Loancer | Il Statistics | | | | | | | | |
| 68 | Minimum of Logged Data | | Il Statistics Mean of logged Data 5.625 | | | | | | | | |
| 69 | Maximum of Logged Data | | SD of logged Data 0.0884 | | | | | | | | |
| 70 71 | Aggs | umina Loans | ormal Distribution | | | | | | | | |
| 72 | 95% H-UCL | N/A | 90% Chebyshev (MVUE) UCL 314.8 | | | | | | | | |
| 73 | 95% Chebyshev (MVUE) UCL | 331.5 | 97.5% Chebyshev (MVUE) UCL 354.7 | | | | | | | | |
| 74 75 | 99% Chebyshev (MVUE) UCL | 400.2 | | | | | | | | | |
| 76 | Nonparame | etric Distribu | tion Free UCL Statistics | | | | | | | | |
| 77 70 | | | Discernible Distribution | | | | | | | | |
| 78 79 | Nonna | rametric Die | tribution Free UCLs | | | | | | | | |
| 80 | 95% CLT UCL | | 95% BCA Bootstrap UCL N/A | | | | | | | | |
| 81 | 95% Standard Bootstrap UCL | N/A | 95% Bootstrap-t UCL N/A | | | | | | | | |
| 82 | 95% Hall's Bootstrap UCL | N/A | 95% Percentile Bootstrap UCL N/A | | | | | | | | |

| | Α | В | С | D | Е | F | G | Н | I | J | K | L | Γ |
|----|----|--------------|----------------|----------------|---------------|----------------|------------------|----------------|----------------|--------------|-----------------|-------|---|
| 83 | | | 90% Ch | ebyshev(Me | an, Sd) UCL | 314.7 | | | 95% Ch | ebyshev(Me | an, Sd) UCL | 331.3 | 1 |
| 84 | | | 97.5% Ch | ebyshev(Me | an, Sd) UCL | 354.4 | | | 99% Ch | ebyshev(Me | an, Sd) UCL | 399.7 |] |
| 85 | | | | | | | | | | | | | |
| 86 | | | | | | Suggested | UCL to Use | | | | | | |
| 87 | | | | 95% Stu | dent's-t UCL | 306.8 | | | | | | | |
| 88 | | | | Red | commended | UCL exceed | ds the maxim | num observa | ation | | | | |
| 89 | | | | | | | | | | | | | |
| 90 | l | Note: Sugges | stions regard | ing the selec | tion of a 95% | 6 UCL are pr | ovided to hel | p the user to | select the m | ost appropri | ate 95% UCL | | |
| 91 | | Recom | mendations | are based up | on data size | , data distrib | ution, and sk | ewness usin | g results fror | m simulation | studies. | | |
| 92 | Ho | wever, simu | lations result | s will not cov | er all Real V | Vorld data se | ts; for addition | nal insight th | ne user may | want to cons | ult a statistic | ian. | |
| 93 | | | | | | | | | | | | | |
| 94 | | Note: For | highly negat | ively-skewe | d data, confi | dence limits | (e.g., Chen, | Johnson, Lo | ognormal, ar | nd Gamma) ı | may not be | | |
| 95 | | | reliable. | Chen's and J | ohnson's m | ethods provi | de adjustme | nts for posit | vely skewed | data sets. | | | |
| 96 | | | | | | | | | | | | | 1 |

| 1 | A B C D E | F | G ensored Full Data | H ta Sets | | J | K | | L |
|----------|---|--------------------|---------------------------------------|---------------|------------------------|-------------------------|---------------------------------|----------------|----------------|
| 2 | | ilica ioi orio | Chisored I dii Dali | ia ocis | | | | | |
| 3 | User Selected Options | 0.E4.00 DN4 | | | | | | | |
| 5 | Date/Time of Computation ProUCL 5.2 10/31/2024 2 From File ProUCL Input.xls | 2:54:29 PIVI | | | | | | | |
| 6 | Full Precision OFF | | | | | | | | |
| 7 | Confidence Coefficient 95% | | | | | | | | |
| 8 | Number of Bootstrap Operations 2000 | | | | | | | | |
| 10 | | | | | | | | | |
| | TL-WRA-0.5-3 | | | | | | | | |
| 12 | | General | Statistics | | | | | | |
| 14 | Total Number of Observations | 10 | | | Number | r of Distin | ct Observatio | ns | 10 |
| 15 16 | Minimo | 201 | | | Number | of Missin | g Observatio | | 0 |
| 17 | Minimum Maximum | 321 438 | | | | | Me Medi | _ | 371 369 |
| 18 | SD | 35.16 | | | | Sto | l. Error of Me | an | 11.12 |
| 19 20 | Coefficient of Variation | 0.0948 | | | | | Skewne | SS | 0.551 |
| 21 | | Normal (| GOF Test | | | | | | |
| 22 | Shapiro Wilk Test Statistic | 0.976 | | | hapiro Wi | | | | |
| 23 24 | 1% Shapiro Wilk Critical Value Lilliefors Test Statistic | 0.781 0.143 | Da | | Normal a Lilliefors | | ificance Leve | | |
| 25 | 1% Lilliefors Critical Value | 0.304 | Da | | | | ificance Leve | | |
| 26 27 | Data appea | ar Normal a | t 1% Significance | e Level | | | | | |
| 28 | Δει | sumina Nor | mal Distribution | | | | | | |
| 29 | 95% Normal UCL | | | | | | Skewness) | | |
| 30 31 | 95% Student's-t UCL | 391.4 | | | | | CL (Chen-199 (Johnson-197 | | 391.4 391.7 |
| 32 | | | 1 | 95 | o ∕o IVIOQITI€ | eu-ι UCL (| JUIIISON-197 | 0) | 381./ |
| 33 | , | | GOF Test | | | | | | |
| 34 35 | A-D Test Statistic 5% A-D Critical Value | 0.146 0.724 | Detected dat | | | | GOF Test | ana | a Levol |
| 36 | K-S Test Statistic | 0.128 | | | | | at 5% Signific a GOF Test | ance | FEAGI |
| 37 | 5% K-S Critical Value | 0.266 | Detected dat | ta appear C | amma Di | | | ance | e Level |
| 38 39 | Detected data appear | Gamma Di | stributed at 5% S | significance | e Level | | | | |
| 40 | | | Statistics | | | | | | |
| 41 | k hat (MLE) | 126.2 | | | | | corrected ML | | 88.42 |
| 43 | Theta hat (MLE) nu hat (MLE) | 2.939 2524 | | | r neta s | | corrected ML (bias correcte | | 4.196 1768 |
| 44 | MLE Mean (bias corrected) | | | | | MLE Sd | (bias correcte | ed) | 39.45 |
| 45 46 | Adjusted Level of Significance | 0.0267 | | Ap | | | are Value (0.0 ni Square Val | | 1672 1655 |
| 47 | Aujusteu Level of Signification | 0.0207 | | | A(| ajusi c u Ol | Oquale Val | u u | 1000 |
| 48 49 | | | ma Distribution | | | O/ A -1:. : | | | 206.2 |
| 50 | 95% Approximate Gamma UCL | 392.5 | 1 | | 95 | % Adjuste | ed Gamma U | JL | 396.3 |
| 51 | | | GOF Test | | | | | | |
| 52 53 | Shapiro Wilk Test Statistic 10% Shapiro Wilk Critical Value | 0.986 0.869 | Deta | | Wilk Log | | | vol | |
| 54 | Lilliefors Test Statistic | 0.869 | Data | | ors Logno | | gnificance Le F Test | vei | |
| 55 | 10% Lilliefors Critical Value | 0.241 | | a appear Lo | | | gnificance Le | vel | |
| 56 57 | Data appear | <u>Lognormal</u> : | at 10% Significan | nce Level | | | | | |
| 58 | | Lognorma | l Statistics | | | | | | |
| 59 60 | Minimum of Logged Data | 5.771 | | | | | of logged Da | | 5.912 |
| 61 | Maximum of Logged Data | 6.082 | 1 | | | 50 | of logged Da | ıld | 0.0935 |
| 62 | | | rmal Distribution | n | | | | | |
| 63 64 | 95% H-UCL 95% Chebyshev (MVUE) UCL | N/A 418.8 | | | | | ev (MVUE) U(ev (MVUE) U(| | 403.9 |
| 65 | 95% Chebyshev (MVUE) UCL 99% Chebyshev (MVUE) UCL | 480.2 | | | 37.3% | CHEDYSHE | ov (IVIVUE) U | ⊅ L | 439.5 |
| 66 | | | | | | | | | |
| 67 68 | | | tion Free UCL St Discernible Distr | | | | | | |
| 69 | | | | | | | | | |
| 70 71 | | | tribution Free UC | CLs | | 0E0/ DOA | Doctor- 11 | - ا اد | 200.2 |
| 72 | 95% CLT UCL 95% Standard Bootstrap UCL | 389.3 388.3 | | | | | Bootstrap UG Bootstrap-t UG | | 390.2 394.5 |
| 73 | 95% Hall's Bootstrap UCL | 395.2 | | | | Percentile | Bootstrap U | CL | 388.6 |
| 74 75 | 90% Chebyshev(Mean, Sd) UCL | 404.4 | | | | | Mean, Sd) U(| | 419.5 |
| 76 | 97.5% Chebyshev(Mean, Sd) UCL | 440.4 | <u> </u> | | 99% CN | ienysnev(| Mean, Sd) U | ∠ L | 481.6 |
| 77 | | | UCL to Use | | | | | | |
| 78 79 | 95% Student's-t UCL | 391.4 | | | | | | | |
| 80 | Note: Suggestions regarding the selection of a 95% | UCL are pr | ovided to help the | e user to se | elect the m | nost appro | priate 95% U | CL. | |
| 81 | Recommendations are based upon data size, | data distrib | ution, and skewne | ess using r | esults fror | m simulati | on studies. | | |
| 82 | However, simulations results will not cover all Real W | orld data se | ts; tor additional in | ınsight the ı | user may | want to co | onsult a statis | ticiar | ٦. |

83 B C D E F G H I J K L

| | Α | В | С | D | E LIOL Otatio | F | G H I J K | L | | | | |
|----------|---|------------------------------|----------------|----------------------------------|-----------------------------------|----------------|--|----------------|--|--|--|--|
| 2 | | | | | UCL Statis | Stics for Unc | ensored Full Data Sets | | | | | |
| 3 | D-t- | | cted Options | | 10/01/0004 | 0.E0.00 DM | | | | | | |
| 5 | Date | e/Time of Co | From File | ProUCL 5.2 ProUCL Inpu | | 2:56:02 PM | | | | | | |
| 6 | | | I Precision | OFF | | | | | | | | |
| 7 8 | | Confidence Bootstrap (| | 95% 2000 | | | | | | | | |
| 9 | Trainber of | Воогонар (| Орогацопо | 12000 | | | | | | | | |
| 10 11 | TL-WRA-0.5 | _1 | | | | | | | | | | |
| 12 | IL-VVINA-U.S | | | | | | | | | | | |
| 13 14 | | | Total | Number of Ol | haanuationa | General 4 | Statistics Number of Distinct Observations | 4 | | | | |
| 15 | | | TOLAI | Number of Or | <u>uservalions</u> | 4 | Number of Missing Observations | 0 | | | | |
| 16 17 | | | | | Minimum Maximum | | | 59 59 | | | | |
| 18 | | | | | SD | | | 14.72 | | | | |
| 19 20 | | | | Coefficient | of Variation | 0.185 | Skewness | 0 | | | | |
| 21 | | Note: Sar | mple size is : | small (e.g., < | 10). if data a | are collected | using incremental sampling methodology (ISM) approach, | | | | | |
| 22 | | | refer also to | o ITRC Tech I | Reg Guide | on ISM (ITR | C 2020 and ITRC 2012) for additional guidance, | | | | | |
| 23 24 | | b | out note that | | | | he Chebyshev UCL for small sample sizes (n < 7). In gross overestimates of the mean. | | | | | |
| 25 | | | Ref | | | | e for a discussion of the Chebyshev UCL. | | | | | |
| 26 27 | | | | | | Normal (| GOF Test | | | | | |
| 28 | | | | hapiro Wilk Te | | 0.991 | Shapiro Wilk GOF Test | | | | | |
| 29 30 | | | | hapiro Wilk Cr | | 0.687 | Data appear Normal at 1% Significance Level Lilliefors GOF Test | | | | | |
| 31 | | | 1 | Lilliefors 16 % Lilliefors Cr | | | Data appear Normal at 1% Significance Level | | | | | |
| 32 33 | | | | | Data appe | ar Normal at | 1% Significance Level | | | | | |
| 34 | Note GOF tests may be unreliable for small sample sizes | | | | | | | | | | | |
| 35 | | Assuming Normal Distribution | | | | | | | | | | |
| 36 37 | | | 95% No | ormal UCL 95% Stud | lent's-t UCL | 193.6 | 95% UCLs (Adjusted for Skewness) 95% Adjusted-CLT UCL (Chen-1995) 1 | 83.2 | | | | |
| 38 | | | | 55 /6 Stuu | OIII 3-I UUL | 100.0 | | 93.6 | | | | |
| 39 40 | | | | | | Comme | POE Toot | | | | | |
| 41 | | | | | est Statistic | 0.208 | GOF Test Anderson-Darling Gamma GOF Test | | | | | |
| 42 43 | | | | 5% A-D Cr | ritical Value | 0.656 | Detected data appear Gamma Distributed at 5% Significance I | Level | | | | |
| 44 | | | | | est Statistic ritical Value | | Kolmogorov-Smirnov Gamma GOF Test Detected data appear Gamma Distributed at 5% Significance I | Level | | | | |
| 45 | | | | Detected (| data appea | r Gamma Di | stributed at 5% Significance Level | | | | | |
| 46 47 | | | | Note | GOF tests | may be unre | liable for small sample sizes | | | | | |
| 48 | | | | | | Gamma | | | | | | |
| 49 50 | | | | | <u>k hat (MLE)</u> a hat (MLE) | 38.25 4.157 | k star (bias corrected MLE) Theta star (bias corrected MLE) | 9.729 16.34 | | | | |
| 51 | | | | nı | u hat (MLE) | 306 | nu star (bias corrected) | 77.83 | | | | |
| 52 53 | | | MI | LE Mean (bias | corrected) | 159 | MLE Sd (bias corrected) | 50.98 58.51 | | | | |
| 54 | | | Adjus | sted Level of S | Significance | N/A | | 58.51 N/A | | | | |
| 55 56 | | | • | | | | | | | | | |
| 57 | | | 95% A | pproximate G | | | ma Distribution 95% Adjusted Gamma UCL N | N/A | | | | |
| 58 | | | 23.071 | | | | | | | | | |
| 59 60 | | | S | hapiro Wilk Te | est Statistic | | GOF Test Shapiro Wilk Lognormal GOF Test | | | | | |
| 61 | | | | hapiro Wilk Cr | ritical Value | 0.792 | Data appear Lognormal at 10% Significance Level | | | | | |
| 62 63 | | | 10 | Lilliefors Te % Lilliefors Cr | est Statistic | | Lilliefors Lognormal GOF Test Data appear Lognormal at 10% Significance Level | | | | | |
| 64 | | | 10 | D | ata appear | Lognormal a | nt 10% Significance Level | | | | | |
| 65 66 | | | | Note | GOF tests | may be unre | liable for small sample sizes | | | | | |
| 67 | | | | | | Lognorma | Statistics | | | | | |
| 68 | | | | Minimum of Lo | | 4.828 | Mean of logged Data | 5.056 | | | | |
| 69 70 | | | N | Maximum of Lo | ogged Data | 5.263 | SD of logged Data | 0.188 | | | | |
| 71 | | | | | Assı | uming Logno | rmal Distribution | | | | | |
| 72 73 | | | Q5% (| <u> </u> | 95% H-UCL | 208 224.1 | | 203.8 252.2 | | | | |
| 74 | | | | Chebyshev (N | | | 37.378 Chebyshev (Wiv CL) CCL 2 | | | | | |
| 75 76 | | | | | Nonnarama | atric Distrib | tion Free UCL Statistics | | | | | |
| 77 | | | | | | | Discernible Distribution | | | | | |
| 78 79 | | | | | | | | | | | | |
| 80 | | | | 959 | Nonpa CLT UCL % | | ribution Free UCLs 95% BCA Bootstrap UCL N | N/A | | | | |
| 81 | | | | Standard Boo | otstrap UCL | N/A | 95% Bootstrap-t UCL N | N/A | | | | |
| 82 | | | 9 | 5% Hall's Boo | otstrap UCL | N/A | 95% Percentile Bootstrap UCL | N/A | | | | |

| | Α | В | С | D | E | F | G | Н | | J | K | L |
|----|----|--|----------------|----------------|---------------|--------------|--------------------------------|----------------|--------------|---------------|-----------------|-------|
| 83 | | | 90% Ch | ebyshev(Me | an, Sd) UCL | 203.2 | 95% Chebyshev(Mean, Sd) UCL 22 | | | | | |
| 84 | | | 97.5% Ch | ebyshev(Me | an, Sd) UCL | 250.9 | | | 99% Ch | ebyshev(Me | an, Sd) UCL | 305.5 |
| 85 | | | | | | | | | | | | |
| 86 | | | | | | Suggested | UCL to Use | | | | | |
| 87 | | | | 95% Stu | dent's-t UCL | 193.6 | | | | | | |
| 88 | | | | Red | commended | UCL exceed | ds the maxim | num observa | tion | | | |
| 89 | | | | | | | | | | | | |
| 90 | | Note: Sugges | stions regard | ing the selec | tion of a 95% | UCL are pr | ovided to hel | p the user to | select the m | nost appropri | ate 95% UCL | |
| 91 | | Recommendations are based upon data size, data distribution, and skewness using results from simulation studies. | | | | | | | | | | |
| 92 | Но | wever, simu | lations result | s will not cov | er all Real W | orld data se | ts; for addition | nal insight th | ne user may | want to cons | ult a statistic | ian. |
| 93 | | | | | | | | | | | | |

| | A B C D E | F | G H I J K | L | | | | | | | |
|----------|---|-----------------|---|-----------------|--|--|--|--|--|--|--|
| 2 | UCL Statis | stics for Unc | ensored Full Data Sets | | | | | | | | |
| 3 | User Selected Options | | | | | | | | | | |
| 4 5 | Date/Time of Computation ProUCL 5.2 10/31/2024 2 | 2:57:47 PM | | | | | | | | | |
| 6 | Full Precision OFF | | | | | | | | | | |
| 7 | Confidence Coefficient 95% Number of Bootstrap Operations 2000 | | | | | | | | | | |
| 9 | Number of Bootstrap Operations 2000 | | | | | | | | | | |
| 10 | TI WOR OF A | | | | | | | | | | |
| 12 | TL-WRB-0.5-1 | | | | | | | | | | |
| 13 | | | Statistics | | | | | | | | |
| 14 15 | Total Number of Observations | 4 | Number of Distinct Observations Number of Missing Observations | 0 | | | | | | | |
| 16 | Minimum | 67 | Mean | 69.75 | | | | | | | |
| 17 18 | Maximum | | Median | 69.5 | | | | | | | |
| 19 | SD Coefficient of Variation | 3.202 0.0459 | Std. Error of Mean Skewness | 1.601 0.0838 | | | | | | | |
| 20 | | , | | 0.000 | | | | | | | |
| 21 22 | | | I using incremental sampling methodology (ISM) approach, C 2020 and ITRC 2012) for additional guidance, | | | | | | | | |
| 23 | | | the Chebyshev UCL for small sample sizes (n < 7). | | | | | | | | |
| 24 25 | The Chebyshev UCL o | ften results | in gross overestimates of the mean. | | | | | | | | |
| 26 | Refer to the ProUCL 5.2 Tec | ennical Guid | e for a discussion of the Chebyshev UCL. | | | | | | | | |
| 27 | | | GOF Test | | | | | | | | |
| 28 29 | Shapiro Wilk Test Statistic 1% Shapiro Wilk Critical Value | | Shapiro Wilk GOF Test Data appear Normal at 1% Significance Level | | | | | | | | |
| 30 | 1% Snapiro Wilk Critical Value Lilliefors Test Statistic | | Lilliefors GOF Test | | | | | | | | |
| 31 | 1% Lilliefors Critical Value | 0.413 | Data appear Normal at 1% Significance Level | | | | | | | | |
| 32 33 | Pata appear resimal at 170 organization 2010. | | | | | | | | | | |
| 34 | Note GOF tests may be unreliable for small sample sizes | | | | | | | | | | |
| 35 36 | Assuming Normal Distribution | | | | | | | | | | |
| 37 | 95% Normal UCL 95% Student's-t UCL | 73.52 | 95% UCLs (Adjusted for Skewness) 95% Adjusted-CLT UCL (Chen-1995) | 72.45 | | | | | | | |
| 38 | 30% Statistics (002 | 70.02 | 95% Modified-t UCL (Johnson-1978) | 73.53 | | | | | | | |
| 39 40 | | Commo | GOF Test | | | | | | | | |
| 41 | A-D Test Statistic | 0.579 | Anderson-Darling Gamma GOF Test | | | | | | | | |
| 42 | 5% A-D Critical Value | 0.657 | Detected data appear Gamma Distributed at 5% Significance | Level | | | | | | | |
| 43 44 | K-S Test Statistic 5% K-S Critical Value | | Kolmogorov-Smirnov Gamma GOF Test Detected data appear Gamma Distributed at 5% Significance | Level | | | | | | | |
| 45 | Detected data appear | r Gamma Di | stributed at 5% Significance Level | Level | | | | | | | |
| 46 47 | Note GOF tests | may be unre | eliable for small sample sizes | | | | | | | | |
| 48 | | Gamma | Statistics | | | | | | | | |
| 49 | k hat (MLE) | | | 158.5 | | | | | | | |
| 50 51 | Theta hat (MLE) nu hat (MLE) | | Theta star (bias corrected MLE) nu star (bias corrected) 1 | 0.44 268 | | | | | | | |
| 52 | MLE Mean (bias corrected) | | MLE Sd (bias corrected) | 5.54 | | | | | | | |
| 53 | | | Approximate Chi Square Value (0.05) 1 | 186 | | | | | | | |
| 54 55 | Adjusted Level of Significance | N/A | Adjusted Chi Square Value | N/A | | | | | | | |
| 56 | As | suming Gam | nma Distribution | | | | | | | | |
| 57 58 | 95% Approximate Gamma UCL | | | N/A | | | | | | | |
| 59 | | Lognorma | I GOF Test | | | | | | | | |
| 60 | Shapiro Wilk Test Statistic | 0.798 | Shapiro Wilk Lognormal GOF Test | | | | | | | | |
| 61 62 | 10% Shapiro Wilk Critical Value | | Data appear Lognormal at 10% Significance Level | | | | | | | | |
| 63 | Lilliefors Test Statistic 10% Lilliefors Critical Value | | Lilliefors Lognormal GOF Test Data appear Lognormal at 10% Significance Level | | | | | | | | |
| 64 | Data appear | Lognormal a | at 10% Significance Level | | | | | | | | |
| 65 66 | Note GOF tests | may be unre | eliable for small sample sizes | | | | | | | | |
| 67 | | Lognorma | I Statistics | | | | | | | | |
| 68 | Minimum of Logged Data | 4.205 | Mean of logged Data | 4.244 | | | | | | | |
| 69 70 | Maximum of Logged Data | 4.29 | SD of logged Data | 0.0459 | | | | | | | |
| 71 | Assı | uming Logno | ormal Distribution | | | | | | | | |
| 72 73 | 95% H-UCL | N/A | 90% Chebyshev (MVUE) UCL | 74.55 | | | | | | | |
| 74 | 95% Chebyshev (MVUE) UCL 99% Chebyshev (MVUE) UCL | 76.72 85.67 | 97.5% Chebyshev (MVUE) UCL | 79.74 | | | | | | | |
| 75 | | | | | | | | | | | |
| 76 77 | | | tion Free UCL Statistics | | | | | | | | |
| 78 | Data appea | ir to follow a | Discernible Distribution | | | | | | | | |
| 79 | | | tribution Free UCLs | | | | | | | | |
| 80 81 | 95% CLT UCL | 72.38 | 95% BCA Bootstrap UCL | N/A | | | | | | | |
| 82 | 95% Standard Bootstrap UCL 95% Hall's Bootstrap UCL | N/A N/A | • | N/A N/A | | | | | | | |
| | 20 /0 Hall 5 DOUISHAP UCL | 11// | 1 30 /0 L GLOGHING DOORNAD OCT | 14//7 | | | | | | | |

| | Α | В | С | D | E | F | G | Н | I | J | K | L | |
|----|----|--|----------------|----------------|---------------|---------------|------------------|----------------|--------------|--------------|------------------|-------|---|
| 83 | | | 90% Ch | ebyshev(Me | an, Sd) UCL | 74.55 | | | 95% Ch | ebyshev(Me | an, Sd) UCL | 76.73 | 1 |
| 84 | | | 97.5% Ch | ebyshev(Me | an, Sd) UCL | 79.75 | | | 99% Ch | ebyshev(Me | an, Sd) UCL | 85.68 | |
| 85 | | | | | | | | | | | | |] |
| 86 | | | | | | Suggested | UCL to Use | | | | | |] |
| 87 | | 95% Student's-t UCL 73.52 | | | | | | | | | | | 1 |
| 88 | | | | Red | commended | UCL exceed | ds the maxim | num observa | ition | | | | 1 |
| 89 | | | | | | | | | | | | |] |
| 90 | 1 | Note: Sugge: | stions regard | ling the selec | tion of a 95% | 6 UCL are pr | ovided to hel | p the user to | select the m | ost appropri | ate 95% UCL | | 1 |
| 91 | | Recommendations are based upon data size, data distribution, and skewness using results from simulation studies. | | | | | | | | | | | |
| 92 | Но | wever, simu | lations result | s will not cov | er all Real W | /orld data se | ts; for addition | nal insight th | ne user may | want to cons | ult a statistici | an. | |
| 93 | | | | | | | | | | | | | 1 |

| | A B C D E | F | G H I J K | L | | | | | | | |
|----------|---|----------------|---|----------------|--|--|--|--|--|--|--|
| 2 | UCL Statis | stics for Unc | ensored Full Data Sets | | | | | | | | |
| 3 | User Selected Options | | | | | | | | | | |
| 4 5 | Date/Time of Computation ProUCL 5.2 10/31/2024 2 From File ProUCL Input.xls | 2:59:12 PM | | | | | | | | | |
| 6 | Full Precision OFF | | | | | | | | | | |
| 7 8 | Confidence Coefficient 95% Number of Bootstrap Operations 2000 | | | | | | | | | | |
| 9 | Number of Bootstrap Operations 2000 | | | | | | | | | | |
| 10 | TI WOD 0.5.0 | | | | | | | | | | |
| 12 | TL-WRB-0.5-2 | | | | | | | | | | |
| 13 | | | Statistics | | | | | | | | |
| 14 15 | Total Number of Observations | 4 | Number of Distinct Observations Number of Missing Observations | 0 | | | | | | | |
| 16 | Minimum | 106 | | 129.5 | | | | | | | |
| 17 18 | Maximum | | Median Std. Error of Mean | 127.5 | | | | | | | |
| 19 | SD Coefficient of Variation | 20.98 0.162 | Sta. Error of Mean Skewness | 10.49 0.561 | | | | | | | |
| 20 | | , | | | | | | | | | |
| 21 22 | | | using incremental sampling methodology (ISM) approach, C 2020 and ITRC 2012) for additional guidance, | | | | | | | | |
| 23 | but note that ITRC may recommend th | ne t-UCL or t | he Chebyshev UCL for small sample sizes (n < 7). | | | | | | | | |
| 24 25 | | | in gross overestimates of the mean. | | | | | | | | |
| 26 | Refer to the Prouct 5.2 Tec | innical Guid | e for a discussion of the Chebyshev UCL. | | | | | | | | |
| 27 | | | OF Test | | | | | | | | |
| 28 29 | Shapiro Wilk Test Statistic 1% Shapiro Wilk Critical Value | | Shapiro Wilk GOF Test Data appear Normal at 1% Significance Level | | | | | | | | |
| 30 | Lilliefors Test Statistic | | Lilliefors GOF Test | | | | | | | | |
| 31 32 | 1% Lilliefors Critical Value | | Data appear Normal at 1% Significance Level | | | | | | | | |
| 33 | | | t 1% Significance Level | | | | | | | | |
| 34 | Note GOF tests may be unreliable for small sample sizes | | | | | | | | | | |
| 35 36 | Assuming Normal Distribution | | | | | | | | | | |
| 37 | 95% Normal UCL 95% Student's-t UCL | 154.2 | 95% UCLs (Adjusted for Skewness) 95% Adjusted-CLT UCL (Chen-1995) | 149.9 | | | | | | | |
| 38 | 2270 31111011101110111011101110111011101110 | | | 154.7 | | | | | | | |
| 39 40 | | Gamma | GOF Test | | | | | | | | |
| 41 | A-D Test Statistic | 0.279 | Anderson-Darling Gamma GOF Test | | | | | | | | |
| 42 43 | 5% A-D Critical Value | | Detected data appear Gamma Distributed at 5% Significance | Level | | | | | | | |
| 43 | K-S Test Statistic 5% K-S Critical Value | | Kolmogorov-Smirnov Gamma GOF Test Detected data appear Gamma Distributed at 5% Significance | level | | | | | | | |
| 45 | Detected data appear | r Gamma Di | stributed at 5% Significance Level | 20101 | | | | | | | |
| 46 47 | Note GOF tests | may be unre | eliable for small sample sizes | | | | | | | | |
| 48 | | Gamma | Statistics | | | | | | | | |
| 49 | k hat (MLE) | 51.52 | k star (bias corrected MLE) | 13.05 | | | | | | | |
| 50 51 | Theta hat (MLE) nu hat (MLE) | | Theta star (bias corrected MLE) nu star (bias corrected) | 9.926 104.4 | | | | | | | |
| 52 | MLE Mean (bias corrected) | | MLE Sd (bias corrected) | 35.85 | | | | | | | |
| 53 | | | Approximate Chi Square Value (0.05) | 81.8 | | | | | | | |
| 54 55 | Adjusted Level of Significance | N/A | Adjusted Chi Square Value | N/A | | | | | | | |
| 56 | | | ma Distribution | | | | | | | | |
| 57 58 | 95% Approximate Gamma UCL | 165.2 | 95% Adjusted Gamma UCL | N/A | | | | | | | |
| 59 | | Lognorma | GOF Test | | | | | | | | |
| 60 | Shapiro Wilk Test Statistic | 0.967 | Shapiro Wilk Lognormal GOF Test | | | | | | | | |
| 61 62 | 10% Shapiro Wilk Critical Value Lilliefors Test Statistic | | Data appear Lognormal at 10% Significance Level Lilliefors Lognormal GOF Test | | | | | | | | |
| 63 | 10% Lilliefors Critical Value | | Data appear Lognormal at 10% Significance Level | | | | | | | | |
| 64 65 | Data appear | Lognormal a | at 10% Significance Level | | | | | | | | |
| 66 | Note GOF tests | may be unre | eliable for small sample sizes | | | | | | | | |
| 67 | | | I Statistics | | | | | | | | |
| 68 69 | Minimum of Logged Data | 4.663 | Mean of logged Data | 4.854 | | | | | | | |
| 70 | Maximum of Logged Data | 5.056 | SD of logged Data | 0.161 | | | | | | | |
| 71 | | | rmal Distribution | | | | | | | | |
| 72 73 | 95% H-UCL | _ | | 160.7 | | | | | | | |
| 74 | 95% Chebyshev (MVUE) UCL 99% Chebyshev (MVUE) UCL | 174.8 232.9 | 97.5% Chebyshev (MVUE) UCL | 194.4 | | | | | | | |
| 75 | | | · | | | | | | | | |
| 76 77 | | | tion Free UCL Statistics | | | | | | | | |
| 78 | Data appea | ir to follow a | Discernible Distribution | | | | | | | | |
| 79 | | | tribution Free UCLs | | | | | | | | |
| 80 81 | 95% CLT UCL | | 95% BCA Bootstrap UCL 95% Bootstrap-t UCL | N/A | | | | | | | |
| 82 | 95% Standard Bootstrap UCL 95% Hall's Bootstrap UCL | | | N/A N/A | | | | | | | |
| | 30 /0 Figil 3 Doolstrap OCL | . 1// 1 | , John Greenine Bootshap GCE | | | | | | | | |

| | Α | В | С | D | E | F | G | Н | I | J | K | L | |
|----|----|---|---------------|---------------|---------------|------------|-----------------------------------|---------------|--------------|---------------|-------------|---|--|
| 83 | | | 90% Ch | ebyshev(Me | an, Sd) UCL | 161 | 95% Chebyshev(Mean, Sd) UCL 175. | | | | | | |
| 84 | | | 97.5% Ch | ebyshev(Me | an, Sd) UCL | 195 | 99% Chebyshev(Mean, Sd) UCL 233.9 | | | | | | |
| 85 | | | | | | | | | | | | | |
| 86 | | | | | | Suggested | UCL to Use | | | | | | |
| 87 | | | | 95% Stu | dent's-t UCL | 154.2 | | | | | | | |
| 88 | | | | | | • | • | | | | | | |
| 89 | ľ | Note: Sugges | stions regard | ing the selec | tion of a 95% | UCL are pr | ovided to hel | p the user to | select the m | ost appropria | ate 95% UCL | | |
| 90 | | Recommendations are based upon data size, data distribution, and skewness using results from simulation studies. | | | | | | | | | | | |
| 91 | Но | However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician. | | | | | | | | | | | |
| 92 | | | | | | | | | | | | | |

| \Box | A B C D E | F | G H I J K L | | | | | | | | |
|----------|---|----------------|--|--|--|--|--|--|--|--|--|
| 2 | UCL Statis | stics for Unc | ensored Full Data Sets | | | | | | | | |
| 3 | User Selected Options | 0.00.40 DM | | | | | | | | | |
| 5 | Date/Time of Computation ProUCL 5.2 10/31/2024 ProUCL Input.xls | 3:00:48 PIVI | | | | | | | | | |
| 6 | Full Precision OFF | | | | | | | | | | |
| 7 | Confidence Coefficient 95% Number of Bootstrap Operations 2000 | | | | | | | | | | |
| 9 | Number of Booletiap Operations (2000 | | | | | | | | | | |
| 10 11 | TL-WRB-0.5-3 | | | | | | | | | | |
| 12 | TE-WNB-0.3-3 | | | | | | | | | | |
| 13 14 | Total Number of Observations | | Statistics Number of Distinct Observations 4 | | | | | | | | |
| 15 | Total Nulliber of Observations | 4 | Number of Missing Observations 0 | | | | | | | | |
| 16 17 | Minimum | | Mean 124.5 Median 123.5 | | | | | | | | |
| 18 | Maximum SD | | Median 123.5 Std. Error of Mean 5.454 | | | | | | | | |
| 19 | Coefficient of Variation | 0.0876 | Skewness 0.419 | | | | | | | | |
| 20 21 | Note: Sample size is small (e.g., <10), if data: | are collected | using incremental sampling methodology (ISM) approach, | | | | | | | | |
| 22 | refer also to ITRC Tech Reg Guide | on ISM (ITR | C 2020 and ITRC 2012) for additional guidance, | | | | | | | | |
| 23 24 | | | the Chebyshev UCL for small sample sizes (n < 7). in gross overestimates of the mean. | | | | | | | | |
| 25 | | | e for a discussion of the Chebyshev UCL. | | | | | | | | |
| 26 27 | | Nlaw! 4 | 20E Took | | | | | | | | |
| 28 | Shapiro Wilk Test Statistic | | GOF Test Shapiro Wilk GOF Test | | | | | | | | |
| 29 | 1% Shapiro Wilk Critical Value | 0.687 | Data appear Normal at 1% Significance Level | | | | | | | | |
| 30 31 | Lilliefors Test Statistic 1% Lilliefors Critical Value | | Lilliefors GOF Test Data appear Normal at 1% Significance Level | | | | | | | | |
| 32 | Data appe | ar Normal at | 1% Significance Level | | | | | | | | |
| 33 34 | Note GOF tests | may be unre | eliable for small sample sizes | | | | | | | | |
| 35 | Assuming Normal Distribution | | | | | | | | | | |
| 36 37 | 95% Normal UCL | | 95% UCLs (Adjusted for Skewness) | | | | | | | | |
| 38 | 95% Student's-t UCL | 137.3 | 95% Adjusted-CLT UCL (Chen-1995) 134.7 95% Modified-t UCL (Johnson-1978) 137.5 | | | | | | | | |
| 39 | | | · · · · · · · · · · · · · · · · · · · | | | | | | | | |
| 40 41 | A-D Test Statistic | | GOF Test Anderson-Darling Gamma GOF Test | | | | | | | | |
| 42 | 5% A-D Critical Value | | Detected data appear Gamma Distributed at 5% Significance Level | | | | | | | | |
| 43 44 | K-S Test Statistic | | Kolmogorov-Smirnov Gamma GOF Test | | | | | | | | |
| 45 | 5% K-S Critical Value Detected data appea | | Detected data appear Gamma Distributed at 5% Significance Level stributed at 5% Significance Level | | | | | | | | |
| 46 47 | | | eliable for small sample sizes | | | | | | | | |
| 48 | | Gamma | Statistics | | | | | | | | |
| 49 | k hat (MLE) | 175.2 | k star (bias corrected MLE) 43.96 | | | | | | | | |
| 50 51 | Theta hat (MLE) nu hat (MLE) | | Theta star (bias corrected MLE) 2.832 nu star (bias corrected) 351.7 | | | | | | | | |
| 52 | MLE Mean (bias corrected) | | MLE Sd (bias corrected) 18.78 | | | | | | | | |
| 53 54 | Adjusted Lavel of Claufferen | N/A | Approximate Chi Square Value (0.05) 309.2 | | | | | | | | |
| 55 | Adjusted Level of Significance | IN/A | Adjusted Chi Square Value N/A | | | | | | | | |
| 56 57 | | | nma Distribution | | | | | | | | |
| 58 | 95% Approximate Gamma UCL | 141.6 | 95% Adjusted Gamma UCL N/A | | | | | | | | |
| 59 | | | GOF Test | | | | | | | | |
| 60 61 | Shapiro Wilk Test Statistic 10% Shapiro Wilk Critical Value | | Shapiro Wilk Lognormal GOF Test Data appear Lognormal at 10% Significance Level | | | | | | | | |
| 62 | Lilliefors Test Statistic | 0.186 | Lilliefors Lognormal GOF Test | | | | | | | | |
| 63 64 | 10% Lilliefors Critical Value | | Data appear Lognormal at 10% Significance Level at 10% Significance Level | | | | | | | | |
| 65 | | | eliable for small sample sizes | | | | | | | | |
| 66 67 | | - | · | | | | | | | | |
| 68 | Minimum of Logged Data | | I Statistics Mean of logged Data 4.821 | | | | | | | | |
| 69 | Maximum of Logged Data | | SD of logged Data 0.0871 | | | | | | | | |
| 70 71 | Λοοι | umina I cana | ormal Distribution | | | | | | | | |
| 72 | 95% H-UCL | N/A | 90% Chebyshev (MVUE) UCL 140.8 | | | | | | | | |
| 73 74 | 95% Chebyshev (MVUE) UCL 99% Chebyshev (MVUE) UCL | | 97.5% Chebyshev (MVUE) UCL 158.3 | | | | | | | | |
| 75 | 33 % Criebystiev (IVIVOE) UCL | 170.4 | | | | | | | | | |
| 76 77 | | | tion Free UCL Statistics | | | | | | | | |
| 78 | Data appea | ar to tollow a | Discernible Distribution | | | | | | | | |
| 79 | | | tribution Free UCLs | | | | | | | | |
| 80 81 | 95% CLT UCL 95% Standard Bootstrap UCL | | 95% BCA Bootstrap UCL N/A 95% Bootstrap-t UCL N/A | | | | | | | | |
| 82 | 95% Hall's Bootstrap UCL | | 95% Percentile Bootstrap UCL N/A | | | | | | | | |
| | | | | | | | | | | | |

| | Α | В | С | D | E | F | G | Н | I | J | K | L | | |
|----|----|---|---------------|---------------|---------------|------------|-----------------------------------|---------------|--------------|----------------|-------------|---|--|--|
| 83 | | | 90% Ch | ebyshev(Me | an, Sd) UCL | 140.9 | 95% Chebyshev(Mean, Sd) UCL 148.3 | | | | | | | |
| 84 | | | 97.5% Ch | ebyshev(Me | an, Sd) UCL | 158.6 | 99% Chebyshev(Mean, Sd) UCL 178.8 | | | | | | | |
| 85 | | | | | | | | | | | | | | |
| 86 | | | | | | Suggested | UCL to Use | | | | | | | |
| 87 | | | | 95% Stu | dent's-t UCL | 137.3 | | | | | | | | |
| 88 | | | | | | • | • | | | | | | | |
| 89 | 1 | Note: Sugges | stions regard | ing the selec | tion of a 95% | UCL are pr | ovided to hel | p the user to | select the m | nost appropria | ate 95% UCL | | | |
| 90 | | Recommendations are based upon data size, data distribution, and skewness using results from simulation studies. | | | | | | | | | | | | |
| 91 | Но | However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician. | | | | | | | | | | | | |
| 92 | | | | | | | | | | | | | | |

| | A B C D E | F | G H I J K L | | | | | | | | |
|----------|---|----------------|---|--|--|--|--|--|--|--|--|
| 2 | UCL Statis | stics for Unc | ensored Full Data Sets | | | | | | | | |
| 3 | User Selected Options Date/Time of Computation ProUCL 5.2 10/31/2024 | 2.02.21 DM | | | | | | | | | |
| 5 | Date/Time of Computation ProUCL 5.2 10/31/2024 From File ProUCL Input.xls | 3:02:31 PIVI | | | | | | | | | |
| 6 7 | Full Precision OFF Confidence Coefficient 95% | | | | | | | | | | |
| 8 | Number of Bootstrap Operations 2000 | | | | | | | | | | |
| 9 | | | | | | | | | | | |
| 11 | TL-WRB-0.5-4 | | | | | | | | | | |
| 12 13 | | General | Statistics | | | | | | | | |
| 14 | Total Number of Observations | | Number of Distinct Observations 8 | | | | | | | | |
| 15 16 | Minimum | 105 | Number of Missing Observations 0 Mean 153.1 | | | | | | | | |
| 17 | Maximum | 184 | Median 165.5 | | | | | | | | |
| 18 19 | SD Coefficient of Variation | | Std. Error of Mean 11.35 Skewness -0.637 | | | | | | | | |
| 20 | | • | | | | | | | | | |
| 21 22 | | | I using incremental sampling methodology (ISM) approach, C 2020 and ITRC 2012) for additional guidance, | | | | | | | | |
| 23 | but note that ITRC may recommend the | he t-UCL or t | he Chebyshev UCL for small sample sizes (n < 7). | | | | | | | | |
| 24 25 | | | in gross overestimates of the mean. e for a discussion of the Chebyshev UCL. | | | | | | | | |
| 26 | | | • | | | | | | | | |
| 27 28 | Shapiro Wilk Test Statistic | | GOF Test Shapiro Wilk GOF Test | | | | | | | | |
| 29 30 | 1% Shapiro Wilk Critical Value | 0.749 | Data appear Normal at 1% Significance Level | | | | | | | | |
| 31 | Lilliefors Test Statistic 1% Lilliefors Critical Value | | Lilliefors GOF Test Data appear Normal at 1% Significance Level | | | | | | | | |
| 32 33 | Data appe | ear Normal at | 1% Significance Level | | | | | | | | |
| 34 | Note GOF tests | may be unre | eliable for small sample sizes | | | | | | | | |
| 35 36 | Assuming Normal Distribution | | | | | | | | | | |
| 37 | 95% Normal UCL 95% Student's-t UCL | . 174.6 | 95% UCLs (Adjusted for Skewness) 95% Adjusted-CLT UCL (Chen-1995) 169.1 | | | | | | | | |
| 38 39 | | | 95% Modified-t UCL (Johnson-1978) 174.2 | | | | | | | | |
| 40 | | Gamma | GOF Test | | | | | | | | |
| 41 42 | A-D Test Statistic 5% A-D Critical Value | | Anderson-Darling Gamma GOF Test | | | | | | | | |
| 43 | K-S Test Statistic | | Detected data appear Gamma Distributed at 5% Significance Level Kolmogorov-Smirnov Gamma GOF Test | | | | | | | | |
| 44 45 | 5% K-S Critical Value | | Detected data appear Gamma Distributed at 5% Significance Level stributed at 5% Significance Level | | | | | | | | |
| 46 | | | eliable for small sample sizes | | | | | | | | |
| 47 48 | | Gamma | Statistics | | | | | | | | |
| 49 | k hat (MLE) | 23.7 | k star (bias corrected MLE) 14.9 | | | | | | | | |
| 50 51 | Theta hat (MLE) nu hat (MLE) | | Theta star (bias corrected MLE) 10.28 nu star (bias corrected) 238.3 | | | | | | | | |
| 52 | MLE Mean (bias corrected) | | MLE Sd (bias corrected) 39.67 | | | | | | | | |
| 53 54 | Adjusted Level of Significance | 0.0195 | Approximate Chi Square Value (0.05) 203.6 Adjusted Chi Square Value 195.5 | | | | | | | | |
| 55 | | • | | | | | | | | | |
| 56 57 | As 95% Approximate Gamma UCL | | ma Distribution 95% Adjusted Gamma UCL 186.7 | | | | | | | | |
| 58 59 | CO.S. Ipproximate Gamma COL | | | | | | | | | | |
| 60 | Shapiro Wilk Test Statistic | | GOF Test Shapiro Wilk Lognormal GOF Test | | | | | | | | |
| 61 62 | 10% Shapiro Wilk Critical Value | 0.851 | Data Not Lognormal at 10% Significance Level | | | | | | | | |
| 63 | Lilliefors Test Statistic 10% Lilliefors Critical Value | | Lilliefors Lognormal GOF Test Data appear Lognormal at 10% Significance Level | | | | | | | | |
| 64 65 | Data appear Appro | ximate Logn | ormal at 10% Significance Level | | | | | | | | |
| 66 | Note GOF tests | inay be unre | eliable for small sample sizes | | | | | | | | |
| 67 68 | Minimum of Laur 15. | | I Statistics | | | | | | | | |
| 69 | Minimum of Logged Data Maximum of Logged Data | | Mean of logged Data 5.01 SD of logged Data 0.226 | | | | | | | | |
| 70 71 | | * | | | | | | | | | |
| 72 | 95% H-UCL | 181.9 | prmal Distribution 90% Chebyshev (MVUE) UCL 190.1 | | | | | | | | |
| 73 74 | 95% Chebyshev (MVUE) UCL | . 206.7 | 97.5% Chebyshev (MVUE) UCL 229.9 | | | | | | | | |
| 75 | 99% Chebyshev (MVUE) UCL | . 2/5.3 | | | | | | | | | |
| 76 77 | | | tion Free UCL Statistics | | | | | | | | |
| 78 | Data appea | ar io toliow a | Discernible Distribution | | | | | | | | |
| 79 80 | | | tribution Free UCLs | | | | | | | | |
| 81 | 95% CLT UCL 95% Standard Bootstrap UCL | | 95% BCA Bootstrap UCL 168.4 95% Bootstrap-t UCL 171.1 | | | | | | | | |
| 82 | 95% Hall's Bootstrap UCL | | 95% Percentile Bootstrap UCL 169.8 | | | | | | | | |

| | Α | В | С | D | Е | F | G | Н | I | J | K | L |
|-------------------------|---|--------------|----------------|----------------|---------------|----------------|-----------------|----------------|----------------|---------------|-----------------|-------|
| 83 | | | 90% Ch | ebyshev(Mea | n, Sd) UCL | 187.2 | | | 95% Ch | ebyshev(Me | an, Sd) UCL | 202.6 |
| 84 | | | 97.5% Ch | ebyshev(Mea | an, Sd) UCL | 224 | | | 99% Ch | ebyshev(Me | an, Sd) UCL | 266.1 |
| 85 | | | | | | | | | | | | |
| 86 Suggested UCL to Use | | | | | | | | | | | | |
| 87 | | | | 95% Stu | dent's-t UCL | 174.6 | | | | | | |
| 88 | | | | | | | | | | | | |
| 89 | | Note: Sugge: | stions regard | ing the selec | tion of a 95% | UCL are pr | ovided to hel | p the user to | select the m | nost appropri | ate 95% UCL | |
| 90 | | Recom | mendations | are based up | on data size | , data distrib | ution, and sk | ewness usin | g results from | m simulation | studies. | |
| 91 | Ho | wever, simu | lations result | s will not cov | er all Real W | orld data se | ts; for additio | nal insight th | ne user may | want to cons | ult a statistic | ian. |
| 92 | | | | | | | | | | | | |
| 93 | Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be | | | | | | | | | | | |
| 94 | | | reliable. | Chen's and J | ohnson's me | ethods provi | de adjustme | nts for posit | vely skewed | data sets. | | |
| 95 | reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets. | | | | | | | | | | | |

| 1 | A B C D E UCL Statis | F stics for Unc | G H I J K L ensored Full Data Sets |
|----------|--|--------------------|--|
| 2 | | | |
| 3 | User Selected Options | | |
| 5 | Date/Time of Computation ProUCL 5.2 10/31/2024 3 | 3:03:54 PM | |
| 6 | From File ProUCL Input.xls Full Precision OFF | | |
| 7 | Confidence Coefficient 95% | | |
| 8 | Number of Bootstrap Operations 2000 | | |
| 9 | | | |
| 10 | | | |
| 12 | TL-WRC-0.5-1 | | |
| 13 | | General | Statistics |
| 14 | Total Number of Observations | 4 | Number of Distinct Observations 3 |
| 15 | | | Number of Missing Observations 0 |
| 16 17 | Minimum | 99 | Mean 132.8 |
| 18 | Maximum SD | 145 22.54 | Median 143.5 Std. Error of Mean 11.27 |
| 19 | Coefficient of Variation | _ | Skewness -1.977 |
| 20 | Occincion of variation | 0.17 | OKOWIIC35 -1.077 |
| 21 | | | l using incremental sampling methodology (ISM) approach, |
| 22 | | | C 2020 and ITRC 2012) for additional guidance, |
| 23 24 | | | the Chebyshev UCL for small sample sizes (n < 7). |
| 25 | I DE CHEDYSNEY UCL O | hnical Guide | in gross overestimates of the mean. e for a discussion of the Chebyshev UCL. |
| 26 | Troid to the Frode 5.2 Tec | ui duiu | 5 15. G GLOUDOIGH OF GIO CHODYSHOT COL. |
| 27 | | | GOF Test |
| 28 | Shapiro Wilk Test Statistic | | Shapiro Wilk GOF Test |
| 29 30 | 1% Shapiro Wilk Critical Value | 0.687 | Data Not Normal at 1% Significance Level |
| 31 | Lilliefors Test Statistic 1% Lilliefors Critical Value | 0.409 0.413 | Lilliefors GOF Test Data appear Normal at 1% Significance Level |
| 32 | | | rmal at 1% Significance Level |
| 33 | | | eliable for small sample sizes |
| 34 | | | |
| 35 | | suming Norr | mal Distribution |
| 36 37 | 95% Normal UCL 95% Student's-t UCL | 159.3 | 95% UCLs (Adjusted for Skewness) 95% Adjusted-CLT UCL (Chen-1995) 139.4 |
| 38 | 95% Students-t OCL | 139.3 | 95% Adjusted-CET OCE (Cheri-1995) 139.4 95% Modified-t UCL (Johnson-1978) 157.4 |
| 39 | | | SO 70 MICAMICA COSE (COMMISSIN 1070) |
| 40 | | r | GOF Test |
| 41 | A-D Test Statistic | 0.852 | Anderson-Darling Gamma GOF Test |
| 42 | 5% A-D Critical Value | 0.656 | Data Not Gamma Distributed at 5% Significance Level |
| 44 | K-S Test Statistic 5% K-S Critical Value | 0.437 0.394 | Kolmogorov-Smirnov Gamma GOF Test Data Not Gamma Distributed at 5% Significance Level |
| 45 | | | ed at 5% Significance Level |
| 46 | | | |
| 47 | | | Statistics |
| 48 49 | k hat (MLE) Theta hat (MLE) | 40.61 3.269 | k star (bias corrected MLE) 10.32 Theta star (bias corrected MLE) 12.87 |
| 50 | nu hat (MLE) | | nu star (bias corrected) 82.54 |
| 51 | MLE Mean (bias corrected) | 132.8 | MLE Sd (bias corrected) 41.33 |
| 52 | | | Approximate Chi Square Value (0.05) 62.61 |
| 53 | Adjusted Level of Significance | N/A | Adjusted Chi Square Value N/A |
| 54 55 | Acc | eumina Ca | ama Distribution |
| 56 | 95% Approximate Gamma UCL | | ma Distribution 95% Adjusted Gamma UCL N/A |
| 57 | | | 5579 Fidjusted Gaining OOL 1974 |
| 58 | | | GOF Test |
| 59 | Shapiro Wilk Test Statistic | 0.669 | Shapiro Wilk Lognormal GOF Test |
| 60 61 | 10% Shapiro Wilk Critical Value | 0.792 | Data Not Lognormal at 10% Significance Level |
| 62 | Lilliefors Test Statistic 10% Lilliefors Critical Value | 0.415 0.346 | Lilliefors Lognormal GOF Test Data Not Lognormal at 10% Significance Level |
| 63 | | | 10% Significance Level |
| 64 | | | |
| 65 | | | Statistics |
| 66 67 | Minimum of Logged Data | 4.595 | Mean of logged Data 4.876 |
| 68 | Maximum of Logged Data | 4.977 | SD of logged Data 0.188 |
| 69 | Δοοι | ımina Loana | ormal Distribution |
| 70 | 95% H-UCL | 173.6 | 90% Chebyshev (MVUE) UCL 170.1 |
| 71 | 95% Chebyshev (MVUE) UCL | 187 | 97.5% Chebyshev (MVUE) UCL 210.5 |
| 72 | 99% Chebyshev (MVUE) UCL | 256.5 | |
| 73 74 | Mannauana | strio Diotelle | tion Fron LICI. Statistics |
| 75 | | | tion Free UCL Statistics Discernible Distribution |
| 76 | | ii to follow a | Disconius Distribution |
| 77 | | rametric Dis | tribution Free UCLs |
| 78 | 95% CLT UCL | 151.3 | 95% BCA Bootstrap UCL N/A |
| 79 80 | 95% Standard Bootstrap UCL | N/A | 95% Bootstrap-t UCL N/A |
| 81 | 95% Hall's Bootstrap UCL 90% Chebyshev(Mean, Sd) UCL | N/A 166.6 | 95% Percentile Bootstrap UCL N/A 95% Chebyshev(Mean, Sd) UCL 181.9 |
| 82 | 97.5% Chebyshev(Mean, Sd) UCL | 203.1 | 99% Chebyshev(Mean, Sd) UCL 244.9 |
| 02 | or.ord oncoyoner(inicall, ou) ool | | OU / OTTODY OTTO (INCOME, OU) OOL ZTT. 3 |

| | Α | В | С | D | E | F | G | Н | I | J | K | L | | |
|----|--|--------------|----------------|-----------------|---------------|----------------|------------------|----------------|---------------|---------------|-----------------|-------|--|--|
| 83 | | | | | | | | | | | | | | |
| 84 | | | | | | Suggested | UCL to Use | | | | | | | |
| 85 | | | | 95% Stu | dent's-t UCL | 159.3 | | | | | | | | |
| 86 | Recommended UCL exceeds the maximum observation | | | | | | | | | | | | | |
| 87 | | | | | | | | | | | | | | |
| 88 | When a data set follows an approximate distribution passing only one of the GOF tests, | | | | | | | | | | | | | |
| 89 | | | it is su | ggested to us | se a UCL ba | sed upon a d | istribution pa | ssing both G | OF tests in | ProUCL | | | | |
| 90 | | | | | | | | | | | | | | |
| 91 | 1 | Note: Sugge: | stions regard | ling the selec | tion of a 95% | 6 UCL are pr | ovided to hel | p the user to | select the n | nost appropri | ate 95% UC | L. | | |
| 92 | | Recom | mendations | are based up | on data size | , data distrib | ution, and sk | ewness using | g results fro | m simulation | studies. | | | |
| 93 | Ho | wever, simu | lations result | ts will not cov | er all Real V | Vorld data se | ts; for addition | nal insight th | e user may | want to cons | ult a statistic | cian. | | |
| 94 | | | | | | | | | | | | | | |
| 95 | | Note: For | highly negat | tively-skewe | d data, confi | dence limits | (e.g., Chen, | Johnson, Lo | gnormal, a | nd Gamma) | may not be | | | |
| 96 | | | reliable. | Chen's and . | lohnson's m | ethods provi | de adjustme | nts for posity | ely skewed | l data sets. | | | | |
| 97 | | | | | | | | | | | | | | |

| 1 | A B C D E | F stics for Unc | G H I J K L ensored Full Data Sets |
|----------|---|--------------------|--|
| 2 | , | | |
| 3 | User Selected Options | 0.05.00.51 | |
| 5 | Date/Time of Computation ProUCL 5.2 10/31/2024 From File ProUCL Input.xls | 3:05:32 PM | |
| 6 | Full Precision OFF | | |
| 7 | Confidence Coefficient 95% | | |
| 8 | Number of Bootstrap Operations 2000 | | |
| 9 10 | | | |
| | TL-WRC-0.5-2 | | |
| 12 | 1L-WRG-0.3-2 | | |
| 13 | | General | Statistics |
| 14 | Total Number of Observations | 4 | Number of Distinct Observations 4 |
| 15 16 | Minimum | 100 | Number of Missing Observations 0 |
| 17 | Minimum Maximum | | Mean 200 Median 203.5 |
| 18 | SD | | Std. Error of Mean 4.021 |
| 19 | Coefficient of Variation | | Skewness -1.938 |
| 20 | | | |
| 21 22 | | | d using incremental sampling methodology (ISM) approach, |
| 23 | | | C 2020 and ITRC 2012) for additional guidance, the Chebyshev UCL for small sample sizes (n < 7). |
| 24 | | | in gross overestimates of the mean. |
| 25 | | | e for a discussion of the Chebyshev UCL. |
| 26 27 | | A | |
| 28 | Shapiro Wilk Test Statistic | | GOF Test Shanira Wilk GOF Test |
| 29 | Snapiro Wilk Test Statistic 1% Shapiro Wilk Critical Value | _ | Shapiro Wilk GOF Test Data appear Normal at 1% Significance Level |
| 30 | Lilliefors Test Statistic | | Lilliefors GOF Test |
| 31 | 1% Lilliefors Critical Value | 0.413 | Data appear Normal at 1% Significance Level |
| 32 | | | t 1% Significance Level |
| 33 34 | Note GOF tests | may be unre | eliable for small sample sizes |
| 35 | Δς | suming Nor | mal Distribution |
| 36 | 95% Normal UCL | Summy Non | 95% UCLs (Adjusted for Skewness) |
| 37 | 95% Student's-t UCL | 209.5 | 95% Adjusted-CLT UCL (Chen-1995) 202.4 |
| 38 | | | 95% Modified-t UCL (Johnson-1978) 208.8 |
| 39 40 | | Commo | COF Took |
| 41 | A-D Test Statistic | | GOF Test Anderson-Darling Gamma GOF Test |
| 42 | 5% A-D Critical Value | | Data Not Gamma Distributed at 5% Significance Level |
| 43 | K-S Test Statistic | | Kolmogorov-Smirnov Gamma GOF Test |
| 44 45 | 5% K-S Critical Value | | Data Not Gamma Distributed at 5% Significance Level |
| 46 | Data Not Gami | ma Distribute | ed at 5% Significance Level |
| 47 | | Gamma | Statistics |
| 48 | k hat (MLE) | 802.9 | k star (bias corrected MLE) 200.9 |
| 49 50 | Theta hat (MLE) | | Theta star (bias corrected MLE) 0.996 |
| 51 | nu hat (MLE) MLE Mean (bias corrected) | | nu star (bias corrected) 1607 MLE Sd (bias corrected) 14.11 |
| 52 | INILE Mean (bias corrected) | 200 | Approximate Chi Square Value (0.05) 1515 |
| 53 | Adjusted Level of Significance | N/A | Adjusted Chi Square Value N/A |
| 54 | | | |
| 55 56 | | | nma Distribution |
| 57 | 95% Approximate Gamma UCL | <u> </u> | 95% Adjusted Gamma UCL N/A |
| 58 | | Lognorma | I GOF Test |
| 59 | Shapiro Wilk Test Statistic | 0.72 | Shapiro Wilk Lognormal GOF Test |
| 60 | 10% Shapiro Wilk Critical Value | | Data Not Lognormal at 10% Significance Level |
| 61 62 | Lilliefors Test Statistic | | Lilliefors Lognormal GOF Test |
| 63 | 10% Lilliefors Critical Value Data Not L | | Data Not Lognormal at 10% Significance Level 10% Significance Level |
| 64 | | -gnomarat | 1070 Organico Ector |
| 65 | | | Statistics |
| 66 | Minimum of Logged Data | | Mean of logged Data 5.298 |
| 67 68 | Maximum of Logged Data | 5.323 | SD of logged Data 0.041 |
| 69 | Δεε | umina I oanc | ormal Distribution |
| 70 | 95% H-UCL | | 90% Chebyshev (MVUE) UCL 212.3 |
| 71 | 95% Chebyshev (MVUE) UCL | 217.9 | 97.5% Chebyshev (MVUE) UCL 225.6 |
| 72 | 99% Chebyshev (MVUE) UCL | 240.8 | |
| 73 74 | Namasan | etric Dietrik | tion Free LICL Statistics |
| 75 | | | tion Free UCL Statistics Discernible Distribution |
| 76 | | 1011011 0 | |
| 77 | | | tribution Free UCLs |
| 78 79 | 95% CLT UCL | | 95% BCA Bootstrap UCL N/A |
| 79 80 | 95% Standard Bootstrap UCL 95% Hall's Bootstrap UCL | | 95% Bootstrap-t UCL N/A 95% Percentile Bootstrap UCL N/A |
| 81 | 95% Hall's Bootstrap OCL 90% Chebyshev(Mean, Sd) UCL | | 95% Percentile Bootstrap UCL N/A 95% Chebyshev(Mean, Sd) UCL 217.5 |
| 82 | 97.5% Chebyshev(Mean, Sd) UCL | | 99% Chebyshev(Mean, Sd) UCL 240 |
| | | | |

| | Α | В | С | D | E | F | G | Н | I | J | K | L | | |
|----|---------------------------|---|---------------|----------------|---------------|----------------|------------------|----------------|----------------|---------------|-----------------|------|--|--|
| 83 | | | | | | | | | | | | | | |
| 84 | Suggested UCL to Use | | | | | | | | | | | | | |
| 85 | 95% Student's-t UCL 209.5 | | | | | | | | | | | | | |
| 86 | | Recommended UCL exceeds the maximum observation | | | | | | | | | | | | |
| 87 | | · · · · · · · · · · · · · · · · · · · | | | | | | | | | | | | |
| 88 | ١ | Note: Sugges | stions regard | ing the selec | tion of a 95% | 6 UCL are pr | ovided to hel | p the user to | select the me | ost appropria | ate 95% UCI | L. | | |
| 89 | | Recom | mendations | are based up | on data size | , data distrib | ution, and sk | ewness usin | g results from | n simulation | studies. | | | |
| 90 | Ho | wever, simul | ations result | s will not cov | er all Real V | Vorld data se | ts; for addition | nal insight th | ne user may v | want to consi | ult a statistic | ian. | | |
| 91 | | | | | | | | | | | | | | |
| 92 | | Note: For | highly negat | ively-skewer | data, confi | dence limits | (e.g., Chen, | Johnson, Lo | ognormal, an | d Gamma) r | nay not be | | | |
| 93 | | | reliable. | Chen's and J | ohnson's m | ethods provi | de adjustme | nts for posity | vely skewed | data sets. | | | | |
| 94 | | | | | | | | | | | | | | |

| 19 | | A B C D E | F | G H I J K L |
|--|----------|---|----------------|---|
| Date Policy Policy 12 12 13 13 14 15 15 15 15 15 15 15 | 2 | UCL Statis | stics for Unc | ensored Full Data Sets |
| Firm File | | | 10.04.50.514 | |
| Fig. 1 Precision OFF Number of Bootstrap Operations 2000 | | | 12:04:58 PM | |
| Number of Bootstrap Operations 2000 | | Full Precision OFF | | |
| UMM-TLA-0,5-1 UMM-TLA-0,5- | | | | |
| Total Number of Observations Same Statistics Same Statistics | 9 | Number of Bookstap Operations 2000 | | |
| Total Number of Observations S | | IIMM-TI A-0 5-1 | | |
| Total Number of Observations S | 12 | DIVINI-1 EA-0.0-1 | | |
| Minimum 53 | | Total Number of Observations | | |
| Maximum 104 | 15 | Total Number of Observations | 3 | |
| 18 | | | | |
| Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach, refer also to ITRC Tech Reg Guide on ISM (ITRC 2012) for additional guidence, 123 | 18 | | | |
| Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach, refer eas to ITRC 1921 and ITRC 2021 oand ITRC 2012 for additional guidance, and the state of the refer ease of the TRC of the Shaper Will (Garden), and the state of the refer to the ProUct, 5.2 Technical Guide for a discussion of the Chebyshev UCL. Section 1977 | | Coefficient of Variation | 0.25 | |
| | | Note: Sample size is small (e.g., <10), if data | are collected | Lusing incremental sampling methodology (ISM) approach |
| The Chebyshev UCL often results in arose overestimates of the mean. | 22 | refer also to ITRC Tech Reg Guide | on ISM (ITR | C 2020 and ITRC 2012) for additional guidance, |
| Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL. | 23 | | | |
| Shapiro Wilk Test Statistic 0.89 | 25 | | | |
| Shapiro Wilk Test Statistic 0.89 | | | Normal C | ====================================== |
| 1% Shapiro Wilk Critical Value 0.866 | 28 | Shapiro Wilk Test Statistic | | |
| 1% Lilliefors Critical Value 0.396 | | | | |
| Data appear Normal at 1% Significance Level | 31 | | | |
| Second S | 32 | Data appe | ar Normal at | 1% Significance Level |
| Assuming Normal Distribution 95% NOrmal UCL 95% Nor | | Note GOF tests | may be unre | eliable for small sample sizes |
| 95% Normal UCL | 35 | | suming Nor | |
| Samma GOF Test | | 95% Normal UCL | | 95% UCLs (Adjusted for Skewness) |
| Comman C | 38 | 95% Students-t OCL | 104.1 | |
| A-D Test Statistic | | | | |
| 1 | | A-D Test Statistic | | |
| 141 | 42 | 5% A-D Critical Value | 0.679 | Detected data appear Gamma Distributed at 5% Significance Level |
| Detected data appear Gamma Distributed at 5% Significance Level | | | | |
| A | 45 | Detected data appea | r Gamma Di | stributed at 5% Significance Level |
| Age | 46 47 | Note GOF tests | may be unre | eliable for small sample sizes |
| Theta hat (MLE) | 48 | | | Statistics |
| Triangle | | | | |
| S2 | 51 | | | |
| Adjusted Level of Significance 0.0086 Adjusted Chi Square Value 45.9 | 52 | | | MLE Sd (bias corrected) 31.48 |
| Assuming Gamma Distribution 95% Adjusted Gamma UCL 130.3 95% Adjusted Gamma UCL 130.3 130.3 95% Adjusted Gamma UCL 130.3 130.3 95% Adjusted Gamma UCL 130.3 13 | ეკ 54 | Adjusted Level of Significance | 0.0086 | |
| S7 | 55 | | | |
| Lognormal GOF Test | | | | |
| Shapiro Wilk Test Statistic 0.863 Shapiro Wilk Lognormal GOF Test | 58 | 93 /0 Арргохинате Gamina OCL | • | |
| 61 10% Shapiro Wilk Critical Value 0.806 Data appear Lognormal at 10% Significance Level 62 Lilliefors Critical Value 0.307 Lilliefors Lognormal GOF Test 63 10% Lilliefors Critical Value 0.319 Data appear Lognormal at 10% Significance Level 64 Data appear Lognormal at 10% Significance Level 65 Note GOF tests may be unreliable for small sample sizes 66 Lognormal Statistics 68 Minimum of Logged Data 3.97 Mean of logged Data 4.402 69 Maximum of Logged Data 4.644 SD of logged Data 0.279 70 Assuming Lognormal Distribution 72 95% H-UCL 117.8 90% Chebyshev (MVUE) UCL 115.5 73 95% Chebyshev (MVUE) UCL 129.7 97.5% Chebyshev (MVUE) UCL 149.5 75 Nonparametric Distribution Free UCL Statistics 76 Nonparametric Distribution Free UCL Statistics 77 Data appear to follow a Discernible Distribution 78 Nonparametric Distribution Free UCLs 80 95% CLT UCL 99.47 95% BCA Bootstrap | | Chanica Mills Took Chaticals | | |
| 62 Lilliefors Test Statistic 0.307 Lilliefors Lognormal GOF Test 63 10% Lilliefors Critical Value 0.319 Data appear Lognormal at 10% Significance Level 64 Data appear Lognormal at 10% Significance Level 65 Note GOF tests may be unreliable for small sample sizes 66 Lognormal Statistics 68 Mean of logged Data 4.402 69 Maximum of Logged Data 4.644 SD of logged Data 0.279 70 Assuming Lognormal Distribution 72 95% H-UCL 117.8 90% Chebyshev (MVUE) UCL 115.5 73 95% Chebyshev (MVUE) UCL 129.7 97.5% Chebyshev (MVUE) UCL 149.5 75 Nonparametric Distribution Free UCL Statistics 77 Data appear to follow a Discernible Distribution 78 Nonparametric Distribution Free UCLs 80 Nonparametric Distribution Free UCLs 80 95% BCA Bootstrap UCL 96 | 61 | | | |
| Data appear Lognormal at 10% Significance Level | | Lilliefors Test Statistic | 0.307 | Lilliefors Lognormal GOF Test |
| Note GOF tests may be unreliable for small sample sizes | 64 | | | |
| Lognormal Statistics Minimum of Logged Data 3.97 Mean of logged Data 4.402 | 65 | | | |
| 68 Minimum of Logged Data 3.97 Mean of logged Data 4.402 69 Maximum of Logged Data 4.644 SD of logged Data 0.279 70 71 Assuming Lognormal Distribution 72 95% H-UCL 117.8 90% Chebyshev (MVUE) UCL 115.5 73 95% Chebyshev (MVUE) UCL 129.7 97.5% Chebyshev (MVUE) UCL 149.5 74 99% Chebyshev (MVUE) UCL 188.2 75 Nonparametric Distribution Free UCL Statistics 77 Data appear to follow a Discernible Distribution 78 Nonparametric Distribution Free UCLs 80 95% BCA Bootstrap UCL 96 | | | Lognorma | I Statistics |
| To | 68 | | 3.97 | Mean of logged Data 4.402 |
| T1 | | Maximum of Logged Data | 4.644 | SD of logged Data 0.279 |
| 72 95% H-UCL 117.8 90% Chebyshev (MVUE) UCL 115.5 73 95% Chebyshev (MVUE) UCL 129.7 97.5% Chebyshev (MVUE) UCL 149.5 74 99% Chebyshev (MVUE) UCL 188.2 189.2 188.2 189 | 71 | Ass | uming Loand | ormal Distribution |
| 74 99% Chebyshev (MVUE) UCL 188.2 75 Nonparametric Distribution Free UCL Statistics 77 Data appear to follow a Discernible Distribution 78 Nonparametric Distribution Free UCLs 80 95% CLT UCL 99.47 95% BCA Bootstrap UCL 96 | 72 | 95% H-UCL | 117.8 | 90% Chebyshev (MVUE) UCL 115.5 |
| 75 76 Nonparametric Distribution Free UCL Statistics 77 Data appear to follow a Discernible Distribution 78 79 Nonparametric Distribution Free UCLs 80 95% CLT UCL 99.47 95% BCA Bootstrap UCL 96 | 74 | | | 97.5% Chebyshev (MVUE) UCL 149.5 |
| 77 Data appear to follow a Discernible Distribution 78 79 80 Nonparametric Distribution Free UCLs 80 95% CLT UCL 99.47 95% BCA Bootstrap UCL 96 | 75 | | | ı |
| 78 | | | | |
| 80 95% CLT UCL 99.47 95% BCA Bootstrap UCL 96 | 78 | Data appea | ai to ioliow a | DISCELLINE DISHIBULION |
| | 79 | | | |
| 81 95% Standard Bootstrap UCL 97.86 95% Bootstrap-t UCL 100.1 | | | | |
| 82 95% Hall's Bootstrap UCL 93.81 95% Percentile Bootstrap UCL 97.6 | | | | |

| | Α | В | С | D | Е | F | G | Н | I | J | K | L | Г |
|----|---|--------------|----------------|----------------|---------------|----------------|------------------|----------------|----------------|--------------|-----------------|-------|---|
| 83 | | - | 90% Ch | ebyshev(Me | an, Sd) UCL | 112.2 | | | 95% Ch | ebyshev(Me | an, Sd) UCL | 125 | 1 |
| 84 | | | 97.5% Ch | ebyshev(Mea | an, Sd) UCL | 142.7 | | | 99% Ch | ebyshev(Me | an, Sd) UCL | 177.6 | |
| 85 | | | | | | | | | | | | | |
| 86 | Cuggotta CCL to CCC | | | | | | | | | | | | |
| 87 | 00 /0 Ottadorito t OCE 104:1 | | | | | | | | | | | | |
| 88 | | | | | | | | | | | | | |
| 89 | | | | | | | | | | | | | |
| 90 | 1 | Note: Sugges | stions regard | ing the selec | tion of a 95% | 6 UCL are pr | ovided to hel | p the user to | select the m | ost appropri | ate 95% UCL | | |
| 91 | | Recom | mendations | are based up | on data size | , data distrib | ution, and sk | ewness usin | g results fror | m simulation | studies. | | |
| 92 | Но | wever, simul | lations result | s will not cov | er all Real V | Vorld data se | ts; for addition | nal insight th | ne user may | want to cons | ult a statistic | ian. | |
| 93 | | | | | | | | | | | | | |
| 94 | Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be | | | | | | | | | | | | |
| 95 | | | reliable. | Chen's and J | ohnson's m | ethods provi | de adjustme | nts for posit | vely skewed | data sets. | | | |
| 96 | | | | | | | | | | | | | 1 |

| 1 | A B C D E | F stics for Unc | G H I J K L ensored Full Data Sets |
|----------|--|--------------------|--|
| 2 | | | |
| 3 | User Selected Options | 40 F0 47 DM | |
| 5 | Date/Time of Computation ProUCL 5.2 10/31/2024 From File ProUCL Input.xls | 12:53:47 PM | 1 |
| 6 | Full Precision OFF | | |
| 7 | Confidence Coefficient 95% | | |
| 8 | Number of Bootstrap Operations 2000 | | |
| 9 10 | | | |
| | UMM-TLA-0.5-2 | | |
| 12 | OMM-1LA-0.3-2 | | |
| 13 | | General | Statistics |
| 14 | Total Number of Observations | 4 | Number of Distinct Observations 4 |
| 15 16 | | 040 | Number of Missing Observations 0 |
| 17 | Minimum Maximum | | Mean 335.8 Median 319.5 |
| 18 | SD | | Std. Error of Mean 17.47 |
| 19 | Coefficient of Variation | | Skewness 1.967 |
| 20 | | | |
| 21 22 | | | d using incremental sampling methodology (ISM) approach, |
| 23 | | | C 2020 and ITRC 2012) for additional guidance, the Chebyshev UCL for small sample sizes (n < 7). |
| 24 | | | in gross overestimates of the mean. |
| 25 | | | e for a discussion of the Chebyshev UCL. |
| 26 27 | | | |
| 28 | Shapiro Wilk Test Statistic | | GOF Test Shapira Wilk GOF Test |
| 29 | Snapiro Wilk Test Statistic 1% Shapiro Wilk Critical Value | | Shapiro Wilk GOF Test Data appear Normal at 1% Significance Level |
| 30 | Lilliefors Test Statistic | | Lilliefors GOF Test |
| 31 | 1% Lilliefors Critical Value | 0.413 | Data appear Normal at 1% Significance Level |
| 32 33 | | | t 1% Significance Level |
| 34 | Note GOF tests | may be unre | eliable for small sample sizes |
| 35 | Δο | suming Nor | mal Distribution |
| 36 | 95% Normal UCL | Summy Non | 95% UCLs (Adjusted for Skewness) |
| 37 | 95% Student's-t UCL | 376.9 | 95% Adjusted-CLT UCL (Chen-1995) 382.8 |
| 38 | | | 95% Modified-t UCL (Johnson-1978) 379.7 |
| 39 40 | | Commo | COF Test |
| 41 | A-D Test Statistic | | GOF Test Anderson-Darling Gamma GOF Test |
| 42 | 5% A-D Critical Value | | Data Not Gamma Distributed at 5% Significance Level |
| 43 | K-S Test Statistic | | Kolmogorov-Smirnov Gamma GOF Test |
| 44 45 | 5% K-S Critical Value | | Data Not Gamma Distributed at 5% Significance Level |
| 46 | Data Not Gami | ma Distribut | ed at 5% Significance Level |
| 47 | | Gamma | Statistics |
| 48 | k hat (MLE) | 131.2 | k star (bias corrected MLE) 32.96 |
| 49 | Theta hat (MLE) | | Theta star (bias corrected MLE) 10.19 |
| 50 51 | nu hat (MLE) | | nu star (bias corrected) 263.7 |
| 52 | MLE Mean (bias corrected) | 335.8 | MLE Sd (bias corrected) 58.48 Approximate Chi Square Value (0.05) 227.1 |
| 53 | Adjusted Level of Significance | N/A | Adjusted Chi Square Value N/A |
| 54 | | | |
| 55 | | | nma Distribution |
| 56 57 | 95% Approximate Gamma UCL | 389.9 | 95% Adjusted Gamma UCL N/A |
| 58 | | Loanorma | I GOF Test |
| 59 | Shapiro Wilk Test Statistic | 0.698 | Shapiro Wilk Lognormal GOF Test |
| 60 | 10% Shapiro Wilk Critical Value | 0.792 | Data Not Lognormal at 10% Significance Level |
| 61 62 | Lilliefors Test Statistic | | Lilliefors Lognormal GOF Test |
| 63 | 10% Lilliefors Critical Value | | Data Not Lognormal at 10% Significance Level 10% Significance Level |
| 64 | Daid NOLL | ognomiai at | 1070 Organication Level |
| 65 | | | l Statistics |
| 66 | Minimum of Logged Data | 5.756 | Mean of logged Data 5.813 |
| 67 68 | Maximum of Logged Data | 5.961 | SD of logged Data 0.0993 |
| 69 | Λοοι | ımina Loana | ormal Distribution |
| 70 | 95% H-UCL | N/A | 90% Chebyshev (MVUE) UCL 385.7 |
| 71 | 95% Chebyshev (MVUE) UCL | 408.3 | 97.5% Chebyshev (MVUE) UCL 439.7 |
| 72 | 99% Chebyshev (MVUE) UCL | 501.4 | |
| 73 74 | Nap | stria Diatelle - | tion Eros LICI Statistics |
| 75 | | | tion Free UCL Statistics Discernible Distribution |
| 76 | | to ronow a | Disconnible Distribution |
| 77 | | | tribution Free UCLs |
| 78 | 95% CLT UCL | 364.5 | 95% BCA Bootstrap UCL N/A |
| 79 80 | 95% Standard Bootstrap UCL | | 95% Bootstrap-t UCL N/A |
| 81 | 95% Hall's Bootstrap UCL 90% Chebyshev(Mean, Sd) UCL | N/A 388.1 | 95% Percentile Bootstrap UCL N/A 95% Chebyshev(Mean, Sd) UCL 411.9 |
| 82 | 97.5% Chebyshev(Mean, Sd) UCL | 444.8 | 99% Chebyshev(Mean, Sd) UCL 509.5 |
| 02 | | | |

| | Α | В | С | D | E | F | G | Н | I | J | K | L |
|----|---|---|---|---|---|---|---|---|---|---|---|---|
| 83 | | | | | | | | | | | | |
| 84 | Suggested UCL to Use | | | | | | | | | | | |
| 85 | 95% Student's-t UCL 376.9 | | | | | | | | | | | |
| 86 | | | | | | | | | | | | |
| 87 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. | | | | | | | | | | | |
| 88 | Recommendations are based upon data size, data distribution, and skewness using results from simulation studies. | | | | | | | | | | | |
| 89 | However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician. | | | | | | | | | | | |
| 90 | | | | | | | | | | | | |

| 1 | Α | В | С | D | E | F | G | Н | | J | K | L |
|----------|------------|---------------------------|--------------------------|---------------------------------|--------------------------------|----------------------|---------------------------------|-------------------------|-------------------------|---------------------------|-------------------------------|-------------------|
| 2 | | | | | UCL Statis | Stics for Unc | ensored Full D | ata Sets | | | | |
| 3 | Date | User Sele e/Time of Co | cted Options | ProUCL 5.2 | 10/21/2024 | 12·56·07 DM | | | | | | |
| 5 | Date | | From File | ProUCL Inpu | | 12.30.071 1 | | | | | | |
| 6 7 | | | Il Precision Coefficient | OFF 95% | | | | | | | | |
| 8 | | Bootstrap | | 2000 | | | | | | | | |
| 9 10 | | | | | | | | | | | | |
| 11 | UMM-TLA-0. | .5-3 | | | | | | | | | | |
| 12 13 | | | | | | General | Statistics | | | | | |
| 14 | | | Total | Number of Ol | bservations | 10 | | | | | Observations | 9 |
| 15 16 | | | | | Minimum | 11 | | | Number | of Missing | Observations Mean | 0 80.2 |
| 17 18 | | | | | Maximum | | | | | 04-1 | Median | 81.5 |
| 19 | | | | Coefficient | SD of Variation | 57.15 0.713 | | | | Sta. I | Error of Mean Skewness | 18.07 -0.00761 |
| 20 21 | | | | | | Normal (| COE Took | | | | | |
| 22 | | | S | Shapiro Wilk Te | est Statistic | 0.877 | GOF Test | S | hapiro Wi | lk GOF Tes | t | |
| 23 24 | | | | hapiro Wilk Cr | ritical Value | 0.781 | | Data appear | | | cance Level | |
| 25 | | | 1 | % Lilliefors Cr | est Statistic ritical Value | | | Data appear | | GOF Test t 1% Signific | cance Level | |
| 26 27 | | | | | Data appe | ar Normal a | 1% Significan | | | | | |
| 28 | | | | | As | suming Nori | mal Distribution | | | | | |
| 29 30 | | | 95% No | ormal UCL | lent's-t UCL | 113.3 | | 95% U | | sted for Ske | | 109.9 |
| 31 | | | | | ieni s-l UCL | 113.3 | | 95 | ∧ Aujuste √ Modifie | ed-t UCL (Jo | (Chen-1995) hnson-1978) | 113.3 |
| 32 33 | | | | | | Gamma | GOF Test | | | | | |
| 34 | | | | A-D T | est Statistic | 0.694 | | | | Gamma GO | | |
| 35 36 | | | | | ritical Value est Statistic | 0.741 0.213 | Detected d | | | stributed at v Gamma (| 5% Significan | ce Level |
| 37 | | | | 5% K-S Cr | ritical Value | 0.272 | | data appear C | Gamma Di | | 5% Significan | ce Level |
| 38 39 | | | | Detected | data appeai | r Gamma Di | stributed at 5% | Significance | e Level | | | |
| 40 | | | | | | | Statistics | | | | | |
| 41 42 | | | | | k hat (MLE) a hat (MLE) | 1.415 56.69 | | | | | rrected MLE) rrected MLE) | 1.057 75.88 |
| 43 | | | | nı | u hat (MLE) | 28.29 | | | mota | nu star (bi | as corrected) | 21.14 |
| 44 45 | | | M | LE Mean (bias | s corrected) | 80.2 | | An | proximate | | as corrected) Value (0.05) | 78.01 11.7 |
| 46 47 | | | Adjus | sted Level of S | Significance | 0.0267 | | | Ac | djusted Chi | Square Value | 10.49 |
| 48 | | | | | Ass | sumina Gam | ıma Distributio | n | | | | |
| 49 50 | | | 95% A | pproximate G | | | | | 95' | % Adjusted | Gamma UCL | 161.6 |
| 51 | | | | | | Lognorma | GOF Test | | | | | |
| 52 53 | | | | Shapiro Wilk To | | 0.813 | | | | normal GO | | |
| 54 | | | 10% 5 | hapiro Wilk Cr Lilliefors Te | est Statistic | 0.869 0.216 | | Data Not Log Lillief | | ormal GOF | | |
| 55 56 | | | 10 | % Lilliefors Cr | | | Da ormal at 10% S | | | at 10% Sign | ificance Level | |
| 57 | | | | рака ар | pear Approx | | | <u>agrinicatice i</u> | FOAGI | | | |
| 58 59 | | | | Minimum of Lo | ogged Data | | l Statistics | | | Mean | f logged Data | 3.991 |
| 60 | | | | Maximum of Lo | | 5.024 | | | | | f logged Data | 1.078 |
| 61 62 | | | | | Δεει | ımina Loana | ormal Distributi | on . | | | | |
| 63 | | | | | 95% H-UCL | 312.7 | a. Disamuli | | | | (MVUE) UCL | 185.3 |
| 64 65 | | | | Chebyshev (M Chebyshev (M | | | | | 97.5% | Chebyshev | (MVUE) UCL | 289.1 |
| 66 | | | 33 /0 | | | | | | | | | |
| 67 68 | | | | | | | tion Free UCL Discernible Di | | | | | |
| 69 | | | | | | | | | | | | |
| 70 71 | | | | 95° | Nonpai % CLT UCL | | tribution Free U | JCLS | | 95% BCA B | ootstrap UCL | 107.7 |
| 72 73 | | | | Standard Boo | otstrap UCL | 108.4 | | | | 95% Bo | otstrap-t UCL | 113.4 |
| 74 | | | | 95% Hall's Boo nebyshev(Mea | | | | | | | ootstrap UCL ean, Sd) UCL | 107.3 159 |
| 75 76 | | | | nebyshev(Mea | | 193.1 | | | | | ean, Sd) UCL | 260 |
| 77 | | | | | | Suggested | UCL to Use | | | | | |
| 78 79 | | | | 95% Stud | lent's-t UCL | 113.3 | | | | | | |
| 80 | N | lote: Sugge | stions regard | ling the select | ion of a 95% | <u>6 UCL a</u> re pr | ovided to help t | the user to se | elect the m | nost appropr | riate 95% UCL | |
| 81 82 | | Recom | mendations | are based upo | on data size | , data distrib | ution, and skew | vness using r | esults fror | n simulation | n studies. | |
| 02 | <u>Hov</u> | vever, simu | <u>liations result</u> | s will not cove | er all Real W | voria data se | ts; for additiona | ıı ınsıght the ı | user may | want to cons | suit a statistici | an. |

| | Α | В | С | D | E | F | G | Н | | J | K | L |
|----|---|-----------|--------------|--------------|---------------|--------------|--------------|----------------|--------------|-------------|------------|---|
| 83 | | | | | | | | | | | | |
| 84 | | Note: For | highly negat | ively-skewed | d data, confi | dence limits | (e.g., Chen, | Johnson, Lo | ognormal, an | id Gamma) r | nay not be | |
| 85 | | | reliable. (| Chen's and J | lohnson's me | ethods provi | de adjustme | nts for posity | vely skewed | data sets. | | |
| 86 | | | | | | | | | | | | |
| | | | | | | | | | | | | |

| | A B C D E | F | G H I J K | L |
|----------|---|-----------------------|---|-----------------|
| 2 | UCL Statis | stics for Unc | ensored Full Data Sets | |
| 3 | User Selected Options | | | |
| 4 5 | Date/Time of Computation ProUCL 5.2 10/31/2024 ProUCL Input.xls | 12:57:45 PM | | |
| 6 | Full Precision OFF | | | |
| 7 8 | Confidence Coefficient 95% Number of Bootstrap Operations 2000 | | | |
| 9 | Number of Bootstrap Operations 2000 | | | |
| 10 | | | | |
| 12 | UMM-TLA-0.5-4 | | | |
| 13 | | | Statistics | |
| 14 15 | Total Number of Observations | 4 | Number of Distinct Observations Number of Missing Observations | 0 |
| 16 | Minimum | 59 | Mean | 75.5 |
| 17 18 | Maximum | | Median | 78.5 |
| 19 | SD Coefficient of Variation | | Std. Error of Mean Skewness | 6.357 -0.817 |
| 20 | | , | | 0.017 |
| 21 22 | | | I using incremental sampling methodology (ISM) approach, C 2020 and ITRC 2012) for additional guidance, | |
| 23 | | | the Chebyshev UCL for small sample sizes (n < 7). | |
| 24 25 | The Chebyshev UCL o | often results | in gross overestimates of the mean. | |
| 26 | Refer to the ProUCL 5.2 Tec | nnical Guide | e for a discussion of the Chebyshev UCL. | |
| 27 | | | GOF Test | |
| 28 29 | Shapiro Wilk Test Statistic 1% Shapiro Wilk Critical Value | | Shapiro Wilk GOF Test | |
| 30 | 1% Snapiro Wilk Critical Value Lilliefors Test Statistic | | Data appear Normal at 1% Significance Level Lilliefors GOF Test | |
| 31 | 1% Lilliefors Critical Value | 0.413 | Data appear Normal at 1% Significance Level | |
| 32 33 | | | t 1% Significance Level eliable for small sample sizes | |
| 34 | | | | |
| 35 36 | | suming Norr | mal Distribution | |
| 37 | 95% Normal UCL 95% Student's-t UCL | 90.46 | 95% UCLs (Adjusted for Skewness) 95% Adjusted-CLT UCL (Chen-1995) | 83.18 |
| 38 | 30% Statistics (002 | 00.10 | 95% Modified-t UCL (Johnson-1978) | 90.03 |
| 39 40 | | | COF Took | |
| 41 | A-D Test Statistic | | GOF Test Anderson-Darling Gamma GOF Test | |
| 42 | 5% A-D Critical Value | 0.656 | Detected data appear Gamma Distributed at 5% Significance | Level |
| 43 44 | K-S Test Statistic 5% K-S Critical Value | | Kolmogorov-Smirnov Gamma GOF Test Detected data appear Gamma Distributed at 5% Significance | a Lovol |
| 45 | | | stributed at 5% Significance Level | ; Level |
| 46 47 | Note GOF tests | may be unre | eliable for small sample sizes | |
| 47 | | Gamma | Statistics | |
| 49 | k hat (MLE) | | k star (bias corrected MLE) | 11.24 |
| 50 51 | Theta hat (MLE) | | Theta star (bias corrected MLE) | 6.718 |
| 52 | nu hat (MLE) MLE Mean (bias corrected) | | nu star (bias corrected) MLE Sd (bias corrected) | 89.91 22.52 |
| 53 | | | Approximate Chi Square Value (0.05) | 69.05 |
| 54 55 | Adjusted Level of Significance | N/A | Adjusted Chi Square Value | N/A |
| 56 | As | suming Garr | nma Distribution | |
| 57 58 | 95% Approximate Gamma UCL | | 95% Adjusted Gamma UCL | N/A |
| 58 | | Lognorma | I GOF Test | |
| 60 | Shapiro Wilk Test Statistic | 0.879 | Shapiro Wilk Lognormal GOF Test | |
| 61 62 | 10% Shapiro Wilk Critical Value | | Data appear Lognormal at 10% Significance Level | |
| 63 | Lilliefors Test Statistic 10% Lilliefors Critical Value | | Lilliefors Lognormal GOF Test Data appear Lognormal at 10% Significance Level | |
| 64 | Data appear | Lognormal a | at 10% Significance Level | |
| 65 66 | Note GOF tests | may be unre | eliable for small sample sizes | |
| 67 | | Lognorma | I Statistics | |
| 68 | Minimum of Logged Data | 4.078 | Mean of logged Data | 4.313 |
| 69 70 | Maximum of Logged Data | 4.454 | SD of logged Data | 0.177 |
| 71 | | | ormal Distribution | |
| 72 73 | 95% H-UCL | 96.84 | 90% Chebyshev (MVUE) UCL | 95.48 |
| 74 | 95% Chebyshev (MVUE) UCL 99% Chebyshev (MVUE) UCL | | 97.5% Chebyshev (MVUE) UCL | 117.1 |
| 75 | | | | |
| 76 77 | | | tion Free UCL Statistics | |
| 78 | Data appea | <u>ir to follow a</u> | Discernible Distribution | |
| 79 | | | tribution Free UCLs | |
| 80 81 | 95% CLT UCL | 85.96 | 95% BCA Bootstrap UCL | N/A |
| 82 | 95% Standard Bootstrap UCL 95% Hall's Bootstrap UCL | | 95% Bootstrap-t UCL 95% Percentile Bootstrap UCL | N/A N/A |
| | 30 /0 Fiall 5 DOUISHAP UCL | 1.11/7.1 | 1 30 /0 1 GLOGHAIG DOUISHAD OCL | 11//3 |

| | Α | В | С | D | Е | F | G | Н | I | J | K | L |
|----|----------------------|--------------|----------------|----------------|---------------|-------------------|------------------|----------------|----------------|--------------|-----------------|-------|
| 83 | | - | 90% Ch | ebyshev(Me | an, Sd) UCL | 94.57 | | | 95% Ch | ebyshev(Me | an, Sd) UCL | 103.2 |
| 84 | | | 97.5% Ch | ebyshev(Me | an, Sd) UCL | 115.2 | | | 99% Ch | ebyshev(Me | an, Sd) UCL | 138.8 |
| 85 | | | | | | | | | | | | |
| 86 | Cuggootou COL to COC | | | | | | | | | | | |
| 87 | | | | 95% Stu | dent's-t UCL | 90.46 | | | | | | |
| 88 | | | | Red | commended | UCL exceed | ds the maxim | num observa | ation | | | |
| 89 | | | | | | | | | | | | |
| 90 | l | Note: Sugges | stions regard | ing the selec | tion of a 95% | 6 UCL are pr | ovided to hel | p the user to | select the m | ost appropri | ate 95% UCL | |
| 91 | | Recom | mendations | are based up | on data size | , data distrib | ution, and sk | ewness usin | g results fror | m simulation | studies. | |
| 92 | Ho | wever, simu | lations result | s will not cov | er all Real V | Vorld data se | ts; for addition | nal insight th | ne user may | want to cons | ult a statistic | ian. |
| 93 | | | | | | | | | | | | |
| 94 | | Note: For | highly negat | ively-skewe | d data, confi | dence limits | (e.g., Chen, | Johnson, Lo | ognormal, ar | nd Gamma) ı | may not be | |
| 95 | | | reliable. | Chen's and J | ohnson's m | ethods provi | de adjustme | nts for posit | vely skewed | data sets. | | |
| 96 | | | | | | | | | | | | |

| 4 | A B C D E | F | G H I J K | L |
|----------|---|--------------------|--|----------------|
| 2 | UCL Statis | stics for Unc | ensored Full Data Sets | |
| 3 | User Selected Options | 10-F0-20 DM | | |
| 5 | Date/Time of Computation ProUCL 5.2 10/31/2024 From File ProUCL Input.xls | 12:59:36 PIVI | | |
| 6 | Full Precision OFF | | | |
| 7 8 | Confidence Coefficient 95% Number of Bootstrap Operations 2000 | | | |
| 9 | Number of Bootstrap Operations (2000 | | | |
| 10 11 | UMM-TLA-0.5-4-DUP | | | |
| 12 | <u> </u> | | | |
| 13 14 | Total Number of Observations | General 4 | Statistics Number of Distinct Observations | 4 |
| 15 | Total Number of Observations | 4 | Number of Missing Observations | 0 |
| 16 17 | Minimum | 64 81 | Mean | 72.5 72.5 |
| 18 | Maximum SD | 6.952 | Median Std. Error of Mean | 3.476 |
| 19 | Coefficient of Variation | | Skewness | 0 |
| 20 21 | Note: Sample size is small (e.g., <10), if data a | are collected | I using incremental sampling methodology (ISM) approach, | |
| 22 | refer also to ITRC Tech Reg Guide of | on ISM (ITR | C 2020 and ITRC 2012) for additional guidance, | |
| 23 24 | | | the Chebyshev UCL for small sample sizes (n < 7). in gross overestimates of the mean. | |
| 25 | | | e for a discussion of the Chebyshev UCL. | |
| 26 27 | | Names -1.4 | | |
| 28 | Shapiro Wilk Test Statistic | | GOF Test Shapiro Wilk GOF Test | |
| 29 | 1% Shapiro Wilk Critical Value | 0.687 | Data appear Normal at 1% Significance Level | |
| 30 31 | Lilliefors Test Statistic 1% Lilliefors Critical Value | | Lilliefors GOF Test Data appear Normal at 1% Significance Level | |
| 32 | Data appe | ar Normal at | 1% Significance Level | |
| 33 34 | Note GOF tests | may be unre | eliable for small sample sizes | |
| 35 | As | suming Nor | mal Distribution | |
| 36 37 | 95% Normal UCL | T | 95% UCLs (Adjusted for Skewness) | 70.00 |
| 38 | 95% Student's-t UCL | 80.68 | 95% Adjusted-CLT UCL (Chen-1995) 95% Modified-t UCL (Johnson-1978) | 78.22 80.68 |
| 39 | | | | 00.00 |
| 40 41 | A-D Test Statistic | Gamma 0.274 | GOF Test Anderson-Darling Gamma GOF Test | |
| 42 | 5% A-D Critical Value | | Detected data appear Gamma Distributed at 5% Significance | Level |
| 43 44 | K-S Test Statistic | | Kolmogorov-Smirnov Gamma GOF Test | Lavel |
| 45 | 5% K-S Critical Value Detected data appear | | Detected data appear Gamma Distributed at 5% Significance stributed at 5% Significance Level | Level |
| 46 47 | Note GOF tests | may be unre | eliable for small sample sizes | |
| 47 | | Gamma | Statistics | |
| 49 | k hat (MLE) | 144.2 | k star (bias corrected MLE) | 36.21 |
| 50 51 | Theta hat (MLE) nu hat (MLE) | | Theta star (bias corrected MLE) nu star (bias corrected) | 2.002 289.7 |
| 52 | MLE Mean (bias corrected) | | MLE Sd (bias corrected) | 12.05 |
| 53 54 | Adjusted Level of Classification | N/A | | 251.3 |
| 55 | Adjusted Level of Significance | IN/A | Adjusted Chi Square Value | N/A |
| 56 57 | | | ma Distribution | N1/A |
| 58 | 95% Approximate Gamma UCL | 83.59 | 95% Adjusted Gamma UCL | N/A |
| 59 | | | GOF Test | |
| 60 61 | Shapiro Wilk Test Statistic 10% Shapiro Wilk Critical Value | | Shapiro Wilk Lognormal GOF Test Data appear Lognormal at 10% Significance Level | |
| 62 | Lilliefors Test Statistic | 0.236 | Lilliefors Lognormal GOF Test | |
| 63 64 | 10% Lilliefors Critical Value | | Data appear Lognormal at 10% Significance Level | |
| 65 | Note GOF tests | may be unre | eliable for small sample sizes | |
| 66 67 | | | | |
| 68 | Minimum of Logged Data | | Il Statistics Mean of logged Data | 4.28 |
| 69 | Maximum of Logged Data | | SD of logged Data | 0.0964 |
| 70 71 | Λοοι | umina Loana | ormal Distribution | |
| 72 | 95% H-UCL | N/A | 90% Chebyshev (MVUE) UCL | 82.98 |
| 73 74 | 95% Chebyshev (MVUE) UCL 99% Chebyshev (MVUE) UCL | 87.73 107.3 | 97.5% Chebyshev (MVUE) UCL | 94.31 |
| 75 | 33 % Chebyshev (MVOE) UCL | 107.3 | | |
| 76 77 | | | tion Free UCL Statistics | |
| 78 | Data appea | ir to tollow a | Discernible Distribution | |
| 79 | | | tribution Free UCLs | |
| 80 81 | 95% CLT UCL 95% Standard Bootstrap UCL | 78.22 N/A | | N/A N/A |
| 82 | 95% Hall's Bootstrap UCL | | | N/A |
| | | | | |

| | Α | В | С | D | E | F | G | Н | I | J | K | L |
|----|---|--------------|----------------|----------------|---------------|----------------|-----------------|----------------|----------------|--------------|------------------|-------|
| 83 | 90% Chebyshev(Mean, Sd) UCL 82.93 95% Chebyshev(Mean, Sd) UCL | | | | | | | | | | | 87.65 |
| 84 | 97.5% Chebyshev(Mean, Sd) UCL 94.21 99% Chebyshev(Mean, Sd) UCL | | | | | | | | | | 107.1 | |
| 85 | | | | | | | | | | | | |
| 86 | | | | | | Suggested | UCL to Use | | | | | |
| 87 | | | | 95% Stu | dent's-t UCL | 80.68 | | | | | | |
| 88 | | | | | | • | • | | | | | |
| 89 | | Note: Sugges | stions regard | ing the selec | tion of a 95% | UCL are pr | ovided to hel | p the user to | select the m | ost appropri | ate 95% UCL | |
| 90 | | Recom | mendations | are based up | on data size | , data distrib | ution, and sk | ewness usin | g results fror | m simulation | studies. | |
| 91 | | wever, simul | lations result | s will not cov | er all Real W | orld data se | ts; for additio | nal insight th | ne user may | want to cons | ult a statistici | ian. |
| 92 | | | | | | | | | | | | |

| 1 | | |
|--|-------------------------------|----------------|
| Date/Time of Computation | | |
| Statistics From File ProUCL Input.xls | | |
| 7 Confidence Coefficient 95% 8 Number of Bootstrap Operations 2000 9 10 11 UMM-TLA-0.5-5 12 3 14 Total Number of Observations 4 15 Number of Distinct 15 Number of Missing 16 Minimum 31 | | |
| 8 Number of Bootstrap Operations 2000 9 10 11 UMM-TLA-0.5-5 12 3 13 General Statistics 14 Total Number of Observations 4 Number of Distinct 15 Number of Missing 16 Minimum 31 | | |
| 9 10 11 UMM-TLA-0.5-5 12 13 General Statistics 14 Total Number of Observations 4 Number of Distinct 15 Number of Missing 16 Minimum 31 31 31 31 31 31 31 3 | | |
| 11 UMM-TLA-0.5-5 12 General Statistics 13 General Statistics 14 Total Number of Observations 4 Number of Distinct 15 Number of Missing 16 Minimum 31 | | |
| 12 13 General Statistics 14 Total Number of Observations 4 Number of Distinct 15 Number of Missing 16 Minimum 31 | | |
| 14Total Number of Observations4Number of Distinct15Number of Missing16Minimum31 | | |
| 15 Number of Missing 16 Minimum 31 | Observations | 4 |
| | | 0 |
| | Mean Median | 38.5 38.5 |
| 18 SD 6.137 Std. | Error of Mean | 3.069 |
| 19 Coefficient of Variation 0.159 | Skewness | 0 |
| Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM | approach. | |
| refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance, | | |
| but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < The Chebyshev UCL often results in gross overestimates of the mean. | 7). | |
| Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL. | | |
| 26 27 Normal GOF Test | | |
| 28 Shapiro Wilk Test Statistic 0.971 Shapiro Wilk GOF Tes | | |
| 29 1% Shapiro Wilk Critical Value 0.687 Data appear Normal at 1% Signification 1% Significa | cance Level | |
| 31 1% Lilliefors Critical Value 0.413 Data appear Normal at 1% Signific | cance Level | |
| Data appear Normal at 1% Significance Level | | |
| Note GOF tests may be unreliable for small sample sizes 34 | | |
| 35 Assuming Normal Distribution | | |
| 36 95% Normal UCL 95% UCLs (Adjusted for Sk 37 95% Student's-t UCL 45.72 95% Adjusted-CLT UCL | | 43.55 |
| 38 95% Modified-t UCL (Jo | | 45.72 |
| 39 40 Gamma GOF Test | | |
| 40 Gamma GOF Test 41 A-D Test Statistic 0.27 Anderson-Darling Gamma GO | OF Test | |
| 42 5% A-D Critical Value 0.656 Detected data appear Gamma Distributed at | 5% Significand | e Level |
| K-S Test Statistic 0.231 Kolmogorov-Smirnov Gamma (44) 5% K-S Critical Value 0.394 Detected data appear Gamma Distributed at | | e l evel |
| 45 Detected data appear Gamma Distributed at 5% Significance Level | 576 Olgrinicario | O LCVOI |
| Note GOF tests may be unreliable for small sample sizes 47 | | |
| 48 Gamma Statistics | | |
| 49 k hat (MLE) 51.64 k star (bias co | | 13.08 |
| Theta hat (m22) | as corrected) | 2.944 104.6 |
| 52 MLE Mean (bias corrected) 38.5 MLE Sd (bi | as corrected) | 10.65 |
| 53 Approximate Chi Square 54 Adjusted Level of Significance N/A Adjusted Chi Adjusted Chi | | 82.01 N/A |
| 55 | oqualo valuo | 13//3 |
| Second | Camma LICI | N/A |
| 58 | uaninia UUL | 111/71 |
| 59 Lognormal GOF Test 60 Shapiro Wilk Test Statistic 0.966 Shapiro Wilk Lognormal GO | E Tost | |
| 61 10% Shapiro Wilk Critical Value 0.792 Data appear Lognormal at 10% Sign | | |
| 62 Lilliefors Test Statistic 0.242 Lilliefors Lognormal GOF | Test | |
| 63 10% Lilliefors Critical Value 0.346 Data appear Lognormal at 10% Sign 64 Data appear Lognormal at 10% Significance Level | ITICANCE Level | |
| Note GOF tests may be unreliable for small sample sizes | | |
| 66 67 Lognormal Statistics | | |
| 68 Minimum of Logged Data 3.434 Mean o | f logged Data | 3.641 |
| 69 Maximum of Logged Data 3.829 SD o | f logged Data | 0.162 |
| 71 Assuming Lognormal Distribution | | |
| 72 95% H-UCL 48.17 90% Chebyshev | | 47.83 |
| 73 95% Chebyshev (MVUE) UCL 52.06 97.5% Chebyshev 74 99% Chebyshev (MVUE) UCL 69.44 | (MVUE) UCL | 57.92 |
| 75 | | |
| Nonparametric Distribution Free UCL Statistics Data appear to follow a Discernible Distribution | | |
| 78 | | |
| 79 Nonparametric Distribution Free UCLs | | N1/0 |
| | ootstrap UCL otstrap-t UCL | N/A N/A |
| 82 95% Hall's Bootstrap UCL N/A 95% Percentile B | | N/A |

| | Α | В | С | D | E | F | G | Н | I | J | K | L |
|----|---|--------------|----------------|----------------|---------------|----------------|------------------|----------------|----------------|---------------|------------------|-------|
| 83 | | | 90% Ch | ebyshev(Me | an, Sd) UCL | 47.71 | | 51.88 | | | | |
| 84 | | | 97.5% Ch | ebyshev(Me | an, Sd) UCL | 57.66 | | | 99% Ch | ebyshev(Me | an, Sd) UCL | 69.03 |
| 85 | | | | | | | | | | | | |
| 86 | | | | | | Suggested | UCL to Use | | | | | |
| 87 | | | | 95% Stu | dent's-t UCL | 45.72 | | | | | | |
| 88 | | | | | | | | | | | | |
| 89 | | Note: Sugges | stions regard | ing the selec | tion of a 95% | UCL are pr | ovided to hel | p the user to | select the m | ost appropria | ate 95% UCL | |
| 90 | | Recom | mendations | are based up | on data size | , data distrib | ution, and sk | ewness usin | g results fror | n simulation | studies. | |
| 91 | | wever, simul | lations result | s will not cov | er all Real W | orld data se | ts; for addition | nal insight th | ne user may | want to cons | ult a statistici | an. |
| 92 | | | | | | | | | | | | |

| 4 | A B C D E | F | G H I J K | L |
|----------|---|----------------|---|----------------|
| 2 | UCL Statis | stics for Unc | ensored Full Data Sets | |
| 3 | User Selected Options | 1.0E:22 DM | | |
| 5 | Date/Time of Computation ProUCL 5.2 10/31/2024 From File ProUCL Input.xls | 1:05:33 PM | | |
| 6 | Full Precision OFF | | | |
| 7 8 | Confidence Coefficient 95% Number of Bootstrap Operations 2000 | | | |
| 9 | Number of Booleting Operations (2000 | | | |
| 10 11 | UMM-TLA-0.5-5-DUP | | | |
| 12 | OMMI-1 LA-0.5-5-DOP | | | |
| 13 14 | Total Number of Observations | | Statistics Number of Distinct Observations | |
| 15 | Total Number of Observations | 4 | Number of Distinct Observations Number of Missing Observations | 0 |
| 16 | Minimum | 33 | Mean | 39.75 |
| 17 18 | Maximum SD | 47 6.801 | Median Std. Error of Mean | 39.5 3.4 |
| 19 | Coefficient of Variation | | Skewness | 0.0914 |
| 20 21 | Note: Sample size is small (e.g. <10) if date (| ara collected | using incremental sampling methodology (ISM) approach, | |
| 22 | | | C 2020 and ITRC 2012) for additional guidance, | |
| 23 24 | | | he Chebyshev UCL for small sample sizes (n < 7). | |
| 25 | | | in gross overestimates of the mean. e for a discussion of the Chebyshev UCL. | |
| 26 | 110101 10 110 1 100 0 1 1 1 1 0 0 | | • | |
| 27 28 | Shapiro Wilk Test Statistic | | GOF Test Shapiro Wilk GOF Test | |
| 29 | 1% Shapiro Wilk Critical Value | 0.687 | Data appear Normal at 1% Significance Level | |
| 30 31 | Lilliefors Test Statistic | | Lilliefors GOF Test | |
| 32 | 1% Lilliefors Critical Value Data apper | | Data appear Normal at 1% Significance Level 1 1% Significance Level | |
| 33 | | | eliable for small sample sizes | |
| 34 35 | Δο | suming Non | mal Distribution | |
| 36 | 95% Normal UCL | Summy Non | 95% UCLs (Adjusted for Skewness) | |
| 37 38 | 95% Student's-t UCL | 47.75 | 95% Adjusted-CLT UCL (Chen-1995) | 45.51 |
| 39 | | | 95% Modified-t UCL (Johnson-1978) | 47.78 |
| 40 | | | GOF Test | |
| 41 42 | A-D Test Statistic 5% A-D Critical Value | 0.396 0.656 | Anderson-Darling Gamma GOF Test Detected data appear Gamma Distributed at 5% Significance | e l evel |
| 43 | K-S Test Statistic | 0.285 | Kolmogorov-Smirnov Gamma GOF Test | |
| 44 45 | 5% K-S Critical Value | | Detected data appear Gamma Distributed at 5% Significance stributed at 5% Significance Level | e Level |
| 46 | Note GOF tests | may be unre | eliable for small sample sizes | |
| 47 48 | | Commo | Ctatistica | |
| 49 | k hat (MLE) | 45.37 | Statistics k star (bias corrected MLE) | 11.51 |
| 50 51 | Theta hat (MLE) | | Theta star (bias corrected MLE) | 3.454 |
| 52 | nu hat (MLE) MLE Mean (bias corrected) | | nu star (bias corrected) MLE Sd (bias corrected) | 92.07 11.72 |
| 53 | | | Approximate Chi Square Value (0.05) | 70.94 |
| 54 55 | Adjusted Level of Significance | N/A | Adjusted Chi Square Value | N/A |
| 56 | | | ma Distribution | |
| 57 58 | 95% Approximate Gamma UCL | 51.59 | 95% Adjusted Gamma UCL | N/A |
| 59 | | Lognorma | GOF Test | |
| 60 61 | Shapiro Wilk Test Statistic | 0.892 | Shapiro Wilk Lognormal GOF Test | |
| 62 | 10% Shapiro Wilk Critical Value Lilliefors Test Statistic | | Data appear Lognormal at 10% Significance Level Lilliefors Lognormal GOF Test | |
| 63 | 10% Lilliefors Critical Value | 0.346 | Data appear Lognormal at 10% Significance Level | |
| 64 65 | Data appear | Lognormal a | at 10% Significance Level Bliable for small sample sizes | |
| 66 | NOTE GOT LESTS | | | |
| 67 68 | Minimum of Long 1 Date | | I Statistics | 2 672 |
| 69 | Minimum of Logged Data Maximum of Logged Data | | Mean of logged Data SD of logged Data | 3.672 0.172 |
| 70 71 | | | | |
| 71 72 | Assı 95% H-UCL | | prmal Distribution 90% Chebyshev (MVUE) UCL | 49.98 |
| 73 | 95% Chebyshev (MVUE) UCL | 54.62 | 97.5% Chebyshev (MVUE) UCL | 61.05 |
| 74 75 | 99% Chebyshev (MVUE) UCL | 73.68 | | |
| 76 | Nonparame | etric Distribu | tion Free UCL Statistics | |
| 77 70 | | | Discernible Distribution | |
| 78 79 | Nonna | rametric Dis | tribution Free UCLs | |
| 80 | 95% CLT UCL | 45.34 | 95% BCA Bootstrap UCL | N/A |
| 81 82 | 95% Standard Bootstrap UCL | | 95% Bootstrap-t UCL | N/A |
| UΖ | 95% Hall's Bootstrap UCL | N/A | 95% Percentile Bootstrap UCL | N/A |

| | Α | В | С | D | Е | F | G | Н | I | J | K | L | |
|----|----|------------------------------|----------------|----------------|---------------|-------------------|------------------|--------------------------------|----------------|--------------|-----------------|-------|---|
| 83 | | | 90% Ch | ebyshev(Me | an, Sd) UCL | 49.95 | | 95% Chebyshev(Mean, Sd) UCL 54 | | | | | |
| 84 | | 97.5% Chebyshev(Mean, Sd) U(| | | | | | | 99% Ch | ebyshev(Me | an, Sd) UCL | 73.58 | |
| 85 | | | | | | | | | | | | |] |
| 86 | | | | | | Suggested | UCL to Use | | | | | |] |
| 87 | | | | 95% Stu | dent's-t UCL | 47.75 | | | | | | | |
| 88 | | | | Red | commended | UCL exceed | ds the maxim | num observa | ition | | | |] |
| 89 | | | | | | | | | | | | | |
| 90 | 1 | Note: Sugge: | stions regard | ling the selec | tion of a 95% | 6 UCL are pr | ovided to hel | p the user to | select the m | ost appropri | ate 95% UCL | | 1 |
| 91 | | Recom | mendations | are based up | on data size | , data distrib | ution, and sk | ewness usin | g results fror | m simulation | studies. | | |
| 92 | Но | wever, simu | lations result | s will not cov | er all Real W | /orld data se | ts; for addition | nal insight th | ne user may | want to cons | ult a statistic | an. | |
| 93 | | | | | | | | | | | | | 1 |

| 1 | Α | В | С | D | E LIOL Obstic | F | G | H | I | J | K | L |
|----------|----------|--|---------------------------|-----------------------------------|--------------------|--------------------|------------------|-------------|-------------------------|------------------------------------|---------------------------------|-----------------|
| 2 | | | | | UCL Statis | Stics for Unc | ensored Full D | Jata Sets | | | | |
| 3 | Dr | User Selection User S | ected Options | ProUCL 5.2 1 | 0/31/2024 - | 1·16·// DM | | | | | | |
| 5 | Da | | From File | ProUCL Input | | 1. 10.44 F W | | | | | | |
| 6 7 | | | Ill Precision Coefficient | OFF 95% | | | | | | | | |
| 8 | Number | of Bootstrap | | 2000 | | | | | | | | |
| 9 | | | | | | | | | | | | |
| 11 | UMM-TLA- | 0.5-6 | | | | | | | | | | |
| 12 13 | | | | | | General | Statistics | | | | | |
| 14 | | | Total | Number of Ob | servations | 10 | | | | | Observations | 10 |
| 15 16 | | | | | Minimum | 2576 | | | Numbe | r of Missing | Observations Mean | 3074 |
| 17 | | | | | Maximum | 3402 | | | | | Median | 3083 |
| 18 19 | | | | Coefficient o | SD of Variation | | | | | Std. | Error of Mean Skewness | 80.46 -0.618 |
| 20 | | | | | variation | | | | | | OKOWNOOD | |
| 21 22 | | | S | Shapiro Wilk Te | st Statistic | Normal 0 0.962 | GOF Test | | Shaniro W | ilk GOF Tes | et . | |
| 23 | | | | hapiro Wilk Cri | tical Value | 0.781 | | | r Normal a | at 1% Signifi | icance Level | |
| 24 25 | | | 1 | Lilliefors Te % Lilliefors Cri | | 0.113 0.304 | | Data annea | | GOF Test | icance Level | |
| 26 | | | ı | | | | 1% Significan | | | 170 Olgilli | | |
| 27 28 | | | | | Δe | sumina Nor | mal Distribution | | | | | |
| 29 | | | 95% No | ormal UCL | | | | 95% U | | usted for Sk | | |
| 30 31 | | | | 95% Stude | ent's-t UCL | 3221 | | 95 c | 5% Adjuste 5% Modifi | ed-CLT UCL ed-t UCL (.) | _(Chen-1995) ohnson-1978) | 3190 3219 |
| 32 | | | | | ļ | | | | | | | |
| 33 34 | | | | A-D Te | st Statistic | Gamma 0.218 | GOF Test | Anders | on-Darling | Gamma G | OF Test | |
| 35 | | | | 5% A-D Cri | tical Value | 0.724 | Detected of | data appear | Gamma D | istributed at | t 5% Significan | ce Level |
| 36 37 | | | | K-S Te 5% K-S Cri | st Statistic | 0.12 0.266 | Detected (| | | ov Gamma | GOF Test t 5% Significan | ce I evel |
| 38 | | | | | | | stributed at 5% | | | | | |
| 39 40 | | | | | | Gamma | Statistics | | | | | |
| 41 | | | | | hat (MLE) | 156.7 | | | | | orrected MLE) | 109.8 |
| 42 43 | | | | | hat (MLE) | | | | Theta | | orrected MLE) ias corrected) | 28 2196 |
| 44 | | | M | LE Mean (bias | | 0.00 | | | | MLE Sd (b | ias corrected) | 293.4 |
| 45 46 | | | Adius | sted Level of Si | ianificance | 0.0267 | | A | pproximate A | <u>e Chi Square</u> diusted Chi | e Value (0.05) Square Value | 2088 |
| 47 48 | | | | | | | B' L' L' L' | | | | | |
| 48 | | | 95% A | pproximate Ga | | | nma Distributio | <u>n</u> | 95 | 5% Adjusted | Gamma UCL | 3261 |
| 50 51 | | | | | • | | LOOF Took | | | • | | |
| 52 | | | S | Shapiro Wilk Te | st Statistic | 0.949 | I GOF Test | Shapir | o Wilk Log | gnormal GC | OF Test | |
| 53 54 | | | 10% S | hapiro Wilk Cri | | 0.869 | D: | | | | nificance Level | |
| 55 | | | 10 | Lilliefors Te 1% Lilliefors Cri | | 0.129 0.241 | D | | | ormal GOF at 10% Sigr | ı est nificance Level | |
| 56 57 | | | | | | | at 10% Signific | | | | | |
| 58 | | | | | | Lognorma | l Statistics | | | | | |
| 59 60 | | | | Minimum of Lo | | | | | | | of logged Data | 8.028 |
| 61 | | | | Maximum of Lo | yyeu Data | 0.132 | | | | 2D (| of logged Data | 0.085 |
| 62 63 | | | | | Assu 5% H-UCL | | rmal Distributi | ion | 009/ | Chohycha | (M)/HE) HO | 3322 |
| 64 | | | 95% | Stephen (M) | | N/A 3435 | | | | | (MVUE) UCL (MVUE) UCL | |
| 65 66 | | | | Chebyshev (M) | | | | | | | | |
| 67 | | | | | | | tion Free UCL | | | | | |
| 68 69 | | | | | Data appea | r to follow a | Discernible Di | istribution | | | | |
| 70 | | | | | | | tribution Free I | UCLs | | | | |
| 71 72 | | | 05% | 95% Standard Boot | CLT UCL | | | | | | Bootstrap UCL ootstrap-t UCL | |
| 73 | | | 9 | 5% Hall's Boot | tstrap UCL | 3195 | | | | Percentile E | Bootstrap UCL | 3196 |
| 74 75 | | | | nebyshev(Mear nebyshev(Mear | , , | | | | | | lean, Sd) UCL lean, Sd) UCL | |
| 76 | | | 37.370 UI | ioby of lev (IVIEd) | i, Guj UCL | | | | J3 /0 UI | iobyoniev(IVI | ioan, ou <i>j</i> ool | 3070 |
| 77 78 | | | | 95% Stude | ent's-t UCL | | UCL to Use | | | | | |
| 79 | | | | | | | | | | | | |
| 80 81 | | | | ding the selection are based upon | | | | | | | | |
| 82 | H | | | ts will not cover | | | | | | | | an. |
| | | · | | | | · | | | | | | |

| | Α | В | С | D | E | F | G | Н | | J | K | L |
|----|---|-----------|--------------|--------------|---------------|--------------|--------------|----------------|--------------|-------------|------------|---|
| 83 | | | | | | | | | | | | |
| 84 | | Note: For | highly negat | ively-skewe | d data, confi | dence limits | (e.g., Chen, | Johnson, Lo | ognormal, an | id Gamma) r | nay not be | |
| 85 | | | reliable. (| Chen's and J | lohnson's me | ethods provi | de adjustme | nts for posity | vely skewed | data sets. | | |
| 86 | | | | | | | | | | | | |
| | | | | | | | | | | | | |

| 1 | Α | В | С | D | E LIOL Objetion | F | G | H | ı | J | K | L |
|----------|----------|--|------------------------------|------------------------------------|-------------------------------|--------------------|--|---------------|-------------------------|------------------------------------|---------------------------------|----------------|
| 2 | | | | | UCL Statis | Stics for Unc | ensored Full D | vata Sets | | | | |
| 3 | Do | User Selection User S | ected Options | ProUCL 5.2 1 | 0/31/2024 : | 1.20.34 DM | | | | | | |
| 5 | Da | | From File | ProUCL Input | | 1.20.34 F W | | | | | | |
| 6 7 | | | III Precision Coefficient | OFF 95% | | | | | | | | |
| 8 | Number | of Bootstrap | | 2000 | | | | | | | | |
| 9 | | | | | | | | | | | | |
| 11 | UMM-TLB- | 0.5-1 | | | | | | | | | | |
| 12 13 | | | | | | General | Statistics | | | | | |
| 14 | | | Total | Number of Ob | servations | 10 | | | | | Observations | 10 |
| 15 16 | | | | | Minimum | 2731 | | | Numbe | r of Missing | Observations Mean | 3120 |
| 17 | | | | | Maximum | 3822 | | | | 0:1 | Median | 3002 |
| 18 19 | | | | Coefficient c | SD of Variation | 381.3 0.122 | | | | Std. | Error of Mean Skewness | 120.6 0.827 |
| 20 | | | | | | | | | | | | |
| 21 22 | | | S | Shapiro Wilk Te | st Statistic | 0.889 | GOF Test | <u></u> | Shapiro W | ilk GOF Tes | st | |
| 23 | | | | hapiro Wilk Cri | itical Value | 0.781 | | | r Normal a | at 1% Signifi | icance Level | |
| 24 25 | | | 1 | Lilliefors Te % Lilliefors Cri | | 0.227 0.304 | | Data appea | | GOF Test at 1% Signifi | cance Level | |
| 26 | | | <u>'</u> | | | | 1% Significan | ice Level | | J Grgriiii | | |
| 27 28 | | | | | Ass | sumina Nori | mal Distribution | | | | | |
| 29 | | | 95% No | ormal UCL | | | | 95% U | | sted for Sk | | 2252 |
| 30 31 | | | | 95% Stude | ent's-t UCL | 3341 | | 95 9 | 5% Adjuste 5% Modifi | ed-t UCL (.). | _(Chen-1995) ohnson-1978) | 3352 3346 |
| 32 | | | | | | | 2057 | | | | , | |
| 34 | | | | A-D Te | est Statistic | Gamma 0.485 | GOF Test | Anderso | on-Darling | Gamma G | OF Test | |
| 35 | | | | 5% A-D Cri | itical Value | 0.724 | Detected of | data appear (| Gamma D | istributed at | t 5% Significan | ce Level |
| 36 37 | | | | K-S Te 5% K-S Cri | est Statistic itical Value | 0.236 0.266 | Detected of | | | ov Gamma istributed at | GOF Test t 5% Significan | ce Level |
| 38 | | | | | | | stributed at 5% | | | | | |
| 39 40 | | | | | | Gamma | Statistics | | | | | |
| 41 | | | | | hat (MLE) | 77.73 | | | | | orrected MLE) | 54.48 |
| 42 43 | | | | | hat (MLE) hat (MLE) | 40.14 1555 | | | Theta | | orrected MLE) ias corrected) | 57.27 1090 |
| 44 | | | M | LE Mean (bias | | | | | | MLE Sd (b | ias corrected) | 422.7 |
| 45 46 | | | Adius | sted Level of S | ianificance | 0.0267 | | Ap | oproximate A | <u>e Chi Square</u> diusted Chi | e Value (0.05) Square Value | 1014 |
| 47 48 | | | | | | | D ' | | | | | |
| 48 | | | 95% A | pproximate Ga | | | ma Distributio | <u>in</u> | 95 | 5% Adjusted | Gamma UCL | 3395 |
| 50 51 | | | | | • | | LOOF Took | | | • | | |
| 52 | | | S | Shapiro Wilk Te | est Statistic | 0.9 | GOF Test | Shapir | o Wilk Log | gnormal GC | OF Test | |
| 53 54 | | | 10% S | hapiro Wilk Cri | | 0.869 | Da | ata appear L | .ognormal | at 10% Sigr | nificance Level | |
| 55 | | | 10 | Lilliefors Te 1% Lilliefors Cri | | 0.224 0.241 | Di | | | ormal GOF at 10% Sigr | ı est nificance Level | |
| 56 57 | | - | | | | | at 10% Signific | | | | | |
| 58 | | | | | | Lognorma | l Statistics | | | | | |
| 59 60 | | | | Minimum of Lo | | | | | | | of logged Data | 8.039 0.118 |
| 61 | | | | Maximum of Lo | yyeu Data | 0.249 | | | | 2D C | of logged Data | U.116 |
| 62 63 | | | | | Assu 5% H-UCL | | rmal Distributi | ion | 000/ | Chohycha | (M)/HE) HO | 3470 |
| 64 | | | 95% | Chebyshev (M | | | | | | | (MVUE) UCL (MVUE) UCL | |
| 65 66 | | | | Chebyshev (M | | | | | | | | |
| 67 | | | | | | | tion Free UCL | | | | | |
| 68 69 | | | | | Data appea | r to follow a | Discernible Di | istribution | | | | |
| 70 | | | | | | | tribution Free I | UCLs | | | | |
| 71 72 | | | 05% | 95% Standard Boot | 6 CLT UCL | | | | | | Bootstrap UCL ootstrap-t UCL | |
| 73 | | | 9 | 5% Hall's Boo | tstrap UCL | 3361 | | | | Percentile E | Bootstrap UCL | 3316 |
| 74 75 | | | | nebyshev(Mear nebyshev(Mear | | | | | | | lean, Sd) UCL lean, Sd) UCL | |
| 76 | | | 37.370 UI | CDYSHEV(IVIEDI | i, Guj UCL | | | | J3 /0 UI | iobyoniev(IVI | ioan, ou <i>j</i> ool | TULU |
| 77 78 | | | | 95% Stude | ent's-t UCL | | UCL to Use | | | | | |
| 79 | | | | | | | 1 | | | | | |
| 80 81 | | | | | | | ovided to help to the skever of the skever o | | | | | |
| 82 | He | | | | | | ts; for additiona | | | | | an. |
| _ | | · | | - | | - | | | | | - | |

83 B C D E F G H I J K L

| 1 | Α | В | С | D | E | F | G | Н | ı | J | K | L |
|----------|-----------|-------------------|-----------------------|-----------------------------------|------------------------|--------------------|--------------------------------------|----------------|--------------------------------|---------------------------|-----------------------------------|----------------|
| 2 | | | | | UCL Statis | Stics for Unc | ensored Full Da | ata Sets | | | | |
| 3 | Date | User Sele | cted Options | ProUCL 5.2 1 | 0/31/2024 - | 1.27.22 DM | | | | | | |
| 5 | Date | | From File | ProUCL Input | | 1.27.321 1 | | | | | | |
| 6 7 | (| Ful Confidence | Precision Coefficient | OFF 95% | | | | | | | | |
| 8 | | Bootstrap | | 2000 | | | | | | | | |
| 9 10 | | | | | | | | | | | | |
| 11 | UMM-TLB-0 | .5-2 | | | | | | | | | | |
| 12 13 | | | | | | General | Statistics | | | | | |
| 14 | | | Total | Number of Ob | servations | 10 | | | | | Observations | 10 |
| 15 16 | | | | | Minimum | 221 | | | Number | of Missing (| Observations Mean | 1034 |
| 17 18 | | | | | Maximum | 2865 | | | | 0.1.5 | Median | 562.5 |
| 19 | | | | Coefficient o | SD f Variation | 945.7 0.915 | | | | Std. E | Error of Mean Skewness | 299.1 1.152 |
| 20 21 | | | | | | | | | | | | |
| 22 | | | S | hapiro Wilk Te | st Statistic | Normal 0 0.775 | GOF Test | S | hapiro Wi | lk GOF Tes | t | |
| 23 | | | | hapiro Wilk Cri | tical Value | 0.781 | | Data Not N | lormal at 1 | % Significa | | |
| 24 25 | | | 1 | Lilliefors Te % Lilliefors Cri | | 0.347 0.304 | | | | GOF Test Significa | nce Level | |
| 26 | | | · | | | | % Significance | | | g-miou | | |
| 27 28 | | | | | Ass | sumina Nori | mal Distribution | <u> </u> | | | | |
| 29 | | | 95% No | ormal UCL | | | | 95% U | | sted for Ske | | 1010 |
| 30 31 | | | | 95% Stude | ent's-t UCL | 1582 | | 95° | <u>% Adjuste</u> 5% Modifie | a-CLI UCL ed-t UCL (Ja | (Chen-1995) hnson-1978) | 1642 |
| 32 | | | | | | | | | | | | |
| 34 | | | | A-D Te | st Statistic | Gamma 0.747 | GOF Test | Anderso | n-Darling | Gamma GC | OF Test | |
| 35 | | | | 5% A-D Cri | tical Value | 0.739 | Data | a Not Gamma | a Distribut | ed at 5% Sig | gnificance Lev | el |
| 36 37 | | | | K-S Te | st Statistic | 0.284 0.271 | Data | | | v Gamma C ed at 5% Sid | 3OF Test gnificance Lev | el |
| 38 | | | | | | | ed at 5% Signif | | | <u> </u> | J00 LOV | |
| 39 40 | | | | | | Gamma | Statistics | | | | | |
| 41 | | | | | hat (MLE) | 1.537 | | | | | rrected MLE) | 1.143 |
| 42 43 | | | | | hat (MLE) hat (MLE) | 672.6 30.74 | rrected MLE) as corrected) | 904.8 22.85 | | | | |
| 44 | | | MI | LE Mean (bias | | | as corrected) | 967.1 | | | | |
| 45 46 | | | Adius | sted Level of Si | anificance | 0.0267 | | Ap | proximate Ac | Chi Square | Value (0.05) Square Value | 12.98 11.7 |
| 47 | | | , tajac | 7.00 20101 01 01 | | | | | 7.00 | ijaotoa om c | oquaio vaiuo | |
| 48 49 | | | 95% A | pproximate Ga | | | ma Distributior | <u>n</u> | 95 | % Adjusted | Gamma UCL | 2018 |
| 50 | | | | , pp. 0 | | | | | | 70 7 14 40104 | | |
| 51 52 | | | S | hapiro Wilk Te | st Statistic | Lognorma 0.899 | I GOF Test | Shapiro | wilk Log | normal GO | F Test | |
| 53 | | | | hapiro Wilk Cri | tical Value | 0.869 | Da | ata appear Lo | ognormal a | at 10% Sign | ificance Level | |
| 54 55 | | | 10 | Lilliefors Te % Lilliefors Cri | | 0.23 0.241 | Da | | | ormal GOF | <u>Test</u> ificance Level | |
| 56 | | | | | | | at 10% Significa | | | | | |
| 57 58 | | | | | | Lognorma | I Statistics | | | | | |
| 59 60 | | | | Minimum of Lo | | 5.398 | | | | | f logged Data | 6.582 |
| 61 | | | N | Maximum of Lo | gged Data | 7.96 | | | | SD of | f logged Data | 0.882 |
| 62 63 | | | | 27 | | | rmal Distribution | on | 000/ | Oh a k · · - ¹ | /M/// IE/ 110: 1 | 1007 |
| 64 | | | 95% | 95 Chebyshev (M | 5% H-UCL VUE) UCL | | | | | | (MVUE) UCL (MVUE) UCL | 1897 2854 |
| 65 | | | | Chebyshev (M) | | | | | | , | , | |
| 66 67 | | | | N | lonparame | tric Distribu | tion Free UCL | Statistics | | | | |
| 68 69 | | | | | | | Discernible Dis | | | | | |
| 70 | | | | | Nonpar | rametric Dis | tribution Free U | JCLs | | | | |
| 71 72 | | | 0501 | | CLT UCL | 1526 | | | Ç | | ootstrap UCL | 1585 |
| 73 | | | | Standard Boot 5% Hall's Boot | | | | | 95% F | | otstrap-t UCL ootstrap UCL | 1784 1519 |
| 74 75 | | | 90% Ch | ebyshev(Mear | , Sd) UCL | 1931 | | | 95% Ch | ebyshev(Me | ean, Sd) UCL | 2337 |
| 76 | | | 97.5% Ch | ebyshev(Mear | ı, Sa) UCL | 2901 | | | 99% Ch | epysnev(Me | ean, Sd) UCL | 4009 |
| 77 78 | | | | | | | UCL to Use | | | | | |
| 79 | | | | 95 | 5% H-UCL | 24/3 | | | | | | |
| 80 | N | | | | | | ovided to help t | | | | | |
| 81 82 | Hov | | | | | | ution, and skew ts; for additiona | | | | | an. |
| | 1101 | | | | | | , additiona | | | | | |

| 1 | Α | В | С | D | E LICI Statis | F | G Full De | H eta Cata | | J | K | L |
|----------|-------------|---------------------------|------------------|--|--|------------------------------------|---------------------------------------|-------------------------------|-------------|----------------------------|-------------------------------|----------------|
| 2 | | | | 1 | OCL Statis | SUCS TOT UNC | ensored Full Da | ala sets | | | | |
| 3 | Dot | User Sele e/Time of Ce | cted Options | ProUCL 5.2 1 | 10/21/2024 : | 1.22.20 DM | | | | | | |
| 5 | Dati | e/Time of Ci | From File | ProUCL 5.2 | | 1.32.39 FIVI | | | | | | |
| 6 7 | | | Il Precision | OFF | | | | | | | | |
| 8 | | Confidence f Bootstrap | | 95% 2000 | | | | | | | | |
| 9 | | . 200:0::: ap | 0 00.00.0 | 12000 | | | | | | | | |
| 10 11 | UMM-TLB-0 | 5-3 | | | | | | | | | | |
| 12 | OWNER TED C | | | | | | | | | | | |
| 13 14 | | | Total | Number of Ob | nearyations | General 10 | Statistics | | Number | r of Distinct | Observations | 10 |
| 15 | | | TOtal | Number of Or | JSEI VALIOIIS | 10 | | | | | Observations Observations | 0 |
| 16 17 | | | | | Minimum Maximum | 367 1143 | | | | | Mean Median | 629.1 515 |
| 18 | | | | | SD | 285.1 | | | | Std. I | Error of Mean | 90.17 |
| 19 20 | | | | Coefficient of | of Variation | 0.453 | | | | | Skewness | 1.121 |
| 21 | | | | | | Normal (| GOF Test | | | | | |
| 22 | | | | hapiro Wilk Te | | 0.829 | | | | lk GOF Tes | | |
| 23 24 | | | 1% S | hapiro Wilk Cr Lilliefors Te | ritical Value est Statistic | 0.781 0.241 | l | Data appear | | t 1% Signific GOF Test | cance Level | |
| 25 | | | 1 | % Lilliefors Cr | itical Value | 0.304 | | Data appear | | | cance Level | |
| 26 27 | | | | | Data appea | ar Normal at | 1% Significand | ce Level | | | | |
| 28 | | | | | As | suming Nor | mal Distribution | | | | | |
| 29 30 | | | 95% No | ormal UCL | ent's-t UCL | 794.4 | | | | sted for Ske | ewness) (Chen-1995) | 811.6 |
| 31 | | | | 90 /0 Studi | onto-t UCL | 7 34.4 | | 95 | % Modifie | ed-t UCL (Jo | ohnson-1978) | |
| 32 33 | | | | | | Gamera | GOF Test | | | | | |
| 34 | | | | A-D Te | est Statistic | 0.535 | GOF TEST | Anderso | n-Darling | Gamma G | OF Test | |
| 35 36 | | | | | itical Value | 0.728 | Detected da | ata appear G | amma Di | stributed at | 5% Significan | ce Level |
| 37 | | | | | est Statistic ritical Value | 0.218 0.267 | Detected da | | | ov Gamma (stributed at | OF Test 5% Significan | ce Level |
| 38 | | | | | | | stributed at 5% | | | | o to organican | 50 2010. |
| 39 40 | | | | | | Gamma | Statistics | | | | | |
| 41 | | | | | k hat (MLE) | 6.262 | Otationes | | | | rrected MLE) | 4.45 |
| 42 43 | | | | | a hat (MLE) u hat (MLE) | 100.5 125.2 | | rrected MLE) as corrected) | 141.4 89 | | | |
| 44 | | | MI | LE Mean (bias | / | | | as corrected) | 298.2 | | | |
| 45 46 | | | ۸ ما:،،، | -td -f O | `:-::::::::::::::::::::::::::::::::::: | 0.0067 | | Ap | proximate | Chi Square | Value (0.05) Square Value | 68.25 |
| 47 | | | Adjus | sted Level of S | oignificance | 0.0267 | | | AC | ajustea Chi s | Square value | 65.1 |
| 48 49 | | | 050/ 4 | | | | ma Distributior | n | 05 | 0/ 4 !' | 0 1101 | 000.4 |
| 50 | | | 95% A | pproximate Ga | amma UCL | 820.4 | | | 95 | % Adjusted | Gamma UCL | 860.1 |
| 51 | | | | | | | GOF Test | | | | | |
| 52 53 | | | | <u>Shapiro Wilk Te</u> hapiro Wilk Cr | | 0.897 0.869 | Da | | | Inormal GO | F Test ificance Level | |
| 54 | | | | Lilliefors Te | est Statistic | 0.193 | | Lillief | ors Logno | ormal GOF | Test | |
| 55 56 | | | 10 | % Lilliefors Cr | | 0.241 Lognormal a | Da at 10% Significa | | gnormal | at 10% Sign | ificance Level | |
| 57 | | | | | аш аррсаі | | - | #1100 F6461 | | | | |
| 58 59 | | | | Minimum of Lo | naged Data | Lognorma 5.905 | l Statistics | | | Mean | f logged Data | 6.362 |
| 60 | | | | Maximum of Lo | | 7.041 | | | | | f logged Data | 0.415 |
| 61 62 | | | | | A = = - | ımina Lasırı | rmal Distribution | | | | | |
| 63 | | | | 9 | ASSU 95% H-UCL | <u>1ming Logno</u> 845.1 | ormal Distributio | <u> </u> | 90% | Chebyshev | (MVUE) UCL | 875.2 |
| 64 65 | | | | Chebyshev (N | IVUE) UCL | 988.1 | | | | | (MVUE) UCL | |
| 66 | | | 99% | Chebyshev (N | IVUE) UCL | 1453 | | | | | | |
| 67 | | | | | | | tion Free UCL | | | | | |
| 68 69 | | | | | Data appea | r to follow a | Discernible Dis | stribution | | | | |
| 70 | | | | | | | tribution Free U | JCLs | | | | |
| 71 72 | | | Q5% | 95% Standard Boo | 6 CLT UCL | 777.4 774.5 | | | | | ootstrap UCL otstrap-t UCL | 814.1 912.7 |
| 73 | | | 9 | 5% Hall's Boo | tstrap UCL | 944.5 | | | | Percentile B | ootstrap UCL | 787.4 |
| 74 75 | | | | nebyshev(Mea nebyshev(Mea | | | | | | | ean, Sd) UCL ean, Sd) UCL | 1022 1526 |
| 76 | | | 97.3% CN | ienysi iev(iviėa | ıı, ou) UCL | 1132 | | | 99% CN | ienysnev(IVI | ean, Su) UCL | 1020 |
| 77 78 | | | - | OEO/ Care-l | ontic + LICI | | UCL to Use | | | - | | |
| 79 | | | | 95% Stud | ent's-t UCL | 794.4 | <u> </u> | | | | | |
| 80 | N | | | | | | ovided to help the | | | | | |
| 81 82 | Hov | | | | | | ution, and skew ts; for additional | | | | | an |
| | 110 | vvovci, Siiilu | iidiioiio iESUll | S WIII HOL COVE | ı un ricai VV | ona aata se | io, ioi audilioila | i irrorgini tire t | addi iilay | vant to COII | oun a statistici | ٠١١٠. |

| 4 | A B C D E | F | G H I J K | L |
|----------|---|----------------|--|----------------|
| 2 | | stics for Unc | ensored Full Data Sets | |
| 3 | User Selected Options Date/Time of Computation ProUCL 5.2 10/31/2024 | 1.27.00 DM | | |
| 5 | From File ProUCL Input.xls | 1.37.00 FIVI | | |
| 6 7 | Full Precision OFF Confidence Coefficient 95% | | | |
| 8 | Number of Bootstrap Operations 2000 | | | |
| 9 | | | | |
| 11 | UMM-TLB-0.5-4 | | | |
| 12 13 | | General | Statistics | |
| 14 15 | Total Number of Observations | | Number of Distinct Observations | 10 |
| 16 | Minimum | 1127 | Number of Missing Observations Mean | 0 1475 |
| 17 18 | Maximum | 2033 | Median | 1364 |
| 19 | SD Coefficient of Variation | | Std. Error of Mean Skewness | 91.54 0.798 |
| 20 21 | | | | |
| 22 | Shapiro Wilk Test Statistic | | GOF Test Shapiro Wilk GOF Test | |
| 23 24 | 1% Shapiro Wilk Critical Value | 0.781 | Data appear Normal at 1% Significance Level | |
| 25 | Lilliefors Test Statistic 1% Lilliefors Critical Value | | Lilliefors GOF Test Data appear Normal at 1% Significance Level | |
| 26 | | | : 1% Significance Level | |
| 27 28 | As | sumina Nori | mal Distribution | |
| 29 30 | 95% Normal UCL | 1 | 95% UCLs (Adjusted for Skewness) | 1050 |
| 31 | 95% Student's-t UCL | 1642 | 95% Adjusted-CLT UCL (Chen-1995) 95% Modified-t UCL (Johnson-1978) | 1650 1646 |
| 32 | | | | |
| 34 | A-D Test Statistic | | GOF Test Anderson-Darling Gamma GOF Test | |
| 35 | 5% A-D Critical Value | 0.724 | Detected data appear Gamma Distributed at 5% Significant | e Level |
| 36 37 | K-S Test Statistic 5% K-S Critical Value | | Kolmogorov-Smirnov Gamma GOF Test Detected data appear Gamma Distributed at 5% Significance | ce Level |
| 38 39 | | | stributed at 5% Significance Level | |
| 40 | | Gamma | Statistics | |
| 41 | k hat (MLE) | 30.49 | k star (bias corrected MLE) | 21.41 |
| 42 43 | Theta hat (MLE) nu hat (MLE) | | Theta star (bias corrected MLE) nu star (bias corrected) | 68.87 428.2 |
| 44 45 | MLE Mean (bias corrected) | | MLE Sd (bias corrected) | 318.7 |
| 46 | Adjusted Level of Significance | 0.0267 | Approximate Chi Square Value (0.05) Adjusted Chi Square Value | 381.3 373.5 |
| 47 48 | | | | |
| 49 | 95% Approximate Gamma UCL | | ma Distribution 95% Adjusted Gamma UCL | 1690 |
| 50 51 | | Lognormo | I COE Toot | |
| 52 | Shapiro Wilk Test Statistic | | GOF Test Shapiro Wilk Lognormal GOF Test | |
| 53 54 | 10% Shapiro Wilk Critical Value | | Data appear Lognormal at 10% Significance Level | |
| 55 | Lilliefors Test Statistic 10% Lilliefors Critical Value | 0.241 | Lilliefors Lognormal GOF Test Data appear Lognormal at 10% Significance Level | |
| 56 57 | Data appear | Lognormal a | at 10% Significance Level | |
| 58 | | | I Statistics | |
| 59 60 | Minimum of Logged Data Maximum of Logged Data | 7.027 | Mean of logged Data SD of logged Data | 7.28 0.189 |
| 61 | | | · | 0.103 |
| 62 63 | Ass : 95% H-UCL | | ormal Distribution 90% Chebyshev (MVUE) UCL | 1739 |
| 64 | 95% Chebyshev (MVUE) UCL | 1859 | 97.5% Chebyshev (MVUE) UCL | 2026 |
| 65 66 | 99% Chebyshev (MVUE) UCL | 2354 | | |
| 67 | | | tion Free UCL Statistics | |
| 68 69 | Data appea | ar to follow a | Discernible Distribution | |
| 70 | | | tribution Free UCLs | |
| 71 72 | 95% CLT UCL 95% Standard Bootstrap UCL | | 95% BCA Bootstrap UCL 95% Bootstrap-t UCL | 1646 1716 |
| 73 | 95% Hall's Bootstrap UCL | 1660 | 95% Percentile Bootstrap UCL | 1628 |
| 74 75 | 90% Chebyshev(Mean, Sd) UCL 97.5% Chebyshev(Mean, Sd) UCL | 1749 2046 | 95% Chebyshev(Mean, Sd) UCL 99% Chebyshev(Mean, Sd) UCL | 1874 2385 |
| 76 | 77.576 Shobyshov(Modif, 50) GOE | | | |
| 77 78 | 95% Student's-t UCL | | UCL to Use | |
| 79 | | ' | | |
| 80 81 | | | ovided to help the user to select the most appropriate 95% UCL. ution, and skewness using results from simulation studies. | |
| 82 | | | ts; for additional insight the user may want to consult a statisticia | an. |
| | | | | |

| -1 | Α | В | С | D | E LIOL Obstic | F | G | H Data Oata | ı | J | K | L |
|----------|-----------|--------------------------|--------------------------|--|--------------------------------|--------------------|-------------------------------------|----------------------|-------------|----------------------------|---------------------------------|----------------|
| 2 | | | | | UCL Statis | sucs for Unc | ensored Full D | vata Sets | | | | |
| 3 | Dat | User Sele e/Time of C | cted Options | ProUCL 5.2 | 10/31/2024 | 1·39·34 PM | | | | | | |
| 5 | - But | | From File | ProUCL Inpu | | 1.00.011 10 | | | | | | |
| 6 7 | 1 | <u>Fu</u> Confidence | Il Precision Coefficient | OFF 95% | | | | | | | | |
| 8 | | f Bootstrap | | 2000 | | | | | | | | |
| 9 10 | | | | | | | | | | | | |
| 11 12 | UMM-TLC-0 |).5-1 | | | | | | | | | | |
| 13 | | | | | | General | Statistics | | | | | |
| 14 15 | | | Total | Number of O | bservations | 10 | | | | | Observations | 10 0 |
| 16 | | | | | Minimum | 410 | | | Numbe | roriviissing | Observations Mean | 1073 |
| 17 18 | | | | | Maximum SD | | | | | C+d | Median Error of Mean | 973.5 143.6 |
| 19 | | | | Coefficient | of Variation | | | | | otu. | Skewness | 0.577 |
| 20 21 | | | | | | Normal (| GOF Test | | | | | |
| 22 | | | | Shapiro Wilk T | | 0.959 | | | | ilk GOF Tes | | |
| 23 24 | | | 1% S | hapiro Wilk C | ritical Value est Statistic | 0.781 0.175 | | Data appea | | at 1% Signifi GOF Test | cance Level | |
| 25 | | | 1 | % Lilliefors C | ritical Value | 0.304 | | | | | icance Level | |
| 26 27 | | | | | Data appea | ar Normal at | t 1% Significan | ice Level | | | | |
| 28 | | | A= | | As | suming Nor | mal Distribution | | 101 11 11 | | | |
| 29 30 | | | 95% No | ormal UCL 95% Stud | dent's-t UCL | 1336 | | | | usted for Sk ed-CLT UCL | (Chen-1995) | 1337 |
| 31 32 | | | | | | | | 9 | 5% Modifi | ed-t UCL (J | ohnson-1978) | 1340 |
| 33 | | | | | | Gamma | GOF Test | | | | | |
| 34 35 | | | | | est Statistic | 0.207 | | | | Gamma G | | |
| 36 | | | | | ritical Value est Statistic | 0.729 0.161 | Detected d | | | ov Gamma | t 5% Significan GOF Test | ce Level |
| 37 38 | | | | | ritical Value | | Detected d | | | istributed at | t 5% Significan | ce Level |
| 39 | | | | Detected | иата арреат | | | <u>s Significano</u> | e Levei | | | |
| 40 41 | | | | | k hat (MLE) | Gamma 5.938 | Statistics | | k | etar (hiae co | orrected MLE) | 4.223 |
| 42 | | | | | ta hat (MLE) | | | | | | orrected MLE) | 254 |
| 43 44 | | | M | n LE Mean (bias | u hat (MLE) | | oias corrected) | 84.46 522 | | | | |
| 45 | | | | , | | | | Aŗ | oproximate | Chi Square | e Value (0.05) | 64.28 |
| 46 47 | | | Adjus | sted Level of S | Significance | 0.0267 | | | A | djusted Chi | Square Value | 61.23 |
| 48 | | | | | | | ma Distributio | 'n | | | | |
| 49 50 | | | 95% A | pproximate G | amma UCL | 1410 | | | 95 | % Adjusted | Gamma UCL | 1480 |
| 51 52 | | | | No and in a MARILLA T | | | I GOF Test | Oh i | - \A#II-1 - | | \C T+ | |
| 53 | | | | <u>Shapiro Wilk T</u> hapiro Wilk C | | 0.969 0.869 | Da | | | gnormal GC at 10% Sigr | or Test nificance Level | |
| 54 55 | | | | | est Statistic | 0.156 | | Lillie | fors Logn | ormal GOF | | |
| 56 | | | 10 | | | | at 10% Signific | | .ognoniidi | at 10 10 Sigi | micarice Level | |
| 57 58 | | | | | | Lognorma | I Statistics | | | | | |
| 59 | | | | Minimum of L | | 6.016 | . 5443463 | | | | of logged Data | 6.891 |
| 60 61 | | | N | Maximum of L | ogged Data | 7.585 | | | | SD c | of logged Data | 0.453 |
| 62 | | | | | | | rmal Distributi | ion | | | (A. A. (A) | 4540 |
| 63 64 | | | 95% | Chebyshev (N | 95% H-UCL MVUE) UCL | | | | | | (MVUE) UCL (MVUE) UCL | 1548 2057 |
| 65 | | | | Chebyshev (N | | | | | 37.070 | 555,51104 | , 32, 002 | |
| 66 67 | | | | | Nonparame | etric Distribu | tion Free UCL | Statistics | | | | |
| 68 69 | | | | | | | Discernible Di | | | | | |
| 70 | | | | | Nonpai | rametric Dis | tribution Free U | UCLs | | | | |
| 71 72 | | | OE0/ | | % CLT UCL | 1309 | | | | | Bootstrap UCL botstrap-t UCL | 1331 |
| 73 | | | 9 | Standard Boo 95% Hall's Boo | otstrap UCL | 1387 | | | | Percentile E | Bootstrap UCL | 1313 |
| 74 75 | | | | nebyshev(Meanebyshev(Mea | | | | | | | lean, Sd) UCL lean, Sd) UCL | |
| 76 | | | 97.3% CF | ienystiev(IVIea | an, ou) UCL | | <u> </u> | | 33% Cl | iebysnev(IVI | i c an, Suj UCL | Z30 I |
| 77 78 | | | | Q5% C+ | dent's-t UCL | | UCL to Use | | | | | |
| 79 | | | | | | | | | | | | |
| 80 81 | N | | | | | | ovided to help t ution, and skew | | | | | |
| 82 | Ho | | | | | | ts; for additiona | | | | | an. |
| | | | | | | | | | | | | |

| 1 | Α | В | С | D | E HOL Oberia | F | G | H | I | J | K | L |
|----------|----------|---------------------------|---------------------------------------|----------------------------------|--------------------------------|-------------------|--------------------------------------|----------------|--------------------------|--|-----------------------------------|-----------------|
| 2 | | | | | UCL Statis | Stics for Unc | ensored Full D | Jata Sets | | | | |
| 3 | Dr | User Sele te/Time of C | ected Options | ProUCL 5.2 1 | 10/31/2024 | 1·/2·21 DM | | | | | | |
| 5 | Da | | From File | ProUCL Inpu | | 1.42.31 F W | | | | | | |
| 6 7 | | Fu Confidence | III Precision | OFF 95% | | | | | | | | |
| 8 | Number | of Bootstrap | | 2000 | | | | | | | | |
| 9 | | | | | | | | | | | | |
| 11 | UMM-TLC- | -0.5-2 | | | | | | | | | | |
| 12 13 | | | | | | General | Statistics | | | | | |
| 14 | | | Total | Number of Ob | oservations | 10 | | | | | Observations | 10 |
| 15 16 | | | | | Minimum | 1794 | | | Numbe | r of Missing | Observations Mean | 0 2621 |
| 17 | | | | | Maximum | 3389 | | | | 0.1 | Median | 2662 |
| 18 19 | | | | Coefficient of | SD of Variation | 440.6 0.168 | | | | Std. | Error of Mean Skewness | 139.3 -0.312 |
| 20 | | | | | | | | | | | | |
| 21 22 | | | S | hapiro Wilk Te | est Statistic | Normal 0 0.971 | GOF Test | <u></u> | Shapiro W | ilk GOF Tes | st | |
| 23 | | | | hapiro Wilk Cr | itical Value | 0.781 | | | r Normal a | at 1% Signifi | cance Level | |
| 24 25 | | | 1 | Lilliefors Le % Lilliefors Cr | est Statistic | 0.148 0.304 | | Data appea | | GOF Test | cance Level | |
| 26 | | | · · · · · · · · · · · · · · · · · · · | | | | 1% Significar | nce Level | | | | |
| 27 28 | | | | | As | sumina Norr | mal Distribution | | | | | |
| 29 | | | 95% No | ormal UCL | | | | 95% U | | sted for Sk | | 0000 |
| 30 31 | | | | 95% Stude | ent's-t UCL | 2877 | | 95 | o% Adjuste 15% Modifi | ed-t UCL (.)(| (Chen-1995) ohnson-1978) | 2836 2874 |
| 32 | | | | | | | 2057 | | | | 32.7 .37.01 | |
| 33 34 | | | | A-D Te | est Statistic | 0.306 | GOF Test | Anderso | on-Darling | Gamma G | OF Test | |
| 35 | | | | 5% A-D Cr | itical Value | 0.724 | Detected of | data appear (| Gamma D | istributed at | 5% Significan | ce Level |
| 36 37 | | | | | est Statistic ritical Value | 0.169 0.266 | Detected of | | | ov Gamma of the contract of th | GOF Test ∶5% Significan | ce l evel |
| 38 | | | | | | | stributed at 5% | | | iotributou ut | . o 70 Olgrinioan | 00 20101 |
| 39 40 | | | | | | Gamma | Statistics | | | | | |
| 41 | | | | | k hat (MLE) | 36.94 | | orrected MLE) | 25.93 | | | |
| 42 43 | | | | | hat (MLE) u hat (MLE) | 70.95 738.9 | | | Theta | | orrected MLE) ias corrected) | 101.1 518.5 |
| 44 | | | MI | LE Mean (bias | | | | | | MLE Sd (b | ias corrected) | 514.8 |
| 45 46 | | | Adius | sted Level of S | Significance | 0.0267 | | Ar | pproximate A | e Chi Square diusted Chi | e Value (0.05) Square Value | 466.7 458.2 |
| 47 | | | 7.0,00 | 7.00 20.0.0.0 | | | | | | <u> </u> | | |
| 48 49 | | | 95% A | pproximate Ga | | | ma Distributio | n | 95 | 5% Adjusted | Gamma UCL | 2967 |
| 50 | | | | | | | | | | | | |
| 51 52 | | | S | hapiro Wilk Te | est Statistic | Lognorma 0.944 | GOF Test | Shapir | o Wilk Loc | gnormal GO | F Test | |
| 53 | | | | hapiro Wilk Cr | itical Value | 0.869 | D | ata appear L | ognormal | at 10% Sign | nificance Level | |
| 54 55 | | | 10 | Lilliefors Le % Lilliefors Cr | est Statistic itical Value | 0.181 0.241 | D | | | ormal GOF at 10% Sign | Test nificance Level | |
| 56 57 | | | · • | | | | at 10% Signific | | | | | |
| 58 | | | | | | Lognorma | l Statistics | | | | | |
| 59 60 | | | | Minimum of Lo | | 7.492 | | | | | of logged Data | 7.858 |
| 61 | | | N | Maximum of Lo | ogged Data | 8.128 | | | | SD o | of logged Data | 0.177 |
| 62 63 | | | | | | | rmal Distributi | ion | 0001 | Oh alassa i | /M///IE/ !!O' | 2065 |
| 63 64 | | | 95% | 9 Chebyshev (M | 95% H-UCL (IVUE) UCL | | | | | | (MVUE) UCL | 3065 3543 |
| 65 | | | | Chebyshev (M | | | | | 21.70.70 | , 55 | , | |
| 66 67 | | | | | Nonparame | tric Distribu | tion Free UCL | . Statistics | | | | |
| 68 69 | | | | | | | Discernible D | | | | | |
| 70 | | | | | Nonpai | ametric Dis | tribution Free | UCLs | | | | |
| 71 72 | | | 0501 | | % CLT UCL | 2850 | | | | | Bootstrap UCL | 2832 |
| 73 | | | | Standard Boo 5% Hall's Boo | | | | | 95% | | ootstrap-t UCL Bootstrap UCL | 2851 2836 |
| 74 75 | | | 90% Ch | ebyshev(Mea | n, Sd) UCL | 3039 | | | 95% Cł | nebyshev(M | ean, Sd) UCL | 3228 |
| 76 | | | 97.5% Ch | ebyshev(Mea | n, Sa) UCL | 3491 | | | 99% Ct | iebysnev(M | ean, Sd) UCL | 4007 |
| 77 78 | | | | 0E0/ 0: 1 | ontic + LIO | | UCL to Use | | | | | |
| 79 | | | | 95% Stud | ent's-t UCL | 28// | | | | | | |
| 80 | | | | | | | ovided to help | | | | | |
| 81 82 | H | | | | | | ution, and skev ts; for additiona | | | | | an. |
| | | اااال | alationio result | ***** 1101 0010 | , un rical VV | ona data se | , ioi additione | ar molynt tile | acci illay | Traint to COII | oun a statistici | wiii. |

| | Α | В | С | D | E | F | G | Н | | J | K | L |
|----|---|-----------|--------------|--------------|---------------|--------------|--------------|----------------|--------------|-------------|------------|---|
| 83 | | | | | | | | | | | | |
| 84 | | Note: For | highly negat | ively-skewed | d data, confi | dence limits | (e.g., Chen, | Johnson, Lo | ognormal, an | id Gamma) r | nay not be | |
| 85 | | | reliable. (| Chen's and J | lohnson's me | ethods provi | de adjustme | nts for posity | vely skewed | data sets. | | |
| 86 | | | | | | | | | | | | |
| | | | | | | | | | | | | |

| 1 | A B C D E UCL Stati | F stics for Unc | G H I J K L ensored Full Data Sets |
|----------|---|--------------------|---|
| 2 | | | |
| 3 | User Selected Options Date/Time of Computation ProUCL 5.2 10/28/2024 | 4.42.20 DM | |
| 5 | From File WorkSheet.xls | 4.42.30 FIVI | |
| 6 | Full Precision OFF | | |
| 7 | Confidence Coefficient 95% | | |
| 8 | Number of Bootstrap Operations 2000 | | |
| 10 | | | |
| | UMM-WRA-0.5-1 | | |
| 12 | | 0 | On-Mi-Mi |
| 14 | Total Number of Observations | | Statistics Number of Distinct Observations 10 |
| 15 | Total Number of Observations | 10 | Number of Missing Observations 0 |
| 16 | Minimum | | Mean 905.9 |
| 17 18 | Maximum | | Median 692 Std. Error of Mean 129.1 |
| 19 | SD Coefficient of Variation | | Skewness 1.737 |
| 20 | 000 | 00 | S.Co.m.sco in C. |
| 21 | | | GOF Test |
| 23 | Shapiro Wilk Test Statistic 1% Shapiro Wilk Critical Value | | Shapiro Wilk GOF Test Data Not Normal at 1% Significance Level |
| 24 | Lilliefors Test Statistic | | Lilliefors GOF Test |
| 25 | 1% Lilliefors Critical Value | | Data appear Normal at 1% Significance Level |
| 26 27 | Data appear App | roximate No | rmal at 1% Significance Level |
| 28 | As | sumina Nori | mal Distribution |
| 29 | 95% Normal UCL | | 95% UCLs (Adjusted for Skewness) |
| 30 | 95% Student's-t UCL | 1143 | 95% Adjusted-CLT UCL (Chen-1995) 1194 |
| 31 | | | 95% Modified-t UCL (Johnson-1978) 1154 |
| 33 | | Gamma | GOF Test |
| 34 | A-D Test Statistic | 0.793 | Anderson-Darling Gamma GOF Test |
| 35 36 | 5% A-D Critical Value | | Data Not Gamma Distributed at 5% Significance Level |
| 37 | K-S Test Statistic 5% K-S Critical Value | | Kolmogorov-Smirnov Gamma GOF Test Data Not Gamma Distributed at 5% Significance Level |
| 38 | | | ed at 5% Significance Level |
| 39 | | | |
| 40 | k hat (MLE) | | Statistics k star (bias corrected MLE) 4.976 |
| 42 | Theta hat (MLE) | | Theta star (bias corrected MLE) 182.1 |
| 43 | nu hat (MLE) | 140.3 | nu star (bias corrected) 99.52 |
| 44 | MLE Mean (bias corrected) | 905.9 | MLE Sd (bias corrected) 406.1 |
| 46 | Adjusted Level of Significance | 0.0267 | Approximate Chi Square Value (0.05) 77.51 Adiusted Chi Square Value 74.14 |
| 47 | Adjusted Estat of eighnicaries | 0.0207 | rajustou em equale value 7 i.i.i |
| 48 49 | | | nma Distribution |
| 50 | 95% Approximate Gamma UCL | 1163 | 95% Adjusted Gamma UCL 1216 |
| 51 | | Lognorma | I GOF Test |
| 52 | Shapiro Wilk Test Statistic | 0.844 | Shapiro Wilk Lognormal GOF Test |
| 53 54 | 10% Shapiro Wilk Critical Value | | Data Not Lognormal at 10% Significance Level |
| 55 | Lilliefors Test Statistic 10% Lilliefors Critical Value | | Lilliefors Lognormal GOF Test Data Not Lognormal at 10% Significance Level |
| 56 | | | 10% Significance Level |
| 57 58 | | | I Statistica |
| 59 | Minimum of Logged Data | | Il Statistics Mean of logged Data 6.736 |
| 60 | Maximum of Logged Data Maximum of Logged Data | | SD of logged Data 0.730 |
| 61 | | | District Co. |
| 62 63 | | | prmal Distribution 90% Chebyshev (MVUE) UCL 1228 |
| 64 | 95% Chebyshev (MVUE) UCL | | 97.5% Chebyshev (MVUE) UCL 1584 |
| 65 | 99% Chebyshev (MVUE) UCL | _ | , |
| 66 67 | Mannauau | otrio Diotelle | tion Fron LICI Statistics |
| 68 | | | tion Free UCL Statistics Discernible Distribution |
| 69 | | | |
| 70 71 | | | tribution Free UCLs |
| 71 72 | 95% CLT UCL 95% Standard Bootstrap UCL | | 95% BCA Bootstrap UCL 1192 95% Bootstrap-t UCL 1347 |
| 73 | 95% Hall's Bootstrap UCL | | 95% Percentile Bootstrap UCL 1119 |
| 74 | 90% Chebyshev(Mean, Sd) UCL | 1293 | 95% Chebyshev(Mean, Sd) UCL 1469 |
| 75 76 | 97.5% Chebyshev(Mean, Sd) UCL | 1712 | 99% Chebyshev(Mean, Sd) UCL 2191 |
| 77 | | Suggested | UCL to Use |
| 78 | 95% Student's-t UCL | | |
| 79 | | | (1) 005 |
| 80 81 | | | stribution passing only one of the GOF tests, istribution passing both GOF tests in ProUCL |
| 82 | it is suggested to use a OCL Da | ocu up∪ii d (I | iourbandii paooing bour GOL teolo III F1000L |
| | | | |

| | Α | В | С | D | E | F | G | Н | | J | K | L |
|----|----|--------------|---------------|----------------|---------------|----------------|-----------------|----------------|----------------|---------------|------------------|-----|
| 83 | 1 | Note: Sugges | stions regard | ing the selec | tion of a 95% | UCL are pr | ovided to hel | p the user to | select the m | ost appropria | ate 95% UCL | |
| 84 | | Recom | mendations | are based up | on data size | , data distrib | ution, and sk | ewness usin | g results fron | n simulation | studies. | |
| 85 | Но | wever, simul | ations result | s will not cov | er all Real W | orld data se | ts; for additio | nal insight th | ne user may v | want to cons | ult a statistici | an. |
| 86 | | | | | | | | | - | | | |
| | | | | | | | | | | | | |

| | A B C | D E | F | G H | 1 | J K | L |
|----------|--------------------------------|------------------------------|----------------------|----------------------------|----------------|-------------------------|-----------|
| 1 | | UCL Statis | Stics for Unce | ensored Full Data Sets | | | |
| 2 | User Selected Options | | | | | | |
| 3 | Date/Time of Computation | ProUCL 5.2 10/28/2024 4 | 1·46·10 PM | | | | |
| 4 | From File | WorkSheet.xls | | | | | |
| 5 6 | Full Precision | OFF | | | | | |
| 7 | Confidence Coefficient | 95% | | | | | |
| 8 | Number of Bootstrap Operations | 2000 | | | | | |
| 9 | | 1 | | | | | |
| 10 | | | | | | | |
| 11 | UMM-WRA-0.5-1-DS | | | | | | |
| 12 | | | | | | | |
| 13 | | | General | Statistics | | | |
| 14 | Total | Number of Observations | 7 | | | f Distinct Observations | |
| 15 | | | | | Number of | f Missing Observations | |
| 16 | | Minimum | 30 | | | Mear | |
| 17 | | Maximum SD | 75 15.49 | | | Mediar | |
| 18 | | Coefficient of Variation | 0.298 | | | Std. Error of Mear | |
| 19 | | Coemicient of Variation | 0.230 | | | Skewness | 0.133 |
| 20 | Note: Sample size is | small (e.g., <10), if data a | re collected | using incremental sample | ling methodol | ogy (ISM) approach | |
| 21 22 | = | o ITRC Tech Reg Guide o | | - | - | | |
| 23 | | ITRC may recommend th | • | • | - | • | |
| 24 | | | | n gross overestimates of | | . , | |
| 25 | Ref | fer to the ProUCL 5.2 Tec | | | | CL. | |
| 26 | | | | | | | |
| 27 | | | Normal G | OF Test | | | |
| 28 | S | Shapiro Wilk Test Statistic | 0.94 | | Shapiro Wilk | | |
| 29 | 1% S | hapiro Wilk Critical Value | 0.73 | Data appea | | % Significance Level | |
| 30 | | Lilliefors Test Statistic | 0.246 | | Lilliefors G | | |
| 31 | 1 | % Lilliefors Critical Value | 0.35 | | ar Normal at 1 | % Significance Level | |
| 32 | | | | 1% Significance Level | | | |
| 33 | | Note GOF lesis | may be unre | liable for small sample si | izes | | |
| 34 | | Δοσ | sumina Norn | nal Distribution | | | |
| 35 | 95% N | ormal UCL | January 140111 | | UCLs (Adiusto | ed for Skewness) | |
| 36 37 | 3570110 | 95% Student's-t UCL | 63.38 | | | CLT UCL (Chen-1995 | 62.09 |
| 38 | | | - | | <u>-</u> | -t UCL (Johnson-1978 | |
| 39 | | | | | | | |
| 40 | | | Gamma C | OF Test | | | |
| 41 | | A-D Test Statistic | 0.344 | Anders | son-Darling G | amma GOF Test | |
| 42 | | 5% A-D Critical Value | 0.708 | | | ributed at 5% Significa | nce Level |
| 43 | | K-S Test Statistic | 0.23 | | | Gamma GOF Test | |
| 44 | | 5% K-S Critical Value | 0.312 | | | ributed at 5% Significa | nce Level |
| 45 | | | | tributed at 5% Significan | | | |
| 46 | | Note GOF tests I | may be unre | liable for small sample si | izes | | |
| 47 | | | Comment | Statistica | | | |
| 48 | | k hat (MLE) | Gamma 9 12.68 | oladSUCS | lv oto | ar (bias corrected MLE | 7.339 |
| 49 | | Theta hat (MLE) | 4.102 | | | ar (bias corrected MLE | |
| 50 | | nu hat (MLE) | 177.5 | | | nu star (bias corrected | |
| 51 | M | LE Mean (bias corrected) | 52 | | | ILE Sd (bias corrected | |
| 52 53 | IVI | (5145 501166164) | <i>52</i> | Α | | thi Square Value (0.05 | |
| 54 | Adjus | sted Level of Significance | 0.0158 | <u> </u> | | sted Chi Square Value | |
| 55 | | 3 / | - | | | , | |
| JJ | | | | | | | |

| | Α | | В | | С | | D | | Е | F | | G | Н | | I | | J | | K | | L |
|----|----|-------|----------|--------|---------|----------|----------|---------|-----------|------------------------|----------|------------|------------|--------|-----------|---------|----------|---------|-------------|----------|-------|
| 56 | | | | | | | | | | suming Ga | amma | Distribu | tion | | | | | | | | |
| 57 | | | | | 95% / | Appro | ximate | Gamn | na UCL | 66.49 | | | | | 9 | 5% / | Adjusted | d Gam | nma UCL | | 71.82 |
| 58 | | | | | | | | | | | | | | | | | | | | | |
| 59 | | | | | | | | | | Lognorm | nal GC | F Test | | | | | | | | | |
| 60 | | | | | | | | | Statistic | | | | | • | o Wilk Lo | | | | | | |
| 61 | | | | | 10% 5 | | | | l Value | | | | Data app | | ognorma | | • | | | əl | |
| 62 | | | | | | | | | Statistic | | | | | | fors Log | | | | | | |
| 63 | | | | | 10 | 0% Li | lliefors | | l Value | | | | | | ognorma | ıl at 1 | 10% Sig | nifica | nce Leve | əl —— | |
| 64 | | | | | | | | | | Lognorma | | _ | | | | | | | | | |
| 65 | | | | | | | No | te GO | F tests | may be un | reliab | le for sn | nall samp | le siz | zes | | | | | | |
| 66 | | | | | | | | | | | | | | | | | | | | | |
| 67 | | | | | | | | | | Lognorn | nal Sta | atistics | | | | | | | | | |
| 68 | | | | | | | | | ed Data | | | | | | | | | | ged Data | | 3.911 |
| 69 | | | | | | Maxir | num of | Logge | ed Data | 4.317 | | | | | | | SD | of log | ged Data | э | 0.31 |
| 70 | | | | | | | | | | | | | | | | | | | | | |
| 71 | | | | | | | | | | uming Log | norma | l Distrib | ution | | | | | | | | |
| 72 | | | | | | | | | H-UCL | 69.53 | | | | | | | • | • | UE) UCL | | 70.41 |
| 73 | | | | | | | • | ` | E) UCL | 78.72 | | | | | 97.5% | 6 Ch | ebyshe | v (MV | UE) UCL | - ! | 90.26 |
| 74 | | | | | 99% | o Chel | oyshev | (MVU | E) UCL | 112.9 | | | | | | | | | | | |
| 75 | | | | | | | | | | | | | | | | | | | | | |
| 76 | | | | | | | | | = | etric Distrik | | | | | | | | | | | |
| 77 | | | | | | | | Data | a appe | ar to follow | a Dis | cernible | Distribut | ion | | | | | | | |
| 78 | | | | | | | | | | | | | | | | | | | | | |
| 79 | | | | | | | | | | rametric D | istribu | tion Fre | e UCLs | | | | | | | | |
| 80 | | | | | | | | | LT UCL | | | | | | | 959 | | | trap UCL | | 61.29 |
| 81 | | | | | | | | | ap UCL | 61.08 | | | | | | | | | ap-t UCL | | 64.82 |
| 82 | | | | | | | | | ap UCL | | | | | | | | | | trap UCL | | 61 |
| 83 | | | | | 90% C | - | - | | - | 69.57 | | | | | | | | | Sd) UCL | | 77.52 |
| 84 | | | | 9 | 7.5% C | hebys | shev(M | ean, S | d) UCL | 88.57 | | | | | 99% C | Cheb | yshev(N | /lean, | Sd) UCL | _ 1 | 10.3 |
| 85 | | | | | | | | | | | | | | | | | | | | | |
| 86 | | | | | | | | | | Suggeste | d UCL | to Use | | | | | | | | | |
| 87 | | | | | | | 95% St | udent's | s-t UCL | 63.38 | | | | | | | | | | | |
| 88 | | | | | | | | | | | | | | | | | | | | | |
| 89 | | Note: | | | | | | | | 6 UCL are _l | • | | • | | | | | | | L | |
| 90 | | | | | | | | | | , data distr | | | | | | | | | | | |
| 91 | Ho | oweve | er, simu | ulatio | ns resu | ılts wil | I not co | ver all | l Real V | Vorld data s | sets; fo | or additic | nal insigl | ht the | user ma | y wa | nt to co | nsult a | ı statistic | cian. | |
| 92 | | | | | | | | | | | | | | | | | | | | | |
| | · | | | | | | | | | | | | | | | | | | | | |

| 4 | A B C D E | F | G H I J K | L |
|----------|---|----------------|--|----------------|
| 2 | | Stics for Unc | ensored Full Data Sets | |
| 3 | User Selected Options Date/Time of Computation ProUCL 5.2 10/28/2024 | 4.40.17 DM | | |
| 5 | From File WorkSheet.xls | 4.40.17 FIVI | | |
| 6 7 | Full Precision OFF Confidence Coefficient 95% | | | |
| 8 | Confidence Coefficient 95% Number of Bootstrap Operations 2000 | | | |
| 9 10 | | | | |
| | UMM-WRA-0.5-2 | | | |
| 12 | | | | |
| 13 14 | Total Number of Observations | | Statistics Number of Distinct Observations | 9 |
| 15 | rotal Number of Observations | | Number of Missing Observations | 0 |
| 16 17 | Minimum Maximum | | Mean Median | 395.1 354.5 |
| 18 | SD | | Std. Error of Mean | 47.71 |
| 19 20 | Coefficient of Variation | 0.382 | Skewness | 1.916 |
| 21 | | Normal (| GOF Test | |
| 22 | Shapiro Wilk Test Statistic | 0.805 | Shapiro Wilk GOF Test | |
| 23 24 | 1% Shapiro Wilk Critical Value Lilliefors Test Statistic | | Data appear Normal at 1% Significance Level Lilliefors GOF Test | |
| 25 | 1% Lilliefors Critical Value | 0.304 | Data appear Normal at 1% Significance Level | |
| 26 27 | Data appe | ar Normal at | 1% Significance Level | |
| 28 | | suming Nor | mal Distribution | |
| 29 30 | 95% Normal UCL 95% Student's-t UCL | 482.6 | 95% UCLs (Adjusted for Skewness) | 504.5 |
| 31 | 95% Student S-t UCL | 402.0 | 95% Adjusted-CLT UCL (Chen-1995) 95% Modified-t UCL (Johnson-1978) | 487.4 |
| 32 33 | | 0 | | |
| 34 | A-D Test Statistic | | GOF Test Anderson-Darling Gamma GOF Test | |
| 35 | 5% A-D Critical Value | 0.725 | Detected data appear Gamma Distributed at 5% Significano | e Level |
| 36 37 | K-S Test Statistic 5% K-S Critical Value | | Kolmogorov-Smirnov Gamma GOF Test Detected data appear Gamma Distributed at 5% Significance | o Lovol |
| 38 | | | stributed at 5% Significance Level | e Level |
| 39 40 | | | Chatiatian | |
| 41 | k hat (MLE) | | Statistics k star (bias corrected MLE) | 6.841 |
| 42 43 | Theta hat (MLE) | 40.83 | Theta star (bias corrected MLE) | 57.76 |
| 43 | nu hat (MLE) MLE Mean (bias corrected) | | nu star (bias corrected) MLE Sd (bias corrected) | 136.8 151.1 |
| 45 | | | Approximate Chi Square Value (0.05) | 110.8 |
| 46 47 | Adjusted Level of Significance | 0.0267 | Adjusted Chi Square Value | 106.7 |
| 48 | | | ma Distribution | |
| 49 50 | 95% Approximate Gamma UCL | 487.9 | 95% Adjusted Gamma UCL | 506.5 |
| 51 | | Lognorma | GOF Test | |
| 52 53 | Shapiro Wilk Test Statistic | | Shapiro Wilk Lognormal GOF Test | |
| 54 | 10% Shapiro Wilk Critical Value Lilliefors Test Statistic | | Data appear Lognormal at 10% Significance Level Lilliefors Lognormal GOF Test | |
| 55 56 | 10% Lilliefors Critical Value | 0.241 | Data appear Lognormal at 10% Significance Level | |
| 57 | Data appear | Lognormal a | at 10% Significance Level | —— |
| 58 | | | Statistics | |
| 59 60 | Minimum of Logged Data Maximum of Logged Data | | Mean of logged Data SD of logged Data | 5.927 0.325 |
| 61 | | • | - | |
| 62 63 | Assi 95% H-UCL | | ormal Distribution 90% Chebyshev (MVUE) UCL | 515.3 |
| 64 | 95% Chebyshev (MVUE) UCL | | 97.5% Chebyshev (MVUE) UCL | 647.6 |
| 65 66 | 99% Chebyshev (MVUE) UCL | 798.5 | | |
| 67 | Nonparame | etric Distribu | tion Free UCL Statistics | |
| 68 | | | Discernible Distribution | |
| 69 70 | Nonna | rametric Dis | tribution Free UCLs | |
| 71 | 95% CLT UCL | 473.6 | 95% BCA Bootstrap UCL | 510.6 |
| 72 73 | 95% Standard Bootstrap UCL 95% Hall's Bootstrap UCL | 471.2 868.1 | 95% Bootstrap-t UCL 95% Percentile Bootstrap UCL | 574.9 477.6 |
| 74 | 90% Chebyshev(Mean, Sd) UCL | 538.2 | 95% Percentile Bootstrap OCL 95% Chebyshev(Mean, Sd) UCL | 603.1 |
| 75 76 | 97.5% Chebyshev(Mean, Sd) UCL | 693 | 99% Chebyshev(Mean, Sd) UCL | 869.8 |
| 77 | | Suggested | UCL to Use | |
| 78 79 | 95% Student's-t UCL | | | |
| 79 80 | Note: Suggestions regarding the selection of a 95% | 6 UCL are nr | ovided to help the user to select the most appropriate 95% UCL. | |
| 81 | Recommendations are based upon data size | , data distrib | ution, and skewness using results from simulation studies. | |
| 82 | However, simulations results will not cover all Real V | Vorld data se | ts; for additional insight the user may want to consult a statisticia | n. |

| 4 | A B C D E | F | G H I J K | L |
|----------|---|------------------------------|---|----------------|
| 2 | UCL Statis | tics for Unc | ensored Full Data Sets | |
| 3 | User Selected Options Date/Time of Computation ProUCL 5.2 10/28/2024 4 | 4.E1.00 DM | | |
| 5 | Date/Time of Computation ProUCL 5.2 10/28/2024 4 From File WorkSheet.xls | 4:51:09 PIVI | | |
| 6 7 | Full Precision OFF Confidence Coefficient 95% | | | |
| 8 | Number of Bootstrap Operations 2000 | | | |
| 9 10 | | | | |
| 11 | UMM-WRA-0.5-2-DS | | | |
| 12 13 | | General | Statistics | |
| 14 | Total Number of Observations | 4 | Number of Distinct Observations | 4 |
| 15 16 | Minimum | 51 | Number of Missing Observations Mean | 0 57.25 |
| 17 | Maximum | 68 | Median | 55 |
| 18 19 | SD Coefficient of Variation | 7.805 0.136 | Std. Error of Mean Skewness | 3.902 1.197 |
| 20 | | | | |
| 21 22 | Note: Sample size is small (e.g., <10), if data a | are collected on ISM (ITR | l using incremental sampling methodology (ISM) approach, C 2020 and ITRC 2012) for additional guidance, | |
| 23 24 | but note that ITRC may recommend th | e t-UCL or t | the Chebyshev UCL for small sample sizes (n < 7). | |
| 25 | | | in gross overestimates of the mean. e for a discussion of the Chebyshev UCL. | |
| 26 | | | - | |
| 27 28 | Shapiro Wilk Test Statistic | Normal 0 0.881 | GOF Test Shapiro Wilk GOF Test | |
| 29 30 | 1% Shapiro Wilk Critical Value | 0.687 | Data appear Normal at 1% Significance Level | |
| 31 | Lilliefors Test Statistic 1% Lilliefors Critical Value | 0.249 0.413 | Lilliefors GOF Test Data appear Normal at 1% Significance Level | |
| 32 33 | Data appea | ar Normal at | t 1% Significance Level | |
| 34 | Note GOF tests | may be unre | eliable for small sample sizes | |
| 35 36 | | suming Nor | mal Distribution | |
| 37 | 95% Normal UCL 95% Student's-t UCL | 66.43 | 95% UCLs (Adjusted for Skewness) 95% Adjusted-CLT UCL (Chen-1995) | 66.17 |
| 38 39 | | | 95% Modified-t UCL (Johnson-1978) | 66.82 |
| 40 | | Gamma | GOF Test | |
| 41 42 | A-D Test Statistic 5% A-D Critical Value | 0.379 0.656 | Anderson-Darling Gamma GOF Test Detected data appear Gamma Distributed at 5% Significance | e l evel |
| 43 | K-S Test Statistic | 0.283 | Kolmogorov-Smirnov Gamma GOF Test | |
| 44 45 | 5% K-S Critical Value | 0.394 Gamma Di | Detected data appear Gamma Distributed at 5% Significance stributed at 5% Significance Level | e Level |
| 46 | | | eliable for small sample sizes | |
| 47 48 | | Gamma | Statistics | |
| 49 | k hat (MLE) | 75.1 | k star (bias corrected MLE) | 18.94 |
| 50 51 | Theta hat (MLE) nu hat (MLE) | 0.762 600.8 | Theta star (bias corrected MLE) nu star (bias corrected) | 3.022 151.5 |
| 52 53 | MLE Mean (bias corrected) | | MLE Sd (bias corrected) | 13.15 |
| 54 | Adjusted Level of Significance | N/A | Approximate Chi Square Value (0.05) Adjusted Chi Square Value | 124.1 N/A |
| 55 56 | | | | |
| 57 | Ass 95% Approximate Gamma UCL | 69.92 | mma Distribution 95% Adjusted Gamma UCL | N/A |
| 58 59 | | | | |
| 60 | Shapiro Wilk Test Statistic | 0.894 | I GOF Test Shapiro Wilk Lognormal GOF Test | |
| 61 62 | 10% Shapiro Wilk Critical Value Lilliefors Test Statistic | 0.792 0.251 | Data appear Lognormal at 10% Significance Level Lilliefors Lognormal GOF Test | |
| 63 | 10% Lilliefors Critical Value | 0.346 | Data appear Lognormal at 10% Significance Level | |
| 64 65 | | | at 10% Significance Level eliable for small sample sizes | |
| 66 | Note GOF lests | | | |
| 67 68 | Minimum of Logged Data | Lognorma 3.932 | Il Statistics Mean of logged Data | 4.041 |
| 69 | Maximum of Logged Data | 4.22 | SD of logged Data | 0.132 |
| 70 71 | Δεει | ımina I oana | ormal Distribution | |
| 72 | 95% H-UCL | 68.3 | 90% Chebyshev (MVUE) UCL | 68.55 |
| 73 74 | 95% Chebyshev (MVUE) UCL 99% Chebyshev (MVUE) UCL | 73.68 94.76 | 97.5% Chebyshev (MVUE) UCL | 80.79 |
| 75 | | | | |
| 76 77 | | | tion Free UCL Statistics Discernible Distribution | |
| 78 | | | | |
| 79 80 | Nonpar 95% CLT UCL | rametric Dis 63.67 | tribution Free UCLs 95% BCA Bootstrap UCL | N/A |
| 81 | 95% Standard Bootstrap UCL | N/A | 95% Bootstrap-t UCL | N/A |
| 82 | 95% Hall's Bootstrap UCL | N/A | 95% Percentile Bootstrap UCL | N/A |

| | Α | В | С | D | E | F | G | Н | I | J | K | L |
|----|---|--------------|---------------|---------------|---------------|---|---------------|---------------|----------------|---------------|-------------|---|
| 83 | | | 90% Ch | ebyshev(Me | an, Sd) UCL | 68.96 | | | 95% Ch | 74.26 | | |
| 84 | | | 97.5% Ch | ebyshev(Me | an, Sd) UCL | 000 0000 0000 0000 0000 0000 0000 0000 0000 | | | | | | |
| 85 | | | | | | | | | | | | |
| 86 | | | | | | Suggested | UCL to Use | | | | | |
| 87 | | | | 95% Stu | dent's-t UCL | 66.43 | | | | | | |
| 88 | | | | | | • | • | | | | | |
| 89 | 1 | Note: Sugges | stions regard | ing the selec | tion of a 95% | UCL are pr | ovided to hel | p the user to | select the m | nost appropri | ate 95% UCL | |
| 90 | | Recom | mendations | are based up | on data size | , data distrib | ution, and sk | ewness usin | g results from | m simulation | studies. | |
| 91 | | | | | | | | | | | an. | |
| 92 | | | | | | | | | | | | |

| 1 | Α | В | С | D | E LICL Static | F | 11 | G H I J K | L |
|----------|--|---------------------------|-------------------------|-------------------------------|----------------------------------|---------------------|-------------|---|--------------|
| 2 | | | | | UCL Statis | SUCS TOP | unc | ensored Full Data Sets | |
| 3 | | | cted Options | | 10/00/0004 | 4.53.04 | D. 1 | | |
| 4 5 | Dat | te/Time of Co | omputation From File | ProUCL 5.2 WorkSheet. | | 4:57:34 | rivi | | |
| 6 | | | I Precision | OFF | | | | | |
| 7 8 | Number | Confidence of Bootstrap (| | 95% 2000 | | | | | |
| 9 | 140111DEL | л Бооганар (| operations . | 12000 | | | | | |
| 10 11 | UMM-WRA | -0.5-4 | | | | | | | |
| 12 | UIVIIVI-VVKA | -0.5-4 | | | | | | | |
| 13 14 | | | . | N 1 10 | \1 | | eral | Statistics | |
| 15 | | | ı otal | Number of O | <u>Ibservations</u> | 5 | | Number of Distinct Observations 5 Number of Missing Observations 0 | |
| 16 | | | | | Minimum | | | Mean 282 | 2 |
| 17 18 | | | | | <u>Maximum</u> SD | | 7 | Median 278 Std. Error of Mean 14 | 3 4.52 |
| 19 | | | | Coefficient | of Variation | | | | .153 |
| 20 21 | | Note: Cor | unio oleo io i | -mall /a a -d | (10) if data | ana aalla | | using ingremental compling methodology (ICM) approach | |
| 22 | | Note: Sar | refer also to | smail (e.g., < o ITRC Tech | Rea Guide | are colle on ISM | (ITR | using incremental sampling methodology (ISM) approach, C 2020 and ITRC 2012) for additional guidance, | |
| 23 | | b | | ITRC may re | commend the | ne t-UCI | L or t | he Chebyshev UCL for small sample sizes (n < 7). | |
| 24 25 | | | Ref | | | | | in gross overestimates of the mean. e for a discussion of the Chebyshev UCL. | |
| 26 | | | I.GI | or to the FIU | JUL 0.2 160 | | | • | |
| 27 28 | <u> </u> | | | hapiro Wilk T | Tact Statistic | | | GOF Test Shapiro Wilk GOF Test | |
| 29 | | | | hapiro Wilk C | | | | Data appear Normal at 1% Significance Level | |
| 30 31 | | | | Lilliefors T | est Statistic | 0.20 | 06 | Lilliefors GOF Test | |
| 32 | | | 1 | % Lilliefors C | | | | Data appear Normal at 1% Significance Level 1% Significance Level | |
| 33 | | | | Note | | | | eliable for small sample sizes | |
| 34 35 | | | | | ۸. | eumina | Non | mal Distribution | |
| 36 | | | 95% No | ormal UCL | | Summy | INUII | 95% UCLs (Adjusted for Skewness) | |
| 37 38 | | | | | dent's-t UCL | 313 | | 95% Adjusted-CLT UCL (Chen-1995) 306 | |
| 38 | | | | | | <u> </u> | | 95% Modified-t UCL (Johnson-1978) 313 | 5.1 |
| 40 | | | | | | | | GOF Test | |
| 41 42 | <u> </u> | | | | Test Statistic Critical Value | | | Anderson-Darling Gamma GOF Test Detected data appear Gamma Distributed at 5% Significance Le | evel |
| 43 | | | | K-S T | est Statistic | 0.23 | 34 | Kolmogorov-Smirnov Gamma GOF Test | |
| 44 45 | | | | | ritical Value | | | Detected data appear Gamma Distributed at 5% Significance Lestributed at 5% Significance Level | evel |
| 46 | | | | | | | | stributed at 5% Significance Level | |
| 47 48 | | | | | | | | | |
| 49 | | | | | k hat (MLE) | | | Statistics k star (bias corrected MLE) 37 | 7.92 |
| 50 | | | | Thet | ta hat (MLE) | 2.98 | 85 | Theta star (bias corrected MLE) 7 | .437 |
| 51 52 | <u> </u> | | ŊΛI | <u>n</u> LE Mean (bia | nu hat (MLE) | | <u> </u> | nu star (bias corrected) 379 MLE Sd (bias corrected) 45 | 9.2 5.8 |
| 53 | | | | , | • | • | | Approximate Chi Square Value (0.05) 335 | |
| 54 55 | | | Adjus | sted Level of | Significance | 0.00 | 86 | Adjusted Chi Square Value 316 | 6.7 |
| 56 | | | | | As | <u>su</u> mina | Gam | ma Distribution | |
| 57 | | | 95% A | pproximate G | | | | 95% Adjusted Gamma UCL 337 | 7.6 |
| 58 59 | | | | | | Loana | orma | GOF Test | |
| 60 | | | | hapiro Wilk T | | 0.92 | 21 | Shapiro Wilk Lognormal GOF Test | |
| 61 62 | | | 10% SI | hapiro Wilk C | ritical Value est Statistic | | | Data appear Lognormal at 10% Significance Level Lilliefors Lognormal GOF Test | |
| 63 | | | 10 | % Lilliefors C | ritical Value | 0.3 | 19 | Data appear Lognormal at 10% Significance Level | |
| 64 65 | | | | | Data appear | Lognor | mal a | at 10% Significance Level | |
| 66 | | | | Note | e GUF tests | may be | unre | liable for small sample sizes | |
| 67 | | | | | | | | Statistics | |
| 68 69 | | | | Minimum of L Maximum of L | | | | | .637 .115 |
| 70 | | | IV | nazimum Ui L | | | | | .110 |
| 71 72 | | | | | Ass | uming L | | ormal Distribution | |
| 73 | | | 95% | Chebyshev (I | 95% H-UCL MVUE) UCL | | | 90% Chebyshev (MVUE) UCL 325 97.5% Chebyshev (MVUE) UCL 372 | |
| 74 | | | | Chebyshev (I | | | | 3.1.2.1 2.1.2., 5.1.5 (1.1.5 2.) | - |
| 75 76 | | | | | Nonnarame | atric Die | tribu | tion Free UCL Statistics | |
| 77 | | | | | | | | Discernible Distribution | |
| 78 79 | | | | | | | | | |
| 80 | | | | 95 | Nonpa CLT UCL | | | tribution Free UCLs 95% BCA Bootstrap UCL 305 | 5.2 |
| 81 | | | | Standard Bo | otstrap UCL | 303.8 | } | 95% Bootstrap-t UCL 325 | 5.1 |
| 82 | | | 9 | 5% Hall's Bo | otstrap UCL | 315.7 | 1 | 95% Percentile Bootstrap UCL 305 | 5.2 |

| | Α | В | С | D | E | F | G | Н | H I J K | | | | | | |
|----|---|--------------|---------------|---------------|---------------|----------------|-------------------|---------------|----------------|---------------|-------------|-------|--|--|--|
| 83 | | | | | | | | | | | 345.3 | | | | |
| 84 | | | 97.5% Ch | ebyshev(Me | an, Sd) UCL | 372.7 | | | 99% Ch | ebyshev(Me | an, Sd) UCL | 426.5 | | | |
| 85 | | | | | | | | | | | | | | | |
| 86 | | | | | | Suggested | UCL to Use | | | | | | | | |
| 87 | | | | 95% Stu | dent's-t UCL | 313 | | | | | | | | | |
| 88 | | | | | | • | • | | | | | - | | | |
| 89 | 1 | Note: Sugges | stions regard | ing the selec | tion of a 95% | 6 UCL are pr | ovided to hel | p the user to | select the m | ost appropria | ate 95% UCL | | | | |
| 90 | | Recom | mendations | are based up | on data size | , data distrib | ution, and sk | ewness usin | g results fror | n simulation | studies. | | | | |
| 91 | However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician. | | | | | | | | | | | | | | |
| 92 | | | | | | | | | | | | | | | |

| 4 | A B C D E | F | G H I J K | L |
|----------|--|----------------|--|----------------|
| 2 | UCL Statis | stics for Unc | ensored Full Data Sets | |
| 3 | User Selected Options | | | |
| 4 5 | Date/Time of Computation ProUCL 5.2 10/28/2024 4 From File WorkSheet.xls | 4:55:41 PM | | |
| 6 | Full Precision OFF | | | |
| 7 8 | Confidence Coefficient 95% Number of Bootstrap Operations 2000 | | | |
| 9 | Number of Bootstrap Operations 2000 | | | |
| 10 | INAMAWDA OF 4 DO | | | |
| 12 | UMM-WRA-0.5-4-DS | | | |
| 13 | | | Statistics | |
| 14 15 | Total Number of Observations | 4 | Number of Distinct Observations Number of Missing Observations | 0 |
| 16 | Minimum | 53 | Mean | 57 |
| 17 18 | Maximum SD | 60 2.944 | Median Std. Error of Mean | 57.5 1.472 |
| 19 | Coefficient of Variation | | | -0.941 |
| 20 | N . 0 . 1 . 1 . 1 . 1 | | | |
| 21 22 | | | l using incremental sampling methodology (ISM) approach, C 2020 and ITRC 2012) for additional guidance, | |
| 23 | but note that ITRC may recommend th | ne t-UCL or t | he Chebyshev UCL for small sample sizes (n < 7). | |
| 24 25 | | | in gross overestimates of the mean. e for a discussion of the Chebyshev UCL. | |
| 26 | Neiel to the F1000L 3.2 Tec | Jiiiicai Guiu | e for a discussion of the Chebyshev OCL. | |
| 27 28 | Objection MESS, Total Care of the | | GOF Test | |
| 29 | Shapiro Wilk Test Statistic 1% Shapiro Wilk Critical Value | | Shapiro Wilk GOF Test Data appear Normal at 1% Significance Level | |
| 30 | Lilliefors Test Statistic | 0.25 | Lilliefors GOF Test | |
| 31 32 | 1% Lilliefors Critical Value | | Data appear Normal at 1% Significance Level 1 1% Significance Level | |
| 33 | | | eliable for small sample sizes | |
| 34 35 | A - | oumina Na- | mal Distribution | |
| 36 | 95% Normal UCL | surning Non | mal Distribution 95% UCLs (Adjusted for Skewness) | |
| 37 | 95% Student's-t UCL | 60.46 | 95% Adjusted-CLT UCL (Chen-1995) | 58.68 |
| 38 39 | | | 95% Modified-t UCL (Johnson-1978) | 60.35 |
| 40 | | | GOF Test | |
| 41 42 | A-D Test Statistic 5% A-D Critical Value | 0.291 0.657 | Anderson-Darling Gamma GOF Test Detected data appear Gamma Distributed at 5% Significance | Lovel |
| 43 | K-S Test Statistic | | Kolmogorov-Smirnov Gamma GOF Test | Level |
| 44 45 | 5% K-S Critical Value | | Detected data appear Gamma Distributed at 5% Significance | Level |
| 46 | | | stributed at 5% Significance Level eliable for small sample sizes | |
| 47 | | | | |
| 48 49 | k hat (MLE) | | Statistics k star (bias corrected MLE) | 122.9 |
| 50 | Theta hat (MLE) | | Theta star (bias corrected MLE) | 0.464 |
| 51 52 | nu hat (MLE) | 3928 | | 983.4 |
| 53 | MLE Mean (bias corrected) | 57 | MLE Sd (bias corrected) Approximate Chi Square Value (0.05) | 5.141 911.6 |
| 54 55 | Adjusted Level of Significance | N/A | | N/A |
| 56 | Δει | sumina Gam | nma Distribution | |
| 57 | 95% Approximate Gamma UCL | | | N/A |
| 58 59 | | Lognorma | GOF Test | |
| 60 | Shapiro Wilk Test Statistic | 0.945 | Shapiro Wilk Lognormal GOF Test | |
| 61 62 | 10% Shapiro Wilk Critical Value | 0.792 | Data appear Lognormal at 10% Significance Level | |
| 63 | Lilliefors Test Statistic 10% Lilliefors Critical Value | | Lilliefors Lognormal GOF Test Data appear Lognormal at 10% Significance Level | |
| 64 | Data appear | Lognormal a | at 10% Significance Level | |
| 65 66 | Note GOF tests | may be unre | eliable for small sample sizes | |
| 67 | | | I Statistics | |
| 68 69 | Minimum of Logged Data | 3.97 | Mean of logged Data | 4.042 |
| 70 | Maximum of Logged Data | 4.094 | SD of logged Data | 0.0524 |
| 71 | Assu | uming Logno | ormal Distribution | |
| 72 73 | 95% H-UCL 95% Chebyshev (MVUE) UCL | N/A 63.5 | 90% Chebyshev (MVUE) UCL 97.5% Chebyshev (MVUE) UCL | 61.48 66.32 |
| 74 | 99% Chebyshev (MVUE) UCL | 71.84 | VI.ON CHODYSHOV (MIVOL) OCC | 30.02 |
| 75 76 | Na | stria Diatelle | tion Fron LICI Statistics | |
| 77 | | | tion Free UCL Statistics Discernible Distribution | |
| 78 | | | | |
| 79 80 | Nonpar 95% CLT UCL | | tribution Free UCLs 95% BCA Bootstrap UCL | N/A |
| 81 | 95% Standard Bootstrap UCL | N/A | 95% Bootstrap-t UCL | N/A |
| 82 | 95% Hall's Bootstrap UCL | N/A | 95% Percentile Bootstrap UCL | N/A |

| | Α | В | С | D | E | F | G H I J K | | | | | | | |
|----|----|---------------------------|----------------|----------------|---------------|-------------------|------------------|----------------|----------------|--------------|-----------------|-------|---|--|
| 83 | | | 90% Ch | ebyshev(Me | an, Sd) UCL | 61.42 | | - | 95% Ch | ebyshev(Me | an, Sd) UCL | 63.42 | 1 | |
| 84 | | | 97.5% Ch | ebyshev(Me | an, Sd) UCL | 66.19 | | | 99% Ch | ebyshev(Me | an, Sd) UCL | 71.65 | | |
| 85 | | | | | | | | | | | | | | |
| 86 | | Suggested UCL to Use | | | | | | | | | | | | |
| 87 | | 95% Student's-t UCL 60.46 | | | | | | | | | | | | |
| 88 | | | | Red | commended | UCL exceed | ds the maxim | num observa | ition | | | | | |
| 89 | | | | | | | | | | | | | | |
| 90 | | Note: Sugges | stions regard | ing the selec | tion of a 95% | 6 UCL are pr | ovided to hel | p the user to | select the m | ost appropri | ate 95% UCL | | | |
| 91 | | Recom | mendations | are based up | on data size | , data distrib | ution, and sk | ewness usin | g results from | m simulation | studies. | | | |
| 92 | Но | wever, simul | lations result | s will not cov | er all Real V | Vorld data se | ts; for addition | nal insight th | ne user may | want to cons | ult a statistic | ian. | | |
| 93 | | | | | | | | | | | | | | |
| 94 | | Note: For | highly negat | ively-skewe | d data, confi | dence limits | (e.g., Chen, | Johnson, Lo | ognormal, ar | nd Gamma) ı | may not be | | | |
| 95 | | | reliable. | Chen's and J | lohnson's m | ethods provi | de adjustme | nts for posity | vely skewed | data sets. | | | | |
| 96 | | | | | | | | | | | | | 1 | |

| 1 | Α | В | С | D | E LIOL Otatio | F | G Full Date | Н | I | J | K | L |
|----------|---------|----------------------------|---------------|-------------------------------------|--------------------------------|------------------------------------|--|----------------------------|------------------------|----------------------------------|----------------------------------|----------------|
| 2 | | | | | UCL Statis | Stics for Unc | ensored Full Dat | ta Sets | | | | |
| 3 | D | User Sele ate/Time of C | ected Options | ProUCL 5.2 1 | 10/28/2024 9 | 2:40:40 DM | | | | | | |
| 5 | D. | | From File | ProUCL Inpu | | 5.40.43 I W | | | | | | |
| 6 7 | | Fu Confidence | III Precision | OFF 95% | | | | | | | | |
| 8 | Number | of Bootstrap | | 2000 | | | | | | | | |
| 9 10 | | | | | | | | | | | | |
| 11 | UMM-WR/ | \-0.5 - 6 | | | | | | | | | | |
| 12 13 | | | | | | General | Statistics | | | | | |
| 14 | | | Total | Number of Ob | oservations | 10 | | | | | Observations | 9 |
| 15 16 | | | | | Minimum | 304 | | | Number | of Missing | Observations Mean | 0 671.2 |
| 17 18 | | | | | Maximum | 1119 | | | | 0.1.5 | Median | 663 |
| 19 | | | | Coefficient of | SD of Variation | 248.1 0.37 | | | | Std. E | Error of Mean Skewness | 78.44 0.384 |
| 20 21 | | | | | | | | | | | | |
| 22 | | | S | Shapiro Wilk Te | est Statistic | 0.966 | GOF Test | Sh | apiro Wil | k GOF Tes | t | |
| 23 | | | | hapiro Wilk Cr | ritical Value | 0.781 | D | ata appear N | Normal at | 1% Signific | | |
| 24 25 | | | 1 | % Lilliefors Cr | est Statistic | 0.187 0.304 | D | L ata appear N | | GOF Test 1% Signific | cance Level | |
| 26 | | | | | | | 1% Significance | | ai at | o.granic | | |
| 27 28 | | | | | Ass | sumina Nori | mal Distribution | | | | | |
| 29 | | | 95% No | ormal UCL | | | | | | sted for Ske | | 010.4 |
| 30 31 | | | | 95% Stud | ent's-t UCL | 815 | | 95% 95° | % Adjuste % Modifie | <u>a-CLT UCL</u> ed-t UCL (Jo | (Chen-1995) hnson-1978) | 810.4 816.6 |
| 32 | | | | | | C - | 005 7 | | | 100 | | |
| 34 | | | | A-D To | est Statistic | 0.2 | GOF Test | Anderson | -Darling | Gamma GC | OF Test | |
| 35 36 | | | | 5% A-D Cr | ritical Value | 0.727 | Detected dat | ta appear Ga | amma Dis | stributed at | 5% Significan | ce Level |
| 37 | | | | | est Statistic ritical Value | 0.14 0.267 | Detected dat | Kolmogorov ta appear Ga | | | <u>iOF Test</u> 5% Significan | ce Level |
| 38 39 | | | | | | Gamma Di | stributed at 5% S | | | | | |
| 40 | | | | | | Gamma | Statistics | | | | | |
| 41 42 | | | | | k hat (MLE) | 7.779 | | | | | rrected MLE) | 5.512 |
| 43 | | | | | a hat (MLE) u hat (MLE) | 86.28 155.6 | | | i neta s | | rrected MLE) as corrected) | 121.8 110.2 |
| 44 45 | | | MI | LE Mean (bias | corrected) | 671.2 | | A | | | as corrected) | 285.9 |
| 46 | | | Adjus | sted Level of S | Significance | 0.0267 | | Арр | <u>roximate</u> Ad | Cni Square | Value (0.05) Square Value | 87.01 83.43 |
| 47 48 | | | | | ٨٥٥ | umina Com | ma Distribution | | | | | |
| 49 | | | 95% A | pproximate G | | | ma Distribution | | 959 | % Adjusted | Gamma UCL | 887 |
| 50 51 | | | | | | Lognorma | I GOF Test | | | | | |
| 52 | | | | Shapiro Wilk Te | | 0.97 | | | | normal GO | | |
| 53 54 | | | 10% S | hapiro Wilk Cr | ritical Value est Statistic | 0.869 0.145 | Data | | | at 10% Sign ormal GOF | ificance Level | |
| 55 | | | 10 | % Lilliefors Cr | ritical Value | 0.241 | | a appear Log | | | ificance Level | |
| 56 57 | | | | <u>D</u> | ata appear | Lognormal a | at 10% Significar | nce Level | | | | |
| 58 | | | | | , | | l Statistics | | | | | |
| 59 60 | } | | | Minimum of Lo Maximum of Lo | | 5.717 7.02 | | | | | f logged Data f logged Data | 6.443 0.392 |
| 61 | | | ı' | naximum or Et | | | 1 | | | 30 0 | . logged Data | 0.002 |
| 62 63 | } | | | С | Assu 95% H-UCL | ı <mark>ming Logno</mark> 890.3 | ormal Distribution | <u>n</u> | 90% (| Chehyshey | (MVUE) UCL | 926.2 |
| 64 | | | | Chebyshev (M | IVUE) UCL | 1041 | | | | | (MVUE) UCL | |
| 65 66 | - | | 99% | Chebyshev (M | IVUE) UCL | 1512 | | | | | | |
| 67 | | | | | | | tion Free UCL St | | | | | |
| 68 69 | | | | | Data appea | r to follow a | Discernible Dist | tribution | | | | |
| 70 | | | | | | | tribution Free UC | CLs | | | | |
| 71 72 | | | 95% | 95% Standard Boo | % CLT UCL otstrap UCL | 800.2 793.7 | | | | | ootstrap UCL otstrap-t UCL | 806.2 840.9 |
| 73 | | | 9 | 5% Hall's Boo | tstrap UCL | 838.3 | | | | Percentile B | ootstrap UCL | 797.7 |
| 74 75 | | | | <u>nebyshev(Mea</u> nebyshev(Mea | | 906.5 1161 | | | | | ean, Sd) UCL ean, Sd) UCL | 1013 1452 |
| 76 | | | | | ,, 502 | | | | | ., | , , , , , , , , | |
| 77 78 | | | | 95% Stud | ent's-t UCL | | UCL to Use | | | | | |
| 79 80 | | Nata: O | | | | | audala de la 1000 | | 4 1- | | into 050/ 1101 | |
| 81 | | | | | | | ovided to help the ution, and skewn | | | | | · |
| 82 | Н | | | | | | ts; for additional i | | | | | an. |

| | A B C D E | F | G H I J K | L |
|----------|--|----------------|--|----------------|
| 2 | | Stics for Unc | ensored Full Data Sets | |
| 3 | User Selected Options Date/Time of Computation ProUCL 5.2 10/28/2024 Prouck 5.2 10/28/2024 Prou | 0.42.14 DM | | |
| 5 | From File ProUCL Input.xls | 0.43. 14 FIVI | | |
| 6 7 | Full Precision OFF Confidence Coefficient 95% | | | |
| 8 | Number of Bootstrap Operations 2000 | | | |
| 9 10 | | | | |
| 11 | UMM-WRA-0.5-7 | | | |
| 12 13 | | General | Statistics | |
| 14 | Total Number of Observations | 10 | Number of Distinct Observations | 9 |
| 15 16 | Minimum | 326 | Number of Missing Observations Mean | 0 528 |
| 17 18 | Maximum | 975 | Median | 498 |
| 19 | SD Coefficient of Variation | | Std. Error of Mean Skewness | 55.53 2.027 |
| 20 | | • | | |
| 21 22 | Shapiro Wilk Test Statistic | | GOF Test Shapiro Wilk GOF Test | |
| 23 24 | 1% Shapiro Wilk Critical Value | 0.781 | Data appear Normal at 1% Significance Level | |
| 25 | Lilliefors Test Statistic 1% Lilliefors Critical Value | 1 | Lilliefors GOF Test Data appear Normal at 1% Significance Level | |
| 26 27 | | | 1% Significance Level | |
| 28 | As | suming Nor | nal Distribution | |
| 29 30 | 95% Normal UCL | | 95% UCLs (Adjusted for Skewness) | CE7.4 |
| 31 | 95% Student's-t UCL | 629.8 | 95% Adjusted-CLT UCL (Chen-1995) 95% Modified-t UCL (Johnson-1978) | 657.4 635.7 |
| 32 33 | | Comme | GOF Test | |
| 34 | A-D Test Statistic | 0.568 | Anderson-Darling Gamma GOF Test | |
| 35 36 | 5% A-D Critical Value | 0.725 | Detected data appear Gamma Distributed at 5% Significance | e Level |
| 37 | K-S Test Statistic 5% K-S Critical Value | | Kolmogorov-Smirnov Gamma GOF Test Detected data appear Gamma Distributed at 5% Significance | e Level |
| 38 39 | Detected data appear | r Gamma Di | stributed at 5% Significance Level | |
| 40 | | Gamma | Statistics | |
| 41 42 | k hat (MLE) Theta hat (MLE) | | k star (bias corrected MLE) Theta star (bias corrected MLE) | 8.829 59.81 |
| 43 | nu hat (MLE) | 250.3 | nu star (bias corrected) | 176.6 |
| 44 45 | MLE Mean (bias corrected) | 528 | MLE Sd (bias corrected) Approximate Chi Square Value (0.05) | 177.7 146.8 |
| 46 | Adjusted Level of Significance | 0.0267 | Approximate ciri Square Value Adjusted Chi Square Value | |
| 47 48 | Δε | suming Gam | ma Distribution | |
| 49 | 95% Approximate Gamma UCL | | 95% Adjusted Gamma UCL | 656 |
| 50 51 | | Lognorma | GOF Test | |
| 52 | Shapiro Wilk Test Statistic | 0.91 | Shapiro Wilk Lognormal GOF Test | |
| 53 54 | 10% Shapiro Wilk Critical Value Lilliefors Test Statistic | | Data appear Lognormal at 10% Significance Level Lilliefors Lognormal GOF Test | |
| 55 56 | 10% Lilliefors Critical Value | 0.241 | Data appear Lognormal at 10% Significance Level | |
| 57 | Data appear | Lognormal a | at 10% Significance Level | |
| 58 59 | Minimum of Laure 15 : | | I Statistics | 6 220 |
| 60 | Minimum of Logged Data Maximum of Logged Data | | Mean of logged Data SD of logged Data | 6.229 0.287 |
| 61 62 | | | - | |
| 63 | ASSI 95% H-UCL | 637.7 | ormal Distribution 90% Chebyshev (MVUE) UCL | 670.5 |
| 64 65 | 95% Chebyshev (MVUE) UCL | 735.9 1005 | 97.5% Chebyshev (MVUE) UCL | 826.6 |
| 66 | 99% Chebyshev (MVUE) UCL | | | |
| 67 68 | | | tion Free UCL Statistics Discernible Distribution | |
| 69 | | | | |
| 70 71 | Nonpa 95% CLT UCL | | tribution Free UCLs 95% BCA Bootstrap UCL | 663.6 |
| 72 | 95% Standard Bootstrap UCL | 615.4 | 95% Bootstrap-t UCL | 714.1 |
| 73 74 | 95% Hall's Bootstrap UCL 90% Chebyshev(Mean, Sd) UCL | 1078 694.6 | 95% Percentile Bootstrap UCL 95% Chebyshev(Mean, Sd) UCL | 630.5 770 |
| 75 | 97.5% Chebyshev(Mean, Sd) UCL | 874.8 | 99% Chebyshev(Mean, Sd) UCL | 1080 |
| 76 77 | | Suggested | UCL to Use | |
| 78 | 95% Student's-t UCL | | | |
| 79 80 | Note: Suggestions regarding the selection of a 95% | 6 UCL are nr | ovided to help the user to select the most appropriate 95% UCL. | |
| 81 | Recommendations are based upon data size | , data distrib | ution, and skewness using results from simulation studies. | |
| 82 | However, simulations results will not cover all Real W | Vorld data se | ts; for additional insight the user may want to consult a statisticia | n. |

| 1 | Α | В | С | ; | D | E | F | G | H Data Cata | I | J | | K | L |
|----------|---------|------------------------|------------------------------|---------|---------------|-----------------------------------|---------------------------------|----------------------------------|-------------------------------|----------------------------------|-----------------------|--------------------------|--------------------|----------------|
| 2 | | | | | | UCL Stati | Stics for Unc | ensored Full | Data Sets | | | | | |
| 3 | D | User Se ate/Time of | elected Opt | | DrollCL 5.2 | 2 10/28/2024 | 9:45:25 DM | | | | | | | |
| 5 | Do | | From F | File | ProUCL Inp | | 0.43.23 F W | | | | | | | |
| 6 7 | | | Full Precisi ce Coefficie | | OFF 95% | | | | | | | | | |
| 8 | Number | of Bootstra | | | 2000 | | | | | | | | | |
| 9 10 | | | | | | | | | | | | | | |
| 11 | UMM-WRA | A-0.5-8 | | | | | | | | | | | | |
| 12 13 | | | | | | | General | Statistics | | | | | | |
| 14 | | | | Total | Number of C | Observations | | | | | | tinct Obse | | 9 |
| 15 16 | | | | | | Minimum | 1 532 | | | Numb | er of Miss | sing Obse | rvations Mean | 0 645.6 |
| 17 18 | | | | | | Maximum | n 873 | | | | | 0 | Median | 601.5 |
| 19 | | | | | Coefficien | SD t of Variation | | | | | | Std. Error Sk | of Mean cewness | 35 1.347 |
| 20 21 | | | | | | | | | | | | | | |
| 22 | | | | Sł | napiro Wilk | Test Statistic | | GOF Test | | Shapiro V | Vilk GOF | Test | | |
| 23 | | | 1 | | napiro Wilk C | Critical Value | 0.781 | | Data appe | ear Normal | at 1% Sig | gnificance | e Level | |
| 24 25 | | | | 19 | | Test Statistic Critical Value | | | Data appe | Lillietor ear Normal | s GOF To at 1% Sid | | e Level | |
| 26 27 | | | | | | | | t 1% Significa | | | | | | |
| 28 | | | | | | A: | ssuming Nor | mal Distribution | on_ | | | | | |
| 29 30 | | | 95 | % No | rmal UCL | | | | 95% | UCLs (Ad | | | | 710.1 |
| 31 | | | | | 95% Stu | dent's-t UCL | 709.8 | | | 95% Adjus 95% Modi | ified-t UC | CL (Johnso | on-1978) | 719.1 712.2 |
| 32 33 | | | | | | | | COE Took | | | | • | | |
| 34 | | | | | A-D - | Test Statistic | | GOF Test | Ander | rson-Darlin | ng Gamm | a GOF To | est | |
| 35 36 | | | | | | Critical Value | | Da | ata Not Gam | ıma Distrib | uted at 5° | % Signific | ance Lev | el |
| 37 | | | | | | Test Statistic Critical Value | | Detected | Kolmog d data appea | orov-Smir i ar Gamma l | | | | ce Level |
| 38 39 | | | | | Detected da | ata follow Ar | pr. Gamma | Distribution a | | | | | | |
| 40 | | | | | | | Gamma | Statistics | | | | | | |
| 41 42 | | | | | The | k hat (MLE) eta hat (MLE) | MLE) 41.75 k star (bias correct | | | | | | | 29.29 22.04 |
| 43 | | | | | | nu hat (MLE) | | | | meta | nu sta | ar (bias co | rrected) | 585.8 |
| 44 45 | | | | ML | .E Mean (bia | as corrected) | 645.6 | | | Approxima | | 6d (bias co | | 119.3 530.6 |
| 46 | | | | Adjust | ted Level of | Significance | 0.0267 | | | Арргохіпіа | Adjusted | Chi Squa | re Value | |
| 47 48 | | | | | | Λ. | seuming Gan | nma Distributi | ion | | | | | |
| 49 | | | 95 | 5% Ap | proximate (| Gamma UCL | | | <u>1011</u> | 9 | 5% Adjus | sted Gam | ma UCL | 725.2 |
| 50 51 | | | | | | | Lognorma | I GOF Test | | | | | | |
| 52 | | | | | | Test Statistic | 0.867 | GOI 163t | | oiro Wilk Lo | | | | |
| 53 54 | | | 10 | 0% Sh | | Critical Value Test Statistic | | | Data Not L | _ognormal : liefors Log | | | e Level | |
| 55 | | | | 109 | | Critical Value | 0.241 | | Data Not L | ognormal | | | e Level | |
| 56 57 | | | | | | Data Not L | <u>.ognormal at</u> | 10% Significa | ance Level | | | | | |
| 58 | | | | | A:: | | | l Statistics | | | | () | | 0.450 |
| 59 60 | | | | | | <u>Logged Data</u> Logged Data | | | | | | an of logg SD of logg | | 6.458 0.16 |
| 61 62 | | | | | | | | | | | ` | | | |
| 63 | | | | | | Ass 95% H-UCL | | ormal Distribu | TIOU | 90% | % Chebys | shev (MVl | JE) UCL | 743.2 |
| 64 65 | | | | | Chebyshev (| MVUE) UCL | 787.6 | | | | | shev (MVL | | 849.1 |
| 66 | | | | 99% (| _nebyshev (| MVUE) UCL | 970.1 | | | | | | | |
| 67 68 | | | | | | | | tion Free UC | | | | | | |
| 69 | | | | | | Data appe | ar to follow a | Discernible I | estribution | | | | | |
| 70 71 | | | | | | | | tribution Free | UCLs | | 050/ 50 | Λ D · · | ror LICI | 7147 |
| 72 | | | | 95% : | | 5% CLT UCL ootstrap UCL | | | | | | CA Bootst 6 Bootstra | | 714.7 786.3 |
| 73 74 | | | | 95 | 5% Hall's Bo | ootstrap UCL | 1077 | | | | 6 Percent | tile Bootst | rap UCL | 701.6 |
| 75 | | | | | | ean, Sd) UCL ean, Sd) UCL | | | | | | ev(Mean, S ev(Mean, S | | 798.2 993.8 |
| 76 77 | | | | | | | | | | | | | | |
| 78 | | | | | 95% Stu | dent's-t UCL | Suggested 709.8 | UCL to Use | | | | | | |
| 79 80 | | Note: Com | gootions | المعتاد | | | | ovided to beli | n the week | | most ser | oronsists (| DE0/ LIQI | |
| 81 | | | | | | | | ovided to help ution, and ske | | | | | | ·- |
| 82 | H | | | | | | | ts; for addition | | | | | | an. |

| 1 | Α | В | С | D | E | F | G | H | I | J | K | L |
|----------|----------|---------|---------------------------------|-----------------|-------------------------------|---------------|--|---------------|--------------------------|--|------------------------------------|----------------|
| 2 | | | | | UCL Statis | Stics for Unc | ensored Full Da | ata Sets | | | | |
| 3 | | | elected Option | | 2 10/28/2024 | 0·12·15 DM | | | | | | |
| 5 | | | From File | e ProUCL In | | 3. 12. 13 F W | | | | | | |
| 6 7 | | | Full Precision ce Coefficien | | | | | | | | | |
| 8 | Number | | p Operation | | | | | | | | | |
| 9 | <u> </u> | | | | | | | | | | | |
| 11 | UMM-WR | B-0.5-1 | | | | | | | | | | |
| 12 13 | | | | | | General | Statistics | | | | | |
| 14 | | | To | tal Number of | Observations | 10 | | | | | Observations | |
| 15 16 | | | | | Minimum | 8550 | | | Numbe | r of Missing | Observations Mean | 0 12512 |
| 17 | | | | | Maximum | 16800 | | | | | Median | 13085 |
| 18 19 | | | | Coefficie | SD nt of Variation | 2811 0.225 | | | | Std. | Error of Mean Skewness | |
| 20 | | | | | | | | | | | | |
| 21 22 | | | | Shapiro Wilk | Test Statistic | | GOF Test | <u></u> | Shapiro W | ilk GOF Tes | st | |
| 23 | | | 1% | Shapiro Wilk | Critical Value | 0.781 | | | r Normal a | at 1% Signifi | cance Level | |
| 24 25 | | | | | Test Statistic Critical Value | _ | | Data appea | | GOF Test at 1% Signifi | cance Level | |
| 26 | | | | | | | 1% Significan | | | J Ciginii | | |
| 27 28 | | | | | As | sumina Nori | mal Distribution | | | | | |
| 29 | | | 95% | Normal UCL | | | | 95% U | | usted for Sk | | 10000 |
| 30 31 | | | | 95% St | udent's-t UCL | 14142 | | 95 9 | o% Adjuste 15% Modifi | ed-CLT UCL ed-t UCL (.) | <u>(Chen-1995)</u> ohnson-1978) | 13980 |
| 32 | | | | | | | 0055 | | | | | |
| 34 | | | | A-D | Test Statistic | | GOF Test | Anderso | on-Darling | Gamma G | OF Test | |
| 35 | | | | 5% A-D | Critical Value | 0.725 | Detected d | lata appear (| Gamma D | istributed at | 5% Significar | ice Level |
| 36 37 | | | | | Test Statistic Critical Value | | Detected d | | | ov Gamma of the contract of th | <u>GOF Test</u> ∶5% Significar | nce Level |
| 38 | | | | | | | stributed at 5% | | | | | |
| 39 40 | | | | | | Gamma | Statistics | | | | | |
| 41 | | | | | k hat (MLE) | 21.3 | | | | | orrected MLE) | |
| 42 43 | | | | Th | eta hat (MLE) nu hat (MLE) | | | | Theta | | orrected MLE) ias corrected) | |
| 44 | | | | MLE Mean (b | ias corrected) | _ | | | | MLE Sd (b | ias corrected) | 3233 |
| 45 46 | | | Ad | ljusted Level c | of Significance | 0.0267 | | Ar | oproximate A | <u>e Chi Square</u> djusted Chi | e Value (0.05) Square Value | 260.4 254.1 |
| 47 48 | | | | | | | District of | | | | | |
| 49 | | | 95% | Approximate | Gamma UCL | | nma Distributior | <u>1</u> | 95 | 5% Adjusted | Gamma UCL | 14749 |
| 50 51 | | | | | | Lagramia | LOOF Tool | | | • | | |
| 52 | | | | Shapiro Wilk | Test Statistic | | I GOF Test | Shapir | o Wilk Lo | gnormal GO | F Test | |
| 53 54 | | | 10% | | Critical Value | | Da | ata appear L | .ognormal | at 10% Sign | nificance Leve | l |
| 55 | | | | | Test Statistic Critical Value | | Da | | | ormal GOF at 10% Sign | ificance Leve | ı |
| 56 57 | | | - | | | | at 10% Significa | | | | | |
| 58 | | | | | | Lognorma | I Statistics | | | | | |
| 59 60 | | | | | f Logged Data | 9.054 | | | | | of logged Data | |
| 61 | | | | | f Logged Data | 9.729 | <u> </u> | | | 2D 0 | of logged Data | 0.232 |
| 62 63 | | | | | Assi 95% H-UCL | | rmal Distribution | on | 009/ | Chobycha | (M)/[IE] [IO] | 15204 |
| 64 | | | | | (MVUE) UCL | 16537 | | | | | (MVUE) UCL (MVUE) UCL | |
| 65 66 | | | | | (MVUE) UCL | | | | | | | |
| 67 | | | | | | | tion Free UCL | | | | | |
| 68 69 | | | | | Data appea | r to follow a | Discernible Dis | stribution | | | | |
| 70 | | | | | | | tribution Free L | JCLs | | | | |
| 71 72 | | | OF | | 95% CLT UCL Bootstrap UCL | | | | | | Bootstrap UCL ootstrap-t UCL | |
| 73 | | | | 95% Hall's E | Bootstrap UCL | 13945 | | | | Percentile B | Bootstrap UCL | 13931 |
| 74 75 | | | | | ean, Sd) UCL ean, Sd) UCL | | | | | | ean, Sd) UCL ean, Sd) UCL | |
| 76 | | | 31.3/0 | OTTODYSTIEV(IVI | our, our ook | | I | | J3 /6 CI | iony ariev (IVI | oan, ouj ool | 21007 |
| 77 78 | | | | 95% St | udent's-t UCL | | UCL to Use | | | | | |
| 79 | | | | | | | I | | | | | |
| 80 81 | | | | | | | ovided to help to the control of the | | | | | <u></u> |
| 82 | ŀ | | | | | | ts; for additiona | | | | | ian. |
| | | | | | | | · | | | | | |

| 1 | A B C D E | F stics for Unc | G H I J K L ensored Full Data Sets |
|----------|--|--|--|
| 2 | JOE State | 31100 101 0110 | oneorou i dii bata ooto |
| 3 | User Selected Options | | |
| 4 5 | Date/Time of Computation ProUCL 5.2 10/28/2024 | 9:15:09 PM | |
| 6 | From File ProUCL Input.xls Full Precision OFF | | |
| 7 | Confidence Coefficient 95% | | |
| 8 | Number of Bootstrap Operations 2000 | | |
| 9 | | | |
| 10 11 | LIMANA NAIDD O E O | | |
| 12 | UMM-WRB-0.5-2 | | |
| 13 | | General | Statistics |
| 14 | Total Number of Observations | 10 | Number of Distinct Observations 10 |
| 15 16 | 10. | 1000 | Number of Missing Observations 0 |
| 17 | Minimum Maximum | | Mean 1756 Median 1718 |
| 18 | SD | | Std. Error of Mean 122.2 |
| 19 | Coefficient of Variation | | Skewness 1.001 |
| 20 | | | |
| 21 22 | Chanina Willy Took Chadiatia | | GOF Test |
| 23 | Shapiro Wilk Test Statistic 1% Shapiro Wilk Critical Value | | Shapiro Wilk GOF Test Data appear Normal at 1% Significance Level |
| 24 | Lilliefors Test Statistic | | Lilliefors GOF Test |
| 25 | 1% Lilliefors Critical Value | 0.304 | Data appear Normal at 1% Significance Level |
| 26 | Data appe | ar Normal a | : 1% Significance Level |
| 27 28 | Λ. | eumina No- | mal Distribution |
| 29 | 95% Normal UCL | summy NOF | mal Distribution 95% UCLs (Adjusted for Skewness) |
| 30 | 95% Student's-t UCL | 1980 | 95% Adjusted-CLT UCL (Chen-1995) 1998 |
| 31 | | | 95% Modified-t UCL (Johnson-1978) 1986 |
| 32 | | | 00F Took |
| 33 34 | A-D Test Statistic | | GOF Test Anderson-Darling Gamma GOF Test |
| 35 | 5% A-D Critical Value | | Detected data appear Gamma Distributed at 5% Significance Level |
| 36 | K-S Test Statistic | | Kolmogorov-Smirnov Gamma GOF Test |
| 37 | 5% K-S Critical Value | 0.266 | Detected data appear Gamma Distributed at 5% Significance Level |
| 38 39 | Detected data appea | <u>r Gamma Di</u> | stributed at 5% Significance Level |
| 40 | | Gamma | Statistics |
| 41 | k hat (MLE) | | k star (bias corrected MLE) 17.4 |
| 42 | Theta hat (MLE) | 70.93 | Theta star (bias corrected MLE) 100.9 |
| 43 | nu hat (MLE) | | nu star (bias corrected) 347.9 |
| 44 45 | MLE Mean (bias corrected) | 1/56 | MLE Sd (bias corrected) 421 Approximate Chi Square Value (0.05) 305.7 |
| 46 | Adjusted Level of Significance | 0.0267 | Approximate Chi Square Value (0.03) 303.7 Adjusted Chi Square Value 298.8 |
| 47 | | | · injusted on equate value |
| 48 | | | ma Distribution |
| 49 50 | 95% Approximate Gamma UCL | 1998 | 95% Adjusted Gamma UCL 2044 |
| 51 | | Lognorma | GOF Test |
| 52 | Shapiro Wilk Test Statistic | | Shapiro Wilk Lognormal GOF Test |
| 53 | 10% Shapiro Wilk Critical Value | 0.869 | Data appear Lognormal at 10% Significance Level |
| 54 55 | Lilliefors Test Statistic | | Lilliefors Lognormal GOF Test |
| 56 | 10% Lilliefors Critical Value | | Data appear Lognormal at 10% Significance Level |
| 57 | рака арреан | Eognomial (| at 1070 digitification botton |
| 58 | | | Statistics |
| 59 60 | Minimum of Logged Data | | Mean of logged Data 7.45 |
| 61 | Maximum of Logged Data | 7.85 | SD of logged Data 0.209 |
| 62 | Ass | umina Loand | ormal Distribution |
| 63 | 95% H-UCL | 2006 | 90% Chebyshev (MVUE) UCL 2104 |
| 64 | 95% Chebyshev (MVUE) UCL | | 97.5% Chebyshev (MVUE) UCL 2483 |
| 65 66 | 99% Chebyshev (MVUE) UCL | 2914 | |
| 67 | Nonnarame | etric Distribu | tion Free UCL Statistics |
| 68 | | | Discernible Distribution |
| 69 | | | |
| 70 71 | | | tribution Free UCLs |
| 71 72 | 95% CLT UCL 95% Standard Bootstrap UCL | | 95% BCA Bootstrap UCL 1997 95% Bootstrap-t UCL 2054 |
| 73 | 95% Hall's Bootstrap UCL | | 95% Percentile Bootstrap UCL 1959 |
| 74 | 90% Chebyshev(Mean, Sd) UCL | 2123 | 95% Chebyshev(Mean, Sd) UCL 2289 |
| 75 76 | 97.5% Chebyshev(Mean, Sd) UCL | 2519 | 99% Chebyshev(Mean, Sd) UCL 2972 |
| 76 77 | | Suggested | UCL to Use |
| // | | nation in it. | USE IO USE |
| 78 | 95% Student's t HCL | | |
| 78 79 | 95% Student's-t UCL | | |
| 79 80 | Note: Suggestions regarding the selection of a 959 | 1980 6 UCL are pr | ovided to help the user to select the most appropriate 95% UCL. |
| 79 | Note: Suggestions regarding the selection of a 959 Recommendations are based upon data size | 1980 6 UCL are pr , data distrib | |

| 1 | A B C D E | F stics for Unc | G H I J K L ensored Full Data Sets |
|----------|---|-----------------------|---|
| 2 | , | | |
| 3 | User Selected Options | 0.40.40.511 | |
| 5 | Date/Time of Computation ProUCL 5.2 10/28/2024 From File ProUCL Input.xls | 9:16:40 PM | |
| 6 | Full Precision OFF | | |
| 7 | Confidence Coefficient 95% | | |
| 8 | Number of Bootstrap Operations 2000 | | |
| 9 | | | |
| _ | UMM-WRB-0.5-2-DS | | |
| 12 | OMM-141 (D-0.0-2-DO | | |
| 13 | | General | Statistics |
| 14 | Total Number of Observations | 4 | Number of Distinct Observations 4 |
| 15 16 | Minimum | 65 | Number of Missing Observations 0 Mean 69 |
| 17 | Maximum | | Median 66.5 |
| 18 | SD | _ | Std. Error of Mean 3.028 |
| 19 | Coefficient of Variation | 0.0878 | Skewness 1.892 |
| 20 21 | Notes Occupie des la constitute de 400 lé data | | |
| 22 | | | l using incremental sampling methodology (ISM) approach, C 2020 and ITRC 2012) for additional guidance, |
| 23 | | | he Chebyshev UCL for small sample sizes (n < 7). |
| 24 | The Chebyshev UCL of | ften results | in gross overestimates of the mean. |
| 25 | Refer to the ProUCL 5.2 Tec | chnical Guid | e for a discussion of the Chebyshev UCL. |
| 26 27 | | Nome at 4 | POE Toet |
| 28 | Shapiro Wilk Test Statistic | | GOF Test Shapiro Wilk GOF Test |
| 29 | 1% Shapiro Wilk Critical Value | | Data appear Normal at 1% Significance Level |
| 30 | Lilliefors Test Statistic | 0.379 | Lilliefors GOF Test |
| 31 32 | 1% Lilliefors Critical Value | | Data appear Normal at 1% Significance Level |
| 33 | | | t 1% Significance Level Bliable for small sample sizes |
| 34 | Note GOF tests | iliay be ullic | silable for Strian Sattiple Sizes |
| 35 | As | suming Nor | mal Distribution |
| 36 | 95% Normal UCL | | 95% UCLs (Adjusted for Skewness) |
| 37 38 | 95% Student's-t UCL | 76.13 | 95% Adjusted-CLT UCL (Chen-1995) 77.04 |
| 39 | | | 95% Modified-t UCL (Johnson-1978) 76.6 |
| 40 | | Gamma | GOF Test |
| 41 | A-D Test Statistic | | Anderson-Darling Gamma GOF Test |
| 42 43 | 5% A-D Critical Value | | Data Not Gamma Distributed at 5% Significance Level |
| 44 | K-S Test Statistic 5% K-S Critical Value | | Kolmogorov-Smirnov Gamma GOF Test Data Not Gamma Distributed at 5% Significance Level |
| 45 | | | ed at 5% Significance Level |
| 46 | | | |
| 47 48 | k hat (MLE) | Gamma 182.3 | Statistics k star (bias corrected MLE) 45.74 |
| 49 | Theta hat (MLE) | | Theta star (bias corrected MLE) 45.74 |
| 50 | nu hat (MLE) | | nu star (bias corrected) 365.9 |
| 51 | MLE Mean (bias corrected) | | MLE Sd (bias corrected) 10.2 |
| 52 | A.F | N1/A | Approximate Chi Square Value (0.05) 322.6 |
| 53 54 | Adjusted Level of Significance | N/A | Adjusted Chi Square Value N/A |
| 55 | As | sumina Gam | ma Distribution |
| 56 | 95% Approximate Gamma UCL | | 95% Adjusted Gamma UCL N/A |
| 57 58 | | | LOOFT |
| 58 | Shapiro Wilk Test Statistic | | GOF Test Shapiro Wilk Lognormal GOF Test |
| 60 | 10% Shapiro Wilk Critical Value | | Data Not Lognormal at 10% Significance Level |
| 61 | Lilliefors Test Statistic | 0.374 | Lilliefors Lognormal GOF Test |
| 62 | 10% Lilliefors Critical Value | | Data Not Lognormal at 10% Significance Level |
| 63 64 | Data Not L | ognormal at | 10% Significance Level |
| 65 | | Lognorma | I Statistics |
| 66 | Minimum of Logged Data | 4.174 | Mean of logged Data 4.231 |
| 67 | Maximum of Logged Data | | SD of logged Data 0.0845 |
| 68 69 | | umalm = 1 · · · | annal Distribution |
| 70 | Assi 95% H-UCL | uming Logno N/A | prmal Distribution 90% Chebyshev (MVUE) UCL 77.73 |
| 71 | 95% Chebyshev (MVUE) UCL | 81.69 | 97.5% Chebyshev (MVUE) UCL 87.18 |
| 72 | 99% Chebyshev (MVUE) UCL | 97.98 | |
| 73 | | | |
| 74 75 | | | tion Free UCL Statistics |
| 76 | Data appea | ii to tollow a | Discernible Distribution |
| 77 | Nonpa | rametric Dis | tribution Free UCLs |
| 78 | 95% CLT UCL | 73.98 | 95% BCA Bootstrap UCL N/A |
| 79 80 | 95% Standard Bootstrap UCL | | 95% Bootstrap-t UCL N/A |
| 81 | 95% Hall's Bootstrap UCL 90% Chebyshev(Mean, Sd) UCL | N/A 78.08 | 95% Percentile Bootstrap UCL N/A 95% Chebyshev(Mean, Sd) UCL 82.2 |
| | | 87.91 | 95% Chebyshev(Mean, Sd) UCL 82.2 99% Chebyshev(Mean, Sd) UCL 99.12 |
| 82 | 97.5% Chebyshev(Mean, Sd) UCL | | |

| | Α | В | С | D | E | F | G | Н | ı | J | K | L | |
|----|---|---|---------------|---------------|---------------|----------------|-------------------|---------------|----------------|---------------|-------------|---|--|
| 83 | | | | | | | | | | | | | |
| 84 | | | | | | Suggested | UCL to Use | | | | | | |
| 85 | | | | 95% Stu | dent's-t UCL | 76.13 | | | | | | | |
| 86 | | | | | | • | | | | | | | |
| 87 | 1 | Note: Sugges | stions regard | ing the selec | tion of a 95% | 6 UCL are pr | ovided to hel | p the user to | select the m | ost appropria | ate 95% UCL | | |
| 88 | | Recom | mendations | are based up | on data size | , data distrib | ution, and sk | ewness usin | g results fror | n simulation | studies. | | |
| 89 | | Recommendations are based upon data size, data distribution, and skewness using results from simulation studies. However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician. | | | | | | | | | | | |
| 90 | | | | | | | | | | | | | |

| 1 | Α | В | С | D | E LICI Chair | F | G Full F | H Data Cata | I | J | K | L | |
|----------|--|--|----------|----------------|--------------------------------|---|--|---------------------|-------------|-----------------------------------|----------------------------------|----------------|--|
| 2 | | UCL Statistics for Uncensored Full Data Sets | | | | | | | | | | | |
| 3 | User Selected Options Date/Time of Computation ProUCL 5.2 10/30/2024 9:26:54 PM | | | | | | | | | | | | |
| 5 | From File ProUCL Input.xls | | | | | | | | | | | | |
| 6 7 | Full Precision OFF Confidence Coefficient 95% | | | | | | | | | | | | |
| 8 | | Number of Bootstrap Operations 2000 | | | | | | | | | | | |
| 9 10 | | | | | | | | | | | | | |
| 11 12 | UMM-WRB | JMM-WRB-0.5-3 | | | | | | | | | | | |
| 13 | | | | | | General | Statistics | | | | | | |
| 14 15 | Total Number of Observation | | | | | 10 | | | | | Observations | 10 0 | |
| 16 | Minimu | | | | | 683 | Number of Missing Observations 0 Mean 878.5 | | | | | | |
| 17 18 | Maximu S | | | | | 1206 162.4 | Median 860.5 Std. Error of Mean 51.36 | | | | | | |
| 19 | Coefficient of Variatio | | | | | | | | | Siu. | Skewness | 0.764 | |
| 20 21 | | Normal GOF Test | | | | | | | | | | | |
| 22 | Shapiro Wilk Test Statistic 0.938 Shapiro Wilk GOF Test | | | | | | | | | | | | |
| 23 24 | 1% Shapiro Wilk Critical Valu Lilliefors Test Statis | | | | | | | | | | | | |
| 25 | | | 1 | % Lilliefors C | ritical Value | 0.304 Data appear Normal at 1% Significance Level | | | | | | | |
| 26 27 | | Data appear Normal at 1% Significance Level | | | | | | | | | | | |
| 28 | | | A=** * * | | As | suming Nor | mal Distributio | | | | | | |
| 29 30 | | 95% Normal UCL 95% Student's-t UC | | | | | | | | <u>usted for Sk</u> ed-CLT UCL | <u>(ewness)</u> _ (Chen-1995) | 976.2 | |
| 31 32 | | 30% Statistics (30 | | | | | | | 95% Modif | ied-t UCL (J | ohnson-1978) | | |
| 33 | | | | | | Gamma | GOF Test | | | | | | |
| 34 35 | | | | | est Statistic | 0.251 | | | | Gamma G | | | |
| 36 | | | | | ritical Value est Statistic | 0.724 0.168 | Detected | | | ov Gamma | t 5% Significan GOF Test | ce Level | |
| 37 38 | | | | | ritical Value | 0.266 | Detected of stributed at 5% | | | istributed at | t 5% Significan | ce Level | |
| 39 | | | | Detected | иата арреат | Gamma Di | stributed at 57 | <u>% Signilican</u> | ice Levei | | | | |
| 40 41 | | | | | k hat (MLE) | Gamma 34.07 | Statistics | | k | star (bias o | orrocted MLE) | 23.92 | |
| 42 | | Theta hat (ML | | | | 25.79 | | | | | | 36.73 | |
| 43 44 | nu hat (MLI MLE Mean (bias correcte | | | | u hat (MLE) | 681.4 878.5 | | | | | ias corrected) | 478.3 179.6 | |
| 45 | | | | | | | | Α | Approximate | e Chi Squar | e Value (0.05) | 428.6 | |
| 46 47 | Adjusted Level of Significance 0.0267 Adjusted Chi Square Value 42 | | | | | | | | | 420.4 | | | |
| 48 | | Assuming Gamma Distribution | | | | | | | | | | | |
| 49 50 | | 95% Approximate Gamma UCL 980.4 95% Adjusted Gamma UCL 999.5 | | | | | | | | | | | |
| 51 52 | | Lognormal GOF Test | | | | | | | | | | | |
| 53 | Shapiro Wilk Test Statisti 10% Shapiro Wilk Critical Valu | | | | | 0.959 0.869 | | | | | | | |
| 54 55 | Lilliefors Test Statisti 10% Lilliefors Critical Valu | | | | | 0.155 0.241 | Lilliefors Lognormal GOF Test Data appear Lognormal at 10% Significance Level | | | | | | |
| 56 | | | 10 | | | | at 10% Signific | | | at 10 /0 SIGI | micarice Level | | |
| 57 58 | | Lognormal Statistics | | | | | | | | | | | |
| 59 | Minimum of Logged Dat | | | | | 6.526 Mean of logged Data 6.763 | | | | | | | |
| 60 61 | | | N | Maximum of L | ogged Data | 7.095 | | | | SD o | of logged Data | 0.179 | |
| 62 | | Assuming Lognormal Distribution | | | | | | | | | | | |
| 63 64 | 95% H-UC 95% Chebyshev (MVUE) UC | | | | 95% H-UCL MVUE) UCL | 983.4 1096 | | | | | | 1028 1190 | |
| 65 | | | | Chebyshev (N | | | | | 07.070 | 332,01101 | , 52, 552 | | |
| 66 67 | | | | | Nonparame | tric Distribu | tion Free UCL | _ Statistics | | | | | |
| 68 69 | | Nonparametric Distribution Free UCL Statistics Data appear to follow a Discernible Distribution | | | | | | | | | | | |
| 70 | | Nonparametric Distribution Free UCLs | | | | | | | | | | | |
| 71 72 | 95% CLT UC | | | | | 963 95% BCA Bootstrap UCL | | | | | | | |
| 73 | 95% Hall's Bootstrap UC | | | | otstrap UCL | 983.7 | | | | | | 993.2 962.9 | |
| 74 75 | 90% Chebyshev(Mean, Sd) UC 97.5% Chebyshev(Mean, Sd) UC | | | | | 1033 1199 | 95% Chebyshev(Mean, Sd) UCL 1102 99% Chebyshev(Mean, Sd) UCL 1390 | | | | | | |
| 76 | | | 37.3% Cr | ienysnev(IVI68 | ari, ou) UCL | | | | 99% C | nebysnev(IV | i c aii, Suj UCL | 1380 | |
| 77 78 | | Suggested UCL to Use 95% Student's-t UCL 972.7 | | | | | | | | | | | |
| 79 | | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. | | | | | | | | | | | |
| 80 81 | | | | | | | ovided to help ution, and skev | | | | | | |
| 82 | Нс | | | | | | | | | | n studies. Isult a statistici | an. | |
| | | | | | | | | | | | | | |

| -1 | A B C D E | F | G ensored Full Da | H eta Sets | | J | K | | L |
|----------|--|--------------------|----------------------|---------------------------------------|--------------------------------|-----------------------|-----------------------------------|-------------|----------------|
| 2 | | 100 101 0110 | ciisorca i ali be | ata Octo | | | | | |
| 3 | User Selected Options |).20.02 D. 4 | | | | | | | |
| 5 | Date/Time of Computation ProUCL 5.2 10/30/2024 9 From File ProUCL Input.xls | 9:29:03 PIVI | | | | | | | |
| 6 | Full Precision OFF | | | | | | | | |
| 7 | Confidence Coefficient 95% | | | | | | | | |
| 8 | Number of Bootstrap Operations 2000 | | | | | | | | |
| 10 | | | | | | | | | |
| 11 | UMM-WRB-0.5-4 | | | | | | | | |
| 12 13 | | General | Statistics | | | | | | |
| 14 | Total Number of Observations | 10 | | | Numbe | r of Distin | ct Observati | ons | 10 |
| 15 16 | Minimum | 450 | | | Numbe | r of Missir | ng Observati | | 0 |
| 17 | Minimum Maximum | 453 891 | | | | | Med | ean lian | 660.3 664.5 |
| 18 | SD | 139.3 | | | | Sto | d. Error of Me | ean | 44.05 |
| 19 20 | Coefficient of Variation | 0.211 | | | | | Skewn | ess | 0.156 |
| 21 | | Normal (| GOF Test | | | | | | |
| 22 | Shapiro Wilk Test Statistic | 0.977 | | | Shapiro W | | | | |
| 23 24 | 1% Shapiro Wilk Critical Value Lilliefors Test Statistic | 0.781 0.123 | | Data appea | | | ificance Lev | el | |
| 25 | 1% Lilliefors Critical Value | 0.123 | 1 1 | Data appea | | GOF Tes at 1% Sign | ificance Lev | el | |
| 26 | | | t 1% Significand | | | | | | |
| 27 28 | And | sumina Non | mal Distribution | | | | | | |
| 29 | 95% Normal UCL | Summy Non | | | UCLs (Adjı | usted for S | Skewness) | | |
| 30 | 95% Student's-t UCL | 741.1 | | 9 | 5% Adjusto | ed-CLT U | CL (Chen-19 | | 735.1 |
| 31 32 | | | l | (| 95% Modifi | ed-t UCL | (Johnson-19 | /8) | /41.4 |
| 33 | | Gamma | GOF Test | | | | | | |
| 34 35 | A-D Test Statistic | 0.173 | | | on-Darling | | | | - 1 |
| 36 | 5% A-D Critical Value K-S Test Statistic | 0.725 0.135 | Detected da | | | | at 5% Signif a GOF Test | canc | e Level |
| 37 | 5% K-S Critical Value | 0.266 | Detected da | ata appear | Gamma D | | at 5% Signif | icanc | e Level |
| 38 39 | Detected data appear | Gamma Di | stributed at 5% | Significan | ce Level | | | | |
| 40 | | Gamma | Statistics | | | | | | |
| 41 | k hat (MLE) | 24.58 | | | | | corrected M | | 17.27 |
| 42 43 | Theta hat (MLE) | 26.86 | | | Theta | | corrected M | | 38.23 |
| 44 | nu hat (MLE) MLE Mean (bias corrected) | | | | | | (bias correct (bias correct | | 345.5 158.9 |
| 45 | | | | Α | | e Chi Squ | are Value (0. | 05) | 303.4 |
| 46 47 | Adjusted Level of Significance | 0.0267 | <u> </u> | | A | djusted C | hi Square Va | lue | 296.5 |
| 48 | Ass | suming Gan | nma Distribution | 1 | | | | | |
| 49 50 | 95% Approximate Gamma UCL | | | | 95 | % Adjuste | ed Gamma L | ICL | 769.2 |
| 51 | | Lognorma | I GOF Test | | | | | | |
| 52 | Shapiro Wilk Test Statistic | 0.976 | | | ro Wilk Lo | | | | |
| 53 54 | 10% Shapiro Wilk Critical Value | 0.869 | Da | | | | gnificance L | evel | |
| 55 | Lilliefors Test Statistic 10% Lilliefors Critical Value | 0.121 0.241 | Da | | efors Logn Lognormal | | gnificance L | evel | |
| 56 | | | at 10% Significa | | | . 3 . 3 0 | ,, | | |
| 57 58 | | Lognorma | al Statistics | | | | | | |
| 59 | Minimum of Logged Data | 6.116 | า วเสนอแบร | | | Mear | n of logged D | ata | 6.472 |
| 60 | Maximum of Logged Data | 6.792 | | | | | of logged D | | 0.215 |
| 61 62 | Λοοι | ımina Loana | ormal Distribution | n . | | | | | |
| 63 | 95% H-UCL | 758.2 | | /II | 90% | Chebysh | ev (MVUE) L | ICL | 795.6 |
| 64 65 | 95% Chebyshev (MVUE) UCL | 856.8 | | | | | ev (MVUE) L | | 941.7 |
| 66 | 99% Chebyshev (MVUE) UCL | 1109 | L | | | | | | |
| 67 | | | tion Free UCL S | | | | | | |
| 68 69 | Data appea | r to follow a | Discernible Dis | stribution | | | | | |
| 70 | Nonnar | ametric Dis | tribution Free U | ICLs | | | | | |
| 71 | 95% CLT UCL | 732.8 | | | | | Bootstrap L | | 728.9 |
| 72 73 | 95% Standard Bootstrap UCL | 728 | | | OE0/ | | Bootstrap-t L | | 741 |
| 74 | 95% Hall's Bootstrap UCL 90% Chebyshev(Mean, Sd) UCL | 733.5 792.5 | 1 | | | | <u>Bootstrap L</u> Mean, Sd) L | | 727.7 852.3 |
| 75 | 97.5% Chebyshev(Mean, Sd) UCL | 935.4 | | | | | Mean, Sd) L | | 1099 |
| 76 77 | | Quaaata 1 | LICI to Lie- | | | | | | |
| 78 | 95% Student's-t UCL | Suggested 741.1 | UCL to Use | | | | | | |
| 79 | | | 1 | | | | | | |
| 80 81 | Note: Suggestions regarding the selection of a 95% | | | | | | | JCL. | |
| 82 | Recommendations are based upon data size, However, simulations results will not cover all Real W | | | | | | | sticia | n. |
| | , constant rooms from the coron direction from | | ., | , , , , , , , , , , , , , , , , , , , | | 10 0 | u Jiuli | | |

| User Selected Options ProUCL 62 1028/2004 8:47:57 PM | 1 | A B C D E | F tatistics for U | G H I J K L |
|--|----|--|----------------------|---|
| Date Prior Prior | | | tatiotics for O | iconsored Full Data Octs |
| From File ProdUct Installation OFF | _ | | | |
| Fig. Processor OFF | | | 124 8:47:57 PI | |
| Number of Boostsea Operations 2000 | | | | |
| | | | | |
| | | Number of Bootstrap Operations 2000 | | |
| Total Number of Observations 10 | | | | |
| Camera Statistics Camera Statistics Camera Statistics Camera Camera Statistics Camera Cam | | UUMM-WRA-0.5-1 | | |
| Total Number of Observations 10 | | | Gonor | al Statistics |
| Minimum 911 | | Total Number of Observation | | |
| | | | 211 | |
| Section 1.00 | | | | |
| Normal GOF Test | 18 | | | |
| Normal GOF Test Shapiro Wilk Test Statistic 0.962 Shapiro Wilk GOF Test 23 1% Shapiro Wilk Critical Value 0.781 Data appear Normal at 1% Significance Level Lillefors Test Statistic 0.18 Data appear Normal at 1% Significance Level 1 1 1 1 1 1 1 1 1 | | Coefficient of Variat | ion 0.107 | Skewness -0.27 |
| Shapiro Wilk Test Statistic 9.962 Shapiro Wilk Sparro Wilk Critical Value 0.781 Data appear Normal at 1% Significance Level | | | Norma | I GOF Test |
| | | | stic 0.962 | Shapiro Wilk GOF Test |
| The common is a | | | | |
| | | | | |
| | | | | |
| | | | Assuming N | ormal Distribution |
| | 29 | 95% Normal UCL | rassuming N | |
| A-D Test Statistic 0.259 | | | ICL 1170 | 95% Adjusted-CLT UCL (Chen-1995) 1160 |
| Gamma QOF Test | | | | 95% Modified-t UCL (Johnson-1978) 1170 |
| Sy A-D Critical Value 0.724 Detected data appear Gamma Distributed at 5% Significance Level Sy K-S Test Statistic 0.266 Detected data appear Gamma Distributed at 5% Significance Level Sy K-S Critical Value 0.266 Detected data appear Gamma Distributed at 5% Significance Level Detected data appear Gamma Distributed at 5% Significance Level Detected data appear Gamma Distributed at 5% Significance Level Sy Gamma Distributed at 5% Significance Level Detected data appear Gamma Distributed at 5% Significance Level Sy Gamma Distributed at 5% Significance Level Sy Gamma Distributed at 5% Significance Level 100 Sy Gamma Distributed at 5% Significance Level 100 Sy Gamma Distributed at 5% Significance Level 100 Sy Gamma Distributed at 5% Significance 16.55 Sy Gamma Distributed 16.55 Sy Gamma Distributed 16.55 Sy Gamma Distributed 100 Sy Gamma Distributed | 33 | | | |
| See See Statistic O.16 Kolmogorov-Smirnov Gamma GOF Test 55% K-S Critical Paleu 0.266 Detected data appear Gamma Distributed at 5% Significance Level 28 Detected data appear Gamma Distributed at 5% Significance Level 38 Detected data appear Gamma Distributed at 5% Significance Level 39 Detected data appear Gamma Distributed at 5% Significance Level Gamma Statistics See Se | | | | |
| | | | | |
| Comma Statistics State | 37 | 5% K-S Critical Va | lue 0.266 | Detected data appear Gamma Distributed at 5% Significance Level |
| Gamma Statistics | | Detected data app | oear Gamma | Distributed at 5% Significance Level |
| | | | Gamm | a Statistics |
| National Color Nati | | | LE) 95.06 | k star (bias corrected MLE) 66.61 |
| MLE Mean (bias corrected) 1102 | | | | Theta star (bias corrected MLE) 16.55 |
| Adjusted Level of Significance 0.0267 | 44 | | | |
| Assuming Gamma Distribution | | | 0.000 | Approximate Chi Square Value (0.05) 1248 |
| Assuming Gamma Distribution 95% Approximate Gamma UCL 1176 95% Adjusted Gamma UCL 1190 | | Adjusted Level of Significan | nce 0.0267 | Adjusted Chi Square Value 1234 |
| Lognormal GOF Test Shapiro Wilk Test Statistic 0.953 Shapiro Wilk Lognormal GOF Test 0.953 Shapiro Wilk Lognormal GOF Test 0.969 Data appear Lognormal at 10% Significance Level 1.58 Lilliefors Lognormal GOF Test 1.58 Lilliefors Lognormal Active Lognormal at 10% Significance Level 1.56 Data appear Lognormal Statistics 1.56 Mean of logged Data 7 1.57 SD of logged Data 7 1.57 SD of logged Data 1.57 Data appear Lognormal Distribution 1.56 Data appear Lognormal Distribution 1.57 Data appear Lognormal Data Distribution 1.57 Data Data Data Data Data Data Data Da | 48 | | | |
| Description | | 95% Approximate Gamma U | ICL 1176 | 95% Adjusted Gamma UCL 1190 |
| Shapiro Wilk Lognormal GOF Test 10% Shapiro Wilk Critical Value 0.869 Data appear Lognormal at 10% Significance Level | | | Lognorr | nal GOF Test |
| Lilliefors Test Statistic 0.158 | | | stic 0.953 | Shapiro Wilk Lognormal GOF Test |
| Data appear Lognormal at 10% Significance Level | | | | |
| Lognormal Statistics Statistics Mean of logged Data 7 | 55 | | | |
| Lognormal Statistics Statistics Mean of logged Data 7.147 SD of logged Data | | | | |
| Minimum of Logged Data 6.815 Mean of logged Data 7 | 58 | | Loanori | nal Statistics |
| Assuming Lognormal Distribution System Sys | 59 | | ata 6.815 | Mean of logged Data 7 |
| Assuming Lognormal Distribution 95% H-UCL 1178 90% Chebyshev (MVUE) UCL 1216 1216 95% Chebyshev (MVUE) UCL 1268 97.5% Chebyshev (MVUE) UCL 1340 | | Maximum of Logged D | ata 7.147 | SD of logged Data 0.109 |
| 95% H-UCL 1178 90% Chebyshev (MVUE) UCL 1216 | 62 | | | normal Distribution |
| Suggested UCL to Use Statistics Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL Recommendations are based upon data size, data distribution, and skewness using results from simulation studies. Statistics Stati | | 95% H-U | ICL 1178 | 90% Chebyshev (MVUE) UCL 1216 |
| Nonparametric Distribution Free UCL Statistics | | | | 97.5% Chebyshev (MVUE) UCL 1340 |
| Data appear to follow a Discernible Distribution Nonparametric Distribution Free UCLs Nonparametric Distribution Free UCLs Standard Bootstrap UCL 1163 95% BCA Bootstrap UCL 1162 95% Standard Bootstrap UCL 1160 95% Bootstrap-t UCL 1168 95% Bootstrap-t UCL 1168 95% Hall's Bootstrap UCL 1160 95% Percentile Bootstrap UCL 1161 95% Chebyshev(Mean, Sd) UCL 1214 95% Chebyshev(Mean, Sd) UCL 1265 97.5% Chebyshev(Mean, Sd) UCL 1335 99% Chebyshev(Mean, Sd) UCL 1473 99% Chebyshev(Mean, Sd) UCL 1473 95% Student's-t UCL 1170 99% Chebyshev(Mean, Sd) UCL 1473 PSW Suggested UCL to Use 95% Student's-t UCL 1170 PSW Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. Recommendations are based upon data size, data distribution, and skewness using results from simulation studies. | 66 | 33 /0 Chebyshev (INIVOE) C | 1400 | |
| Nonparametric Distribution Free UCLs 1163 95% BCA Bootstrap UCL 1162 1162 95% Standard Bootstrap UCL 1160 95% Bootstrap-t UCL 1168 1160 95% Percentile Bootstrap UCL 1161 11 | | | | |
| Nonparametric Distribution Free UCLs | | Data ap | pear to follow | a Discernible Distribution |
| 95% Standard Bootstrap UCL 1160 95% Bootstrap+t UCL 1168 95% Hall's Bootstrap UCL 1160 95% Percentile Bootstrap UCL 1161 90% Chebyshev(Mean, Sd) UCL 1214 95% Chebyshev(Mean, Sd) UCL 1265 97.5 97.5% Chebyshev(Mean, Sd) UCL 1335 99% Chebyshev(Mean, Sd) UCL 1473 95% Suggested UCL to Use 95% Student's-t UCL 1170 95% Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. 81 Recommendations are based upon data size, data distribution, and skewness using results from simulation studies. | 70 | | | |
| 73 95% Hall's Bootstrap UCL 1160 95% Percentile Bootstrap UCL 1161 74 90% Chebyshev(Mean, Sd) UCL 1214 95% Chebyshev(Mean, Sd) UCL 1265 75 97.5% Chebyshev(Mean, Sd) UCL 1335 99% Chebyshev(Mean, Sd) UCL 1473 76 77 Suggested UCL to Use 78 95% Student's-t UCL 1170 79 80 Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. 81 Recommendations are based upon data size, data distribution, and skewness using results from simulation studies. | | | | |
| 90% Chebyshev(Mean, Sd) UCL 1214 95% Chebyshev(Mean, Sd) UCL 1265 97.5% Chebyshev(Mean, Sd) UCL 1335 99% Chebyshev(Mean, Sd) UCL 1473 76 Suggested UCL to Use 95% Student's-t UCL 1170 Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. Recommendations are based upon data size, data distribution, and skewness using results from simulation studies. | 73 | | | |
| Suggested UCL to Use Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. Recommendations are based upon data size, data distribution, and skewness using results from simulation studies. | 74 | 90% Chebyshev(Mean, Sd) U | ICL 1214 | 95% Chebyshev(Mean, Sd) UCL 1265 |
| Suggested UCL to Use 95% Student's-t UCL 1170 Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. Recommendations are based upon data size, data distribution, and skewness using results from simulation studies. | | 97.5% Chebyshev(Mean, Sd) U | ICL 1335 | 99% Chebyshev(Mean, Sd) UCL 1473 |
| 95% Student's-t UCL 1170 79 80 Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. 81 Recommendations are based upon data size, data distribution, and skewness using results from simulation studies. | 77 | | Sugaeste | d UCL to Use |
| Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. Recommendations are based upon data size, data distribution, and skewness using results from simulation studies. | | 95% Student's-t U | | |
| 81 Recommendations are based upon data size, data distribution, and skewness using results from simulation studies. | | Note: Suggestions regarding the solection of a | 95% LICL ara | provided to help the user to select the most appropriate 05% LICI |
| | 81 | | | |
| | 82 | | | |

| | Α | В | С | D | E | F | G | Н | | J | K | L |
|----|---|-----------|--------------|--------------|---------------|--------------|--------------|----------------|--------------|-------------|------------|---|
| 83 | | | | | | | | | | | | |
| 84 | | Note: For | highly negat | ively-skewed | d data, confi | dence limits | (e.g., Chen, | Johnson, Lo | ognormal, an | id Gamma) r | nay not be | |
| 85 | | | reliable. (| Chen's and J | lohnson's me | ethods provi | de adjustme | nts for posity | vely skewed | data sets. | | |
| 86 | | | | | | | | | | | | |
| | | | | | | | | | | | | |

| 1 | Α | В | С | D | E LICL Statis | F | G | H Data Sata | I | J | K | L |
|----------|---------|----------------|------------------------------|-----------------------------------|--------------------------------|-----------------------|---------------------------------------|-------------------------------|-------------------------|--|-------------------------------------|----------------|
| 2 | | | | | OUL Statis | SUCS TOF UNC | ensored Full D | Jata Sets | | | | |
| 3 | Do | | ected Options Computation | ProUCL 5.2 | 10/28/2024 : | 8·50·02 DM | | | | | | |
| 5 | Da | | From File | ProUCL Inpu | | 5.30.02 F IVI | | | | | | |
| 6 7 | | | ull Precision Coefficient | OFF 95% | | | | | | | | |
| 8 | Number | | Operations | 2000 | | | | | | | | |
| 9 | | | | | | | | | | | | |
| 11 | UUMM-WF | RA-0.5-2 | | | | | | | | | | |
| 12 13 | | | | | | General | Statistics | | | | | |
| 14 | | | Total | Number of Ol | bservations | 10 | | | | | Observations | 10 |
| 15 16 | | | | | Minimum | 1447 | | | Numbe | er of Missing | Observations Mean | |
| 17 18 | | | | | Maximum | 3092 | | | | 0.1 | Median | 2062 |
| 19 | | | | Coefficient | SD of Variation | | | | | Std. | Error of Mean Skewness | 176.9 0.549 |
| 20 | | | | | | | | | | | | |
| 21 22 | | | S | Shapiro Wilk Te | est Statistic | Normal 0 0.912 | GOF Test | | Shapiro W | ilk GOF Te | st | |
| 23 | | | | hapiro Wilk Cr | ritical Value | 0.781 | | | ar Normal | at 1% Signif | icance Level | |
| 24 25 | | | 1 | % Lilliefors Cr | est Statistic | 0.224 0.304 | | Data appe | | GOF Test at 1% Signif | icance Level | |
| 26 | | | <u>'</u> | | | | 1% Significar | nce Level | | o organi | | |
| 27 28 | | | | | As | sumina Nori | mal Distributio | | | | | |
| 29 | | | 95% No | ormal UCL | | | | 95% | | usted for SI | | 0.405 |
| 30 31 | | | | 95% Stud | lent's-t UCL | 2435 | | 9 | 95% Adjust 95% Modif | ea-CLT UC ied-t UCL (.) | L (Chen-1995) Iohnson-1978) | 2435 2440 |
| 32 | | | | | | | 2055 | | | | | |
| 34 | | | | A-D To | est Statistic | Gamma 0.4 | GOF Test | Anders | son-Darling | g Gamma G | OF Test | |
| 35 | | | | 5% A-D Cr | ritical Value | 0.725 | Detected (| data appear | r Gamma D | Distributed a | t 5% Significan | ce Level |
| 36 37 | | | | | est Statistic ritical Value | 0.193 0.266 | Detected (| | | ov Gamma | GOF Test t 5% Significan | ice I evel |
| 38 | | | | | | | stributed at 59 | | | TOUT DUCCU U | t o 70 o igriiiloan | |
| 39 40 | | | | | | Gamma | Statistics | | | | | |
| 41 | | | | | k hat (MLE) | 16.33 | | | | | orrected MLE) | 11.5 |
| 42 43 | | | | | a hat (MLE) u hat (MLE) | | | orrected MLE) bias corrected) | | | | |
| 44 | | | М | LE Mean (bias | | | | | | MLE Sd (b | oias corrected) | 622.5 |
| 45 46 | | | Adius | sted Level of S | Significance | 0.0267 | | | Approximat A | e Chi Squar diusted Chi | e Value (0.05) Square Value | 195.9 190.4 |
| 47 | | | , rajut | 200 20101010 | | | | | • | iajaotoa om | Oquaio vaiao | |
| 48 49 | | | 95% A | pproximate G | | | ma Distributio | <u>nc</u> | 9! | 5% Adjusted | d Gamma UCL | 2550 |
| 50 | | | 00707 | | | | | | | 70710 0000 | | |
| 51 52 | | | 5 | Shapiro Wilk Te | est Statistic | Lognorma 0.927 | GOF Test | Shan | iro Wilk Lo | gnormal G0 | OF Test | |
| 53 | | | | hapiro Wilk Cr | ritical Value | 0.869 | D | ata appear | Lognormal | at 10% Sig | nificance Leve | ĺ |
| 54 55 | | | 10 | Lilliefors Te 1% Lilliefors Cr | est Statistic | 0.177 0.241 | D | | | ormal GOF at 10% Sig | Test nificance Leve | |
| 56 57 | | | | | | | at 10% Signific | | | | | |
| 58 | | | | | | Lognorma | l Statistics | | | | | |
| 59 60 | | | | Minimum of Lo | | 7.277 | | | | | of logged Data | 7.624 |
| 61 | | | <u>r</u> | Maximum of Lo | ogged Data | 8.037 | | | | SD | of logged Data | 0.261 |
| 62 63 | | | | | | | rmal Distribut | tion | 0001 | Obstant | . /M// / IE\ ! ! O' | 2020 |
| 63 64 | | | 95% | Chebyshev (M | 95% H-UCL MVUE) UCL | | | | | | <u>/ (MVUE) UCL</u> / (MVUE) UCL | 2636 3204 |
| 65 | | | | Chebyshev (M | | | | | 3.1070 | , | | |
| 66 67 | | | | | Nonparame | etric Distribu | tion Free UCL | Statistics | | | | |
| 68 69 | | | | | | | Discernible D | | | | | |
| 70 | | | | | Nonpa | rametric Dis | tribution Free | UCLs | | | | |
| 71 72 | | | 050 | | % CLT UCL | 2402 | | | | | Bootstrap UCL | |
| 73 | | | | Standard Boo 95% Hall's Boo | | | | | 95% | | ootstrap-t UCL Bootstrap UCL | |
| 74 75 | | | 90% Ch | nebyshev(Mea | ın, Sd) UCL | 2642 | | | 95% C | hebyshev(M | lean, Sd) UCL | 2882 |
| 76 | | | 97.5% Ch | nebyshev(Mea | ın, Sd) UCL | 3216 | | | 99% C | nebyshev(N | lean, Sd) UCL | 3871 |
| 77 78 | | | | 050/ 0: : | ontic t LIO | | UCL to Use | | | | | |
| 79 | | | | 95% Stud | lent's-t UCL | 2435 | | | | | | |
| 80 | | | | | | | | | | | oriate 95% UCL | |
| 81 82 | H | | | | | | ution, and skever ts: for addition | | | | n studies. nsult a statistic | an. |
| | | 5770701, 3IIII | | vv 1101 COVE | or un rical W | ona aata se | , ioi additioni | ar maignit till | o door may | ************************************** | iouri a sidiisilo | G11. |

| 1 | A B C D E | F | G H I J K L censored Full Data Sets |
|----------|---|----------------------|--|
| 2 | - OCE GENERAL | ilica ioi oilic | censored i un pata cets |
| 3 | User Selected Options | 0.E0.44 DN4 | |
| 5 | Date/Time of Computation ProUCL 5.2 10/28/2024 8 From File ProUCL Input.xls | 3:52:14 PIVI | |
| 6 | Full Precision OFF | | |
| 7 | Confidence Coefficient 95% | | |
| 9 | Number of Bootstrap Operations 2000 | | |
| 10 | | | |
| 11 | UUMM-WRA-0.5-3 | | |
| 12 | | Canaral | I Ctatistics |
| 14 | Total Number of Observations | 10 | Statistics Number of Distinct Observations 10 |
| 15 | | | Number of Missing Observations 0 |
| 16 17 | Minimum | 1382 | Mean 1584 |
| 18 | Maximum SD | 1937 194.9 | Median 1524 Std. Error of Mean 61.64 |
| 19 | Coefficient of Variation | 0.123 | Skewness 0.697 |
| 20 21 | | NI I d | 0057 |
| 22 | Shapiro Wilk Test Statistic | 0.899 | GOF Test Shapiro Wilk GOF Test |
| 23 | 1% Shapiro Wilk Critical Value | 0.781 | Data appear Normal at 1% Significance Level |
| 24 | Lilliefors Test Statistic | 0.185 | Lilliefors GOF Test |
| 25 26 | 1% Lilliefors Critical Value | 0.304 ar Normal a | Data appear Normal at 1% Significance Level at 1% Significance Level |
| 27 | рака аррек | ai itoiiilai a | at 170 organication beton |
| 28 | | suming Nor | rmal Distribution |
| 29 30 | 95% Normal UCL 95% Student's-t UCL | 1697 | 95% UCLs (Adjusted for Skewness) |
| 31 | 95% Student S-f UCL | וטש/ | 95% Adjusted-CLT UCL (Chen-1995) 1700 95% Modified-t UCL (Johnson-1978) 1699 |
| 32 | | | |
| 33 34 | A.D. Tank Okasilati | | Anderson Porling Commo COE Toot |
| 35 | A-D Test Statistic 5% A-D Critical Value | 0.448 0.724 | Anderson-Darling Gamma GOF Test Detected data appear Gamma Distributed at 5% Significance Level |
| 36 | K-S Test Statistic | 0.187 | Kolmogorov-Smirnov Gamma GOF Test |
| 37 38 | 5% K-S Critical Value | 0.266 | Detected data appear Gamma Distributed at 5% Significance Level Distributed at 5% Significance Level |
| 39 | Detected data appear | чатта И | Distributed at 5% Significance Level |
| 40 | | | a Statistics |
| 41 | k hat (MLE) Theta hat (MLE) | 76.07 20.82 | k star (bias corrected MLE) 53.31 Theta star (bias corrected MLE) 29.71 |
| 43 | nu hat (MLE) | | nu star (bias corrected) 1066 |
| 44 | MLE Mean (bias corrected) | | MLE Sd (bias corrected) 216.9 |
| 45 46 | Adjusted Level of Significance | 0.0267 | Approximate Chi Square Value (0.05) 991.5 Adjusted Chi Square Value 978.9 |
| 47 | Aujusted Level of Significance | 0.0207 | Aujusteu Cili Square value 978.9 |
| 48 | | | mma Distribution |
| 49 50 | 95% Approximate Gamma UCL | 1/03 | 95% Adjusted Gamma UCL 1725 |
| 51 | | Lognorma | al GOF Test |
| 52 | Shapiro Wilk Test Statistic | 0.907 | Shapiro Wilk Lognormal GOF Test |
| 53 54 | 10% Shapiro Wilk Critical Value Lilliefors Test Statistic | 0.869 0.175 | Data appear Lognormal at 10% Significance Level Lilliefors Lognormal GOF Test |
| 55 | 10% Lilliefors Critical Value | 0.175 | Data appear Lognormal at 10% Significance Level |
| 56 | | | at 10% Significance Level |
| 57 58 | | Lognorma | al Statistics |
| 59 | Minimum of Logged Data | 7.231 | Mean of logged Data 7.361 |
| 60 | Maximum of Logged Data | 7.569 | SD of logged Data 0.12 |
| 61 62 | Ass | ımina Loana | normal Distribution |
| 63 | 95% H-UCL | 1704 | 90% Chebyshev (MVUE) UCL 1764 |
| 64 | 95% Chebyshev (MVUE) UCL | 1846 | 97.5% Chebyshev (MVUE) UCL 1959 |
| 65 66 | 99% Chebyshev (MVUE) UCL | 2182 | |
| 67 | Nonparame | tric Distribu | ution Free UCL Statistics |
| 68 | | | a Discernible Distribution |
| 69 70 | Manna | ametric Di- | stribution Fron LICLs |
| 71 | Nonpar 95% CLT UCL | | stribution Free UCLs 95% BCA Bootstrap UCL 1698 |
| 72 | 95% Standard Bootstrap UCL | 1682 | 95% Bootstrap-t UCL 1718 |
| 73 74 | 95% Hall's Bootstrap UCL | 1686 | 95% Percentile Bootstrap UCL 1685 |
| 74 75 | 90% Chebyshev(Mean, Sd) UCL 97.5% Chebyshev(Mean, Sd) UCL | 1769 1969 | 95% Chebyshev(Mean, Sd) UCL 1852 99% Chebyshev(Mean, Sd) UCL 2197 |
| 76 | or.on onedyshov(mean, od) ode | | |
| 77 78 | 050/ 0: 1 11 1101 | | d UCL to Use |
| 78 79 | 95% Student's-t UCL | 1697 | |
| 80 | | | provided to help the user to select the most appropriate 95% UCL. |
| 81 82 | | | bution, and skewness using results from simulation studies. |
| OΖ | However, simulations results will not cover all Real W | oria data se | ets; for additional insight the user may want to consult a statistician. |

| 4 | A B C D E | F | G H I J K | L | | | | | | | | | |
|----------|---|----------------|---|----------------|--|--|--|--|--|--|--|--|--|
| 2 | UCL Statis | stics for Unc | ensored Full Data Sets | | | | | | | | | | |
| 3 | User Selected Options | | | | | | | | | | | | |
| 4 5 | Date/Time of Computation ProUCL 5.2 10/28/2024 8 From File ProUCL Input.xls | 8:55:20 PM | | | | | | | | | | | |
| 6 | Full Precision OFF | | | | | | | | | | | | |
| 7 | Confidence Coefficient 95% | | | | | | | | | | | | |
| 9 | Number of Bootstrap Operations 2000 | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | | |
| 12 | UUMM-WRA-0.5-3-DS | | | | | | | | | | | | |
| 13 | | General | Statistics | | | | | | | | | | |
| 14 15 | Total Number of Observations | 4 | Number of Distinct Observations Number of Missing Observations | 0 | | | | | | | | | |
| 16 | Minimum | 19 | Mean | 24.25 | | | | | | | | | |
| 17 18 | Maximum | | Median | 21.5 | | | | | | | | | |
| 19 | SD Coefficient of Variation | 7.274 0.3 | Std. Error of Mean Skewness | 3.637 1.822 | | | | | | | | | |
| 20 | | , | | | | | | | | | | | |
| 21 22 | Note: Sample size is small (e.g., <10), if data a | are collected | using incremental sampling methodology (ISM) approach, C 2020 and ITRC 2012) for additional guidance, | | | | | | | | | | |
| 23 | | | he Chebyshev UCL for small sample sizes (n < 7). | | | | | | | | | | |
| 24 25 | | | in gross overestimates of the mean. | | | | | | | | | | |
| 26 | Refer to the ProUCL 5.2 Tec | innical Guid | e for a discussion of the Chebyshev UCL. | | | | | | | | | | |
| 27 | | | GOF Test | | | | | | | | | | |
| 28 29 | Shapiro Wilk Test Statistic 1% Shapiro Wilk Critical Value | | Shapiro Wilk GOF Test Data appear Normal at 1% Significance Level | | | | | | | | | | |
| 30 | 1% Snapiro Wilk Critical Value Lilliefors Test Statistic | | Lilliefors GOF Test | | | | | | | | | | |
| 31 | 1% Lilliefors Critical Value | 0.413 | Data appear Normal at 1% Significance Level | | | | | | | | | | |
| 32 33 | | | t 1% Significance Level Bliable for small sample sizes | | | | | | | | | | |
| 34 | | | | | | | | | | | | | |
| 35 36 | Assuming Normal Distribution | | | | | | | | | | | | |
| 37 | 95% Normal UCL 95% Student's-t UCL | 32.81 | 95% UCLs (Adjusted for Skewness) 95% Adjusted-CLT UCL (Chen-1995) | 33.77 | | | | | | | | | |
| 38 | 5575 Stateshie 1 60E | | 95% Modified-t UCL (Johnson-1978) | 33.36 | | | | | | | | | |
| 39 40 | | Gammo | GOF Test | | | | | | | | | | |
| 41 | A-D Test Statistic | 0.555 | Anderson-Darling Gamma GOF Test | | | | | | | | | | |
| 42 | 5% A-D Critical Value | 0.657 | Detected data appear Gamma Distributed at 5% Significance | Level | | | | | | | | | |
| 43 44 | K-S Test Statistic 5% K-S Critical Value | | Kolmogorov-Smirnov Gamma GOF Test Detected data appear Gamma Distributed at 5% Significance | ı l evel | | | | | | | | | |
| 45 | Detected data appear | r Gamma Di | stributed at 5% Significance Level | , ECACI | | | | | | | | | |
| 46 47 | Note GOF tests | may be unre | eliable for small sample sizes | | | | | | | | | | |
| 48 | | Gamma | Statistics | | | | | | | | | | |
| 49 | k hat (MLE) | 17.07 | k star (bias corrected MLE) | 4.434 | | | | | | | | | |
| 50 51 | Theta hat (MLE) nu hat (MLE) | | Theta star (bias corrected MLE) nu star (bias corrected) | 5.469 35.47 | | | | | | | | | |
| 52 | MLE Mean (bias corrected) | 24.25 | MLE Sd (bias corrected) | 11.52 | | | | | | | | | |
| 53 | | | Approximate Chi Square Value (0.05) | 22.84 | | | | | | | | | |
| 54 55 | Adjusted Level of Significance | N/A | Adjusted Chi Square Value | N/A | | | | | | | | | |
| 56 | | | ma Distribution | | | | | | | | | | |
| 57 58 | 95% Approximate Gamma UCL | | 95% Adjusted Gamma UCL | N/A | | | | | | | | | |
| 59 | | Lognorma | GOF Test | | | | | | | | | | |
| 60 | Shapiro Wilk Test Statistic | 0.828 | Shapiro Wilk Lognormal GOF Test | | | | | | | | | | |
| 61 62 | 10% Shapiro Wilk Critical Value Lilliefors Test Statistic | | Data appear Lognormal at 10% Significance Level Lilliefors Lognormal GOF Test | | | | | | | | | | |
| 63 | 10% Lilliefors Critical Value | | Data Not Lognormal at 10% Significance Level | | | | | | | | | | |
| 64 | Data appear Approx | ximate Logn | ormal at 10% Significance Level | | | | | | | | | | |
| 65 66 | Note GOF tests | may be unre | eliable for small sample sizes | | | | | | | | | | |
| 67 | | | l Statistics | | | | | | | | | | |
| 68 69 | Minimum of Logged Data | 2.944 | Mean of logged Data | 3.159 | | | | | | | | | |
| 70 | Maximum of Logged Data | 3.555 | SD of logged Data | 0.271 | | | | | | | | | |
| 71 | | | rmal Distribution | | | | | | | | | | |
| 72 73 | 95% H-UCL | _ | 90% Chebyshev (MVUE) UCL | 33.99 | | | | | | | | | |
| 74 | 95% Chebyshev (MVUE) UCL 99% Chebyshev (MVUE) UCL | 38.43 56.68 | 97.5% Chebyshev (MVUE) UCL | 44.59 | | | | | | | | | |
| 75 | | • | | | | | | | | | | | |
| 76 77 | | | tion Free UCL Statistics | | | | | | | | | | |
| 78 | Data appea | ir to follow a | Discernible Distribution | | | | | | | | | | |
| 79 | | | tribution Free UCLs | | | | | | | | | | |
| 80 81 | 95% CLT UCL | | 95% BCA Bootstrap UCL 95% Bootstrap-t UCL | N/A | | | | | | | | | |
| 82 | 95% Standard Bootstrap UCL 95% Hall's Bootstrap UCL | | 95% Bootstrap-t UCL 95% Percentile Bootstrap UCL | N/A N/A | | | | | | | | | |
| | 55 /6 Hall 5 Doolstrap OCL | 13//3 | 3070 Forcentile Bootstrap OCE | . 1// 1 | | | | | | | | | |

| | Α | В | С | D | E | F | G | Н | I | J | K | L | |
|----|----------------------|--------------|----------------|----------------|---------------|----------------|------------------|----------------|----------------|----------------|------------------|-------|--|
| 83 | | | 90% Ch | ebyshev(Me | an, Sd) UCL | 35.16 | | | 95% Ch | ebyshev(Me | an, Sd) UCL | 40.1 | |
| 84 | | | 97.5% Ch | ebyshev(Me | an, Sd) UCL | 46.96 | | | 99% Ch | ebyshev(Me | an, Sd) UCL | 60.44 | |
| 85 | | | | | | | | | | | | | |
| 86 | Suggested UCL to Use | | | | | | | | | | | | |
| 87 | | | | 95% Stu | dent's-t UCL | 32.81 | | | | | | | |
| 88 | | | | | | • | • | | | | | | |
| 89 | 1 | Note: Sugges | stions regard | ing the selec | tion of a 95% | UCL are pr | ovided to hel | p the user to | select the m | nost appropria | ate 95% UCL | | |
| 90 | | Recom | mendations | are based up | on data size | , data distrib | ution, and sk | ewness usin | g results from | m simulation | studies. | | |
| 91 | Но | wever, simul | lations result | s will not cov | er all Real W | orld data se | ts; for addition | nal insight th | ne user may | want to cons | ult a statistici | an. | |
| 92 | | | | | | | | | | | | | |

| 1 | A B C D E | F tics for Unc | G H I J K L censored Full Data Sets |
|----------|---|----------------------|---|
| 2 | | 101 0110 | cerisored i dii bata oets |
| 3 | User Selected Options | 0.E0.00 DN4 | |
| 5 | Date/Time of Computation ProUCL 5.2 10/28/2024 8 From File ProUCL Input.xls | 3:58:28 PIVI | |
| 6 | Full Precision OFF | | |
| 7 | Confidence Coefficient 95% | | |
| 9 | Number of Bootstrap Operations 2000 | | |
| 10 | | | |
| | UUMM-WRB-0.5-1 | | |
| 12 13 | | General | Il Statistics |
| 14 | Total Number of Observations | 10 | Number of Distinct Observations 10 |
| 15 16 | | 00 | Number of Missing Observations 0 |
| 17 | Minimum Maximum | 96 202 | Mean 137.8 Median 129 |
| 18 | SD | 37.42 | Std. Error of Mean 11.83 |
| 19 20 | Coefficient of Variation | 0.272 | Skewness 0.618 |
| 21 | | Normal (| GOF Test |
| 22 | Shapiro Wilk Test Statistic | 0.908 | Shapiro Wilk GOF Test |
| 23 24 | 1% Shapiro Wilk Critical Value | 0.781 | Data appear Normal at 1% Significance Level |
| 25 | Lilliefors Test Statistic 1% Lilliefors Critical Value | 0.179 0.304 | Lilliefors GOF Test Data appear Normal at 1% Significance Level |
| 26 | | | at 1% Significance Level |
| 27 28 | | | |
| 29 | 95% Normal UCL | suming Nor | rmal Distribution 95% UCLs (Adjusted for Skewness) |
| 30 | 95% Student's-t UCL | 159.5 | 95% Adjusted-CLT UCL (Chen-1995) 159.7 |
| 31 32 | | | 95% Modified-t UCL (Johnson-1978) 159.9 |
| 33 | | Gamma | a GOF Test |
| 34 | A-D Test Statistic | 0.383 | Anderson-Darling Gamma GOF Test |
| 35 | 5% A-D Critical Value | 0.725 | Detected data appear Gamma Distributed at 5% Significance Level |
| 36 37 | K-S Test Statistic 5% K-S Critical Value | 0.191 0.266 | Kolmogorov-Smirnov Gamma GOF Test Detected data appear Gamma Distributed at 5% Significance Level |
| 38 | Detected data appear | Gamma Di | Distributed at 5% Significance Level |
| 39 40 | | | |
| 40 | k hat (MLE) | <u>Gamma</u> 15.8 | k star (bias corrected MLE) 11.13 |
| 42 | Theta hat (MLE) | 8.721 | Theta star (bias corrected MLE) 12.38 |
| 43 | nu hat (MLE) | | nu star (bias corrected) 222.5 |
| 44 45 | MLE Mean (bias corrected) | 137.8 | MLE Sd (bias corrected) 41.31 Approximate Chi Square Value (0.05) 189 |
| 46 | Adjusted Level of Significance | 0.0267 | Adjusted Chi Square Value 183.6 |
| 47 48 | | | |
| 48 | Ass 95% Approximate Gamma UCL | | mma Distribution 95% Adjusted Gamma UCL 167 |
| 50 | 50% Approximate dumina 60E | | |
| 51 52 | OL- 1 MPH T + C+ + + 1 | | al GOF Test |
| 53 | Shapiro Wilk Test Statistic 10% Shapiro Wilk Critical Value | 0.927 0.869 | Shapiro Wilk Lognormal GOF Test Data appear Lognormal at 10% Significance Level |
| 54 | Lilliefors Test Statistic | 0.178 | Lilliefors Lognormal GOF Test |
| 55 56 | 10% Lilliefors Critical Value | 0.241 | Data appear Lognormal at 10% Significance Level |
| 57 | Data appear I | <u>Lognormal</u> : | at 10% Significance Level |
| 58 | | | nal Statistics |
| 59 60 | Minimum of Logged Data | 4.564 | Mean of logged Data 4.894 |
| 61 | Maximum of Logged Data | 5.308 | SD of logged Data 0.264 |
| 62 | | | normal Distribution |
| 63 64 | 95% H-UCL | 164 | 90% Chebyshev (MVUE) UCL 172.4 |
| 65 | 95% Chebyshev (MVUE) UCL 99% Chebyshev (MVUE) UCL | 188.1 252.8 | 97.5% Chebyshev (MVUE) UCL 209.9 |
| 66 | | | |
| 67 68 | | | ution Free UCL Statistics a Discernible Distribution |
| 69 | | i to follow a | |
| 70 | | | stribution Free UCLs |
| 71 72 | 95% CLT UCL 95% Standard Bootstrap UCL | 157.3 156.7 | 95% BCA Bootstrap UCL 159.1 95% Bootstrap-t UCL 164.5 |
| 73 | 95% Standard Bootstrap UCL 95% Hall's Bootstrap UCL | 156.7 | 95% Bootstrap-t UCL 164.5 95% Percentile Bootstrap UCL 157.1 |
| 74 | 90% Chebyshev(Mean, Sd) UCL | 173.3 | 95% Chebyshev(Mean, Sd) UCL 189.4 |
| 75 76 | 97.5% Chebyshev(Mean, Sd) UCL | 211.7 | 99% Chebyshev(Mean, Sd) UCL 255.6 |
| 77 | | Suggested | d UCL to Use |
| 78 | 95% Student's-t UCL | 159.5 | |
| 79 80 | Note: Cugastions regarding the calculation of a 05% | LICI are re- | provided to help the upprite acless the most energy into 050/ LIO |
| 81 | | | provided to help the user to select the most appropriate 95% UCL. bution, and skewness using results from simulation studies. |
| 82 | | | ets; for additional insight the user may want to consult a statistician. |
| | | | |

| 1 | A B C D E | F | G H I J K | L |
|----------|---|----------------|--|---------------|
| 2 | UCL Statis | stics for Unc | ensored Full Data Sets | |
| 3 | User Selected Options | 0-00-10 DM | | |
| 5 | Date/Time of Computation ProUCL 5.2 10/28/2024 9 From File ProUCL Input.xls | 9:00:19 PM | | |
| 6 | Full Precision OFF | | | |
| 7 | Confidence Coefficient 95% Number of Bootstrap Operations 2000 | | | |
| 9 | Number of Bootstrap Operations (2000 | | | |
| 10 11 | UUMM-WRC-0.5-1 | | | |
| 12 | OUMINI-VANC-0.3-1 | | | |
| 13 14 | Total Number of Observations | General 4 | Statistics Number of Distinct Observations | 4 |
| 15 | Total Indiliber of Observations | 4 | Number of Missing Observations | 0 |
| 16 17 | Minimum | 16 20 | Mean | 17.75 17.5 |
| 18 | Maximum SD | 1.708 | Median Std. Error of Mean | 0.854 |
| 19 | Coefficient of Variation | 0.0962 | Skewness | 0.753 |
| 20 21 | Note: Sample size is small (e.g., <10), if data a | are collected | using incremental sampling methodology (ISM) approach, | |
| 22 | refer also to ITRC Tech Reg Guide | on ISM (ITR | C 2020 and ITRC 2012) for additional guidance, | |
| 23 24 | | | he Chebyshev UCL for small sample sizes (n < 7). in gross overestimates of the mean. | |
| 25 | | | e for a discussion of the Chebyshev UCL. | |
| 26 27 | | Normal | POE Toot | |
| 28 | Shapiro Wilk Test Statistic | | GOF Test Shapiro Wilk GOF Test | |
| 29 30 | 1% Shapiro Wilk Critical Value | | Data appear Normal at 1% Significance Level | |
| 31 | Lilliefors Test Statistic 1% Lilliefors Critical Value | | Lilliefors GOF Test Data appear Normal at 1% Significance Level | |
| 32 | Data appe | ar Normal at | 1% Significance Level | |
| 33 34 | Note GOF tests | may be unre | eliable for small sample sizes | |
| 35 | | suming Nor | mal Distribution | |
| 36 37 | 95% Normal UCL 95% Student's-t UCL | 19.76 | 95% UCLs (Adjusted for Skewness) 95% Adjusted-CLT UCL (Chen-1995) | 10 F |
| 38 | 95% Students-t OCL | 19.76 | 95% Adjusted-CLT OCL (Chen-1995) 95% Modified-t UCL (Johnson-1978) | 19.5 19.81 |
| 39 | | | | |
| 40 41 | A-D Test Statistic | 0.227 | GOF Test Anderson-Darling Gamma GOF Test | |
| 42 | 5% A-D Critical Value | 0.657 | Detected data appear Gamma Distributed at 5% Significance | Level |
| 43 44 | K-S Test Statistic 5% K-S Critical Value | | Kolmogorov-Smirnov Gamma GOF Test Detected data appear Gamma Distributed at 5% Significance | Level |
| 45 | Detected data appear | r Gamma Di | stributed at 5% Significance Level | LCVCI |
| 46 47 | Note GOF tests | may be unre | eliable for small sample sizes | |
| 48 | | Gamma | Statistics | |
| 49 50 | k hat (MLE) | 146.8 | k star (bias corrected MLE) | 36.88 |
| 51 | Theta hat (MLE) nu hat (MLE) | | Theta star (bias corrected MLE) nu star (bias corrected) 2 | 0.481 295 |
| 52 | MLE Mean (bias corrected) | | MLE Sd (bias corrected) | 2.923 |
| 53 54 | Adjusted Level of Significance | N/A | | 256.2 N/A |
| 55 | | ! | | |
| 56 57 | Ase 95% Approximate Gamma UCL | | ma Distribution 95% Adjusted Gamma UCL | N/A |
| 58 | 95 /0 Approximate damina OCL | | | 11// |
| 59 60 | Chanica Wills Took Charlesia | | GOF Test | |
| 61 | Shapiro Wilk Test Statistic 10% Shapiro Wilk Critical Value | | Shapiro Wilk Lognormal GOF Test Data appear Lognormal at 10% Significance Level | |
| 62 63 | Lilliefors Test Statistic | 0.177 | Lilliefors Lognormal GOF Test | |
| 64 | 10% Lilliefors Critical Value Data appear | | Data appear Lognormal at 10% Significance Level at 10% Significance Level | |
| 65 | Note GOF tests | may be unre | eliable for small sample sizes | |
| 66 67 | | Lognorma | I Statistics | |
| 68 | Minimum of Logged Data | 2.773 | Mean of logged Data | 2.873 |
| 69 70 | Maximum of Logged Data | 2.996 | SD of logged Data | 0.0949 |
| 71 | Assı | uming Logno | ormal Distribution | |
| 72 | 95% H-UCL | N/A | 90% Chebyshev (MVUE) UCL | 20.27 |
| 73 74 | 95% Chebyshev (MVUE) UCL 99% Chebyshev (MVUE) UCL | 21.42 26.13 | 97.5% Chebyshev (MVUE) UCL | 23.01 |
| 75 | | • | | |
| 76 77 | | | tion Free UCL Statistics Discernible Distribution | |
| 78 | рака арреа | ii to follow a | | |
| 79 80 | | | tribution Free UCLs | NI/A |
| 81 | 95% CLT UCL 95% Standard Bootstrap UCL | | | N/A N/A |
| 82 | 95% Hall's Bootstrap UCL | | | N/A |

| | Α | В | С | D | E | F | G | Н | I | J | K | L | | |
|----|----|----------------------|----------------|----------------|---------------|----------------|------------------|----------------|----------------|---------------|------------------|-------|--|--|
| 83 | | | 90% Ch | ebyshev(Me | an, Sd) UCL | 20.31 | | | 95% Ch | ebyshev(Me | an, Sd) UCL | 21.47 | | |
| 84 | | | 97.5% Ch | ebyshev(Me | an, Sd) UCL | 23.08 | | | 99% Ch | ebyshev(Me | an, Sd) UCL | 26.25 | | |
| 85 | | | | | | | | | | | | | | |
| 86 | | Suggested UCL to Use | | | | | | | | | | | | |
| 87 | | | | 95% Stu | dent's-t UCL | 19.76 | | | | | | | | |
| 88 | | | | | | • | • | | | | | - | | |
| 89 | ľ | Note: Sugges | stions regard | ing the selec | tion of a 95% | UCL are pr | ovided to hel | p the user to | select the m | ost appropria | ate 95% UCL | | | |
| 90 | | Recom | mendations | are based up | on data size | , data distrib | ution, and sk | ewness usin | g results fror | m simulation | studies. | | | |
| 91 | Но | wever, simul | lations result | s will not cov | er all Real W | orld data se | ts; for addition | nal insight th | ne user may | want to cons | ult a statistici | ian. | | |
| 92 | | | | | | | | | | | | | | |

| | A B C D E | F | G H I J K L | | | | | | | | |
|----------|--|------------------------------|---|--|--|--|--|--|--|--|--|
| 2 | UCL Statis | tics for Unc | ensored Full Data Sets | | | | | | | | |
| 3 | User Selected Options Date/Time of Computation ProUCL 5.2 10/28/2024 9 | 0.00.E0 DM | | | | | | | | | |
| 5 | Date/Time of Computation ProUCL 5.2 10/28/2024 9 From File ProUCL Input.xls | 9:02:59 PIVI | | | | | | | | | |
| 6 7 | Full Precision OFF Confidence Coefficient 95% | | | | | | | | | | |
| 8 | Number of Bootstrap Operations 2000 | | | | | | | | | | |
| 9 | | | | | | | | | | | |
| 11 | UUMM-WRD-0.5-1 | | | | | | | | | | |
| 12 13 | | General | Statistics | | | | | | | | |
| 14 | Total Number of Observations | 4 | Number of Distinct Observations 4 | | | | | | | | |
| 15 16 | Minimum | 269 | Number of Missing Observations 0 Mean 291 | | | | | | | | |
| 17 | Maximum | 334 | Median 280.5 | | | | | | | | |
| 18 19 | SD Coefficient of Variation | 29.2 0.1 | Std. Error of Mean 14.6 Skewness 1.778 | | | | | | | | |
| 20 | | | | | | | | | | | |
| 21 | Note: Sample size is small (e.g., <10), if data a | are collected on ISM (ITR | l using incremental sampling methodology (ISM) approach, C 2020 and ITRC 2012) for additional guidance, | | | | | | | | |
| 23 | but note that ITRC may recommend th | e t-UCL or t | he Chebyshev UCL for small sample sizes (n < 7). | | | | | | | | |
| 24 25 | | | in gross overestimates of the mean. e for a discussion of the Chebyshev UCL. | | | | | | | | |
| 26 | . 10.0. 10 110 1 100 0 10 100 | | • | | | | | | | | |
| 27 28 | Shapiro Wilk Test Statistic | Normal 0 0.798 | GOF Test Shapiro Wilk GOF Test | | | | | | | | |
| 29 30 | 1% Shapiro Wilk Critical Value | 0.687 | Data appear Normal at 1% Significance Level | | | | | | | | |
| 31 | Lilliefors Test Statistic 1% Lilliefors Critical Value | 0.371 0.413 | Lilliefors GOF Test Data appear Normal at 1% Significance Level | | | | | | | | |
| 32 33 | Data appea | ar Normal at | 1% Significance Level | | | | | | | | |
| 34 | Note GOF tests | may be unre | eliable for small sample sizes | | | | | | | | |
| 35 36 | | suming Nor | mal Distribution | | | | | | | | |
| 37 | 95% Normal UCL 95% UCLs (Adjusted for Skewness) 95% Student's-t UCL 325.4 95% Adjusted-CLT UCL (Chen-1995) 328.9 | | | | | | | | | | |
| 38 39 | | | 95% Modified-t UCL (Johnson-1978) 327.5 | | | | | | | | |
| 40 | | Gamma | GOF Test | | | | | | | | |
| 41 42 | A-D Test Statistic 5% A-D Critical Value | 0.571 0.657 | Anderson-Darling Gamma GOF Test | | | | | | | | |
| 43 | K-S Test Statistic | 0.884 | Detected data appear Gamma Distributed at 5% Significance Level Kolmogorov-Smirnov Gamma GOF Test | | | | | | | | |
| 44 45 | 5% K-S Critical Value | 0.394 | Detected data appear Gamma Distributed at 5% Significance Level stributed at 5% Significance Level | | | | | | | | |
| 46 | Note GOF tests | may be unre | eliable for small sample sizes | | | | | | | | |
| 47 48 | | Camma | Statistics | | | | | | | | |
| 49 | k hat (MLE) | 139.8 | k star (bias corrected MLE) 35.12 | | | | | | | | |
| 50 51 | Theta hat (MLE) nu hat (MLE) | 2.081 | Theta star (bias corrected MLE) 8.286 nu star (bias corrected) 281 | | | | | | | | |
| 52 | MLE Mean (bias corrected) | | MLE Sd (bias corrected) 49.1 | | | | | | | | |
| 53 54 | Adjusted Level of Significance | N/A | Approximate Chi Square Value (0.05) 243.1 Adjusted Chi Square Value N/A | | | | | | | | |
| 55 | | | | | | | | | | | |
| 56 57 | Ass 95% Approximate Gamma UCL | | ma Distribution 95% Adjusted Gamma UCL N/A | | | | | | | | |
| 58 | oo /o / ggrozimulo dumina dol. | | | | | | | | | | |
| 59 60 | Shapiro Wilk Test Statistic | Lognorma 0.813 | GOF Test Shapiro Wilk Lognormal GOF Test | | | | | | | | |
| 61 | 10% Shapiro Wilk Critical Value | 0.792 | Data appear Lognormal at 10% Significance Level | | | | | | | | |
| 62 63 | Lilliefors Test Statistic 10% Lilliefors Critical Value | 0.364 0.346 | Lilliefors Lognormal GOF Test Data Not Lognormal at 10% Significance Level | | | | | | | | |
| 64 65 | Data appear Approx | cimate Logn | ormal at 10% Significance Level | | | | | | | | |
| 66 | Note GOF tests | may be unre | eliable for small sample sizes | | | | | | | | |
| 67 68 | | | Statistics | | | | | | | | |
| 69 | Minimum of Logged Data Maximum of Logged Data | <u>5.595</u> 5.811 | Mean of logged Data 5.67 SD of logged Data 0.0964 | | | | | | | | |
| 70 | | | | | | | | | | | |
| 71 72 | Assu 95% H-UCL | <u>ıming Logno</u> N/A | prmal Distribution 90% Chebyshev (MVUE) UCL 333 | | | | | | | | |
| 73 74 | 95% Chebyshev (MVUE) UCL | 352.1 | 97.5% Chebyshev (MVUE) UCL 378.5 | | | | | | | | |
| 75 | 99% Chebyshev (MVUE) UCL | 430.4 | | | | | | | | | |
| 76 77 | | | tion Free UCL Statistics | | | | | | | | |
| 78 | Data appea | r to tollow a | Discernible Distribution | | | | | | | | |
| 79 80 | | | tribution Free UCLs | | | | | | | | |
| 81 | 95% CLT UCL 95% Standard Bootstrap UCL | 315 N/A | 95% BCA Bootstrap UCL N/A 95% Bootstrap-t UCL N/A | | | | | | | | |
| 82 | 95% Hall's Bootstrap UCL | N/A | 95% Percentile Bootstrap UCL N/A | | | | | | | | |

| | Α | В | С | D | E | F | G | Н | | J | K | L | |
|----|----|----------------------|----------------|----------------|---------------|----------------|------------------|----------------|----------------|----------------|-----------------|-------|--|
| 83 | | | 90% Ch | ebyshev(Me | an, Sd) UCL | 334.8 | | | 95% Ch | ebyshev(Me | an, Sd) UCL | 354.6 | |
| 84 | | | 97.5% Ch | ebyshev(Me | an, Sd) UCL | 382.2 | | | 99% Ch | ebyshev(Me | an, Sd) UCL | 436.3 | |
| 85 | | | | | | | | | | | | | |
| 86 | | Suggested UCL to Use | | | | | | | | | | | |
| 87 | | | | 95% Stu | dent's-t UCL | 325.4 | | | | | | | |
| 88 | | | | | | • | • | | | | | | |
| 89 | 1 | Note: Sugges | stions regard | ing the selec | tion of a 95% | UCL are pr | ovided to hel | p the user to | select the m | nost appropria | ate 95% UCL | | |
| 90 | | Recom | mendations | are based up | on data size | , data distrib | ution, and sk | ewness usin | g results fror | m simulation | studies. | | |
| 91 | Но | wever, simul | lations result | s will not cov | er all Real W | orld data se | ts; for addition | nal insight th | ne user may | want to cons | ult a statistic | ian. | |
| 92 | | | | | | | | | | | | | |

| | A B C D E | F | G H I J K | L |
|----------|---|-----------------|--|----------------|
| 2 | UCL Statis | stics for Unc | ensored Full Data Sets | |
| 3 | User Selected Options | 0.04.50.504 | | |
| 4 5 | Date/Time of Computation ProUCL 5.2 10/28/2024 9 From File ProUCL Input.xls | 9:04:56 PM | | |
| 6 | Full Precision OFF | | | |
| 7 | Confidence Coefficient 95% Number of Bootstrap Operations 2000 | | | |
| 9 | Number of Bootstrap Operations 2000 | | | |
| 10 | | | | |
| 12 | UUMM-WRE-0.5-1 | | | |
| 13 | | | Statistics | |
| 14 15 | Total Number of Observations | 4 | | 3 0 |
| 16 | Minimum | 24 | | 24.75 |
| 17 18 | Maximum | | | 24.5 |
| 19 | SD Coefficient of Variation | 0.957 0.0387 | | 0.479 0.855 |
| 20 | | | | |
| 21 | | | l using incremental sampling methodology (ISM) approach, C 2020 and ITRC 2012) for additional guidance, | |
| 23 | | | he Chebyshev UCL for small sample sizes (n < 7). | |
| 24 | The Chebyshev UCL o | ften results | in gross overestimates of the mean. | |
| 25 26 | Refer to the ProUCL 5.2 Tec | ennical Guid | e for a discussion of the Chebyshev UCL. | |
| 27 | | | GOF Test | |
| 28 29 | Shapiro Wilk Test Statistic 1% Shapiro Wilk Critical Value | | Shapiro Wilk GOF Test Data appear Normal at 1% Significance Level | |
| 30 | 1% Snapiro Wilk Critical Value Lilliefors Test Statistic | | Lilliefors GOF Test | |
| 31 | 1% Lilliefors Critical Value | 0.413 | Data appear Normal at 1% Significance Level | |
| 32 33 | | | t 1% Significance Level Bliable for small sample sizes | |
| 34 | | | | |
| 35 36 | | suming Nor | mal Distribution | |
| 36 | 95% Normal UCL 95% Student's-t UCL | 25.88 | 95% UCLs (Adjusted for Skewness) 95% Adjusted-CLT UCL (Chen-1995) 2 | 25.76 |
| 38 | 35% Students-t OCL | _0.00 | | 25.91 |
| 39 40 | | Comme | COE Toot | |
| 41 | A-D Test Statistic | 0.427 | GOF Test Anderson-Darling Gamma GOF Test | —— |
| 42 | 5% A-D Critical Value | 0.657 | Detected data appear Gamma Distributed at 5% Significance L | evel |
| 43 44 | K-S Test Statistic 5% K-S Critical Value | | Kolmogorov-Smirnov Gamma GOF Test Detected data appear Gamma Distributed at 5% Significance L. | evel |
| 45 | Detected data appear | r Gamma Di | stributed at 5% Significance Level | U V U I |
| 46 47 | Note GOF tests | may be unre | eliable for small sample sizes | |
| 48 | | Gamma | Statistics | —— |
| 49 | k hat (MLE) | 900.3 | k star (bias corrected MLE) 22 | 25.2 |
| 50 51 | Theta hat (MLE) nu hat (MLE) | | Theta star (bias corrected MLE) (nu star (bias corrected) 186 | 0.11 |
| 52 | MLE Mean (bias corrected) | | MLE Sd (bias corrected) | 02 1.649 |
| 53 | | | Approximate Chi Square Value (0.05) 170 | 04 |
| 54 55 | Adjusted Level of Significance | N/A | Adjusted Chi Square Value N | /A |
| 56 | | | ma Distribution | |
| 57 58 | 95% Approximate Gamma UCL | | | /A |
| 59 | | Lognorma | GOF Test | |
| 60 | Shapiro Wilk Test Statistic | 0.865 | Shapiro Wilk Lognormal GOF Test | |
| 61 62 | 10% Shapiro Wilk Critical Value Lilliefors Test Statistic | | Data appear Lognormal at 10% Significance Level Lilliefors Lognormal GOF Test | |
| 63 | 10% Lilliefors Critical Value | | Data appear Lognormal at 10% Significance Level | |
| 64 | Data appear | Lognormal a | at 10% Significance Level | |
| 65 66 | Note GOF tests | may be unre | eliable for small sample sizes | |
| 67 | | Lognorma | I Statistics | |
| 68 69 | Minimum of Logged Data | 3.178 | Mean of logged Data | 3.208 |
| 70 | Maximum of Logged Data | 3.258 | SD of logged Data 0 | 0.0384 |
| 71 | Assı | uming Logno | rmal Distribution | |
| 72 73 | 95% H-UCL | | | 26.17 |
| 74 | 95% Chebyshev (MVUE) UCL 99% Chebyshev (MVUE) UCL | 26.82 29.48 | 97.5% Chebyshev (MVUE) UCL 2 | 27.72 |
| 75 | | • | | |
| 76 77 | | | tion Free UCL Statistics | |
| 78 | | ir to follow a | Discernible Distribution | |
| 79 | | | tribution Free UCLs | |
| 80 81 | 95% CLT UCL | | | /A |
| 82 | 95% Standard Bootstrap UCL 95% Hall's Bootstrap UCL | N/A N/A | | /A /A |
| | 30 /0 Fidil 3 Doolottap OOL | 13//3 | , CO 70 1 Greening Douglap COL N | ··· |

| | Α | В | С | D | E | F | G | Н | | J | K | L | | |
|----|--|-------------|----------------|----------------|---------------|--------------|----------------------------------|----------------|-------------|--------------|-----------------|-------|--|--|
| 83 | | | 90% Ch | ebyshev(Me | an, Sd) UCL | 26.19 | 95% Chebyshev(Mean, Sd) UCL 26.8 | | | | | | | |
| 84 | | | 97.5% Ch | ebyshev(Me | an, Sd) UCL | 27.74 | | | 99% Ch | ebyshev(Me | an, Sd) UCL | 29.51 | | |
| 85 | | | | | | | | | | | | | | |
| 86 | | | | | | Suggested | UCL to Use | | | | | | | |
| 87 | | | | | | | | | | | | | | |
| 88 | | | | | | | • | | | | | | | |
| 89 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. | | | | | | | | | | | | | |
| 90 | Recommendations are based upon data size, data distribution, and skewness using results from simulation studies. | | | | | | | | | | | | | |
| 91 | Но | wever, simu | lations result | s will not cov | er all Real W | orld data se | ts; for additio | nal insight th | ne user may | want to cons | ult a statistic | ian. | | |
| 92 | | | | | | | | | | | | | | |

| 1 | Α | В | С | D | E E | F | G | H | I | J | K | L |
|----------|----------|---|--------------------------|--|---------------------------------|--------------------------|--------------------------------------|----------------|-------------------------|--|--|----------------|
| 2 | | | | | UCL Statis | Stics for Unc | ensored Full D | Jata Sets | | | | |
| 3 | Date | | cted Options omputation | ProUCL 5.2 | 10/28/2024 (| 0.00.10 DM | | | | | | |
| 5 | Date | | From File | ProUCL Inpu | | 9.09.19 F W | | | | | | |
| 6 7 | | | Il Precision Coefficient | OFF 95% | | | | | | | | |
| 8 | | | Operations | 2000 | | | | | | | | |
| 9 | | | | | | | | | | | | |
| 11 | UUMM-WRF | - -0.5-1 | | | | | | | | | | |
| 12 13 | | | | | | General | Statistics | | | | | |
| 14 | | | Total | Number of O | bservations | 10 | | | | | Observations | 10 |
| 15 16 | | | | | Minimum | 290 | | | Numbe | r of Missing | Observations Mean | 0 509.4 |
| 17 | | | | | Maximum | 786 | | | | | Median | 501 |
| 18 19 | | | | Coefficient | SD of Variation | 140.5 0.276 | | | | Std. | Error of Mean Skewness | 44.42 0.491 |
| 20 | | | | | or variation | | | | | | CROWNOOD | |
| 21 22 | | | S | Shapiro Wilk T | est Statistic | Normal 0 0.98 | GOF Test | 5 | Shaniro W | ilk GOF Tes | et | |
| 23 | | | | hapiro Wilk C | ritical Value | 0.781 | | | r Normal a | at 1% Signifi | cance Level | |
| 24 25 | | | 1 | Lilliefors T % Lilliefors C | est Statistic | 0.136 0.304 | | Data annea | | GOF Test | cance Level | |
| 26 | | | | Limololo O | | | t 1% Significan | | | 170 Olgilill | 231100 20101 | |
| 27 28 | | | | | Δο | sumina Nor | mal Distribution | | | | | |
| 29 | | | 95% No | ormal UCL | | | | 95% U | | usted for Sk | | |
| 30 31 | | | | 95% Stuc | dent's-t UCL | 590.8 | | 95 9 | 5% Adjuste 5% Modifi | ed-CLT UCL ed-t UCL (.)(| (Chen-1995) ohnson-1978) | 589.8 592 |
| 32 | | | | | | | | | | | | |
| 33 34 | | | | A-D T | est Statistic | Gamma 0.143 | GOF Test | Anderso | on-Darling | Gamma G | OF Test | |
| 35 | | | | 5% A-D C | ritical Value | 0.725 | Detected of | data appear (| Gamma D | istributed at | 5% Significan | ce Level |
| 36 37 | | | | | est Statistic critical Value | 0.106 0.266 | Detected (| | | ov Gamma of the contract of th | GOF Test ∶5% Significan | ce l evel |
| 38 | | | | | | | stributed at 5% | | | iotributou ut | o 70 Olgriiiloari | 50 20 701 |
| 39 40 | | | | | | Gamma | Statistics | | | | | |
| 41 | | | | | k hat (MLE) | 14.5 | | | | | orrected MLE) | 10.22 |
| 42 43 | | | | | ta hat (MLE) nu hat (MLE) | 35.13 290 | | | Theta | | orrected MLE) ias corrected) | 49.86 204.3 |
| 44 | | | MI | LE Mean (bia: | | | | | | MLE Sd (b | ias corrected) | 159.4 |
| 45 46 | | | Adius | sted Level of S | Significance | 0.0267 | | Ar | pproximate A | e Chi Square diusted Chi | e Value (0.05) Square Value | 172.3 167.1 |
| 47 | | | 7.0,00 | | | | | | | <u> </u> | | |
| 48 49 | | | 95% A | pproximate G | | | ma Distributio | n | 95 | 5% Adjusted | Gamma UCL | 622.8 |
| 50 | | | | | | | | | | | | |
| 51 52 | | | S | Shapiro Wilk T | est Statistic | Lognorma 0.988 | I GOF Test | Shapir | o Wilk Loc | gnormal GO | F Test | |
| 53 | | | | hapiro Wilk C | ritical Value | 0.869 | D: | ata appear L | ognormal | at 10% Sign | nificance Level | |
| 54 55 | | | 10 | <u>Lilliefors 1</u> 1% Lilliefors C | est Statistic critical Value | 0.116 0.241 | D | | | ormal GOF at 10% Sign | Test nificance Level | |
| 56 57 | | | | | | | at 10% Signific | | | | | |
| 58 | | | | | | Lognorma | I Statistics | | | | | |
| 59 60 | | | | Minimum of L | | 5.67 | | | | | of logged Data | 6.198 |
| 61 | | | <u>N</u> | Maximum of L | .ogged Data | 6.667 | | | | SD o | of logged Data | 0.282 |
| 62 63 | | | | | | | rmal Distributi | ion | 0001 | Oh alassa | /M/// IE/ : : 0: 1 | 640.0 |
| 64 | | | 95% | Chebyshev (N | 95% H-UCL MVUE) UCL | | | | | | (MVUE) UCL (MVUE) UCL | 646.8 795.1 |
| 65 | | | | Chebyshev (M | | 964.3 | | | | , | , | |
| 66 67 | | | | | Nonparame | etric Distribu | tion Free UCL | . Statistics | | | | |
| 68 69 | | | | | | | Discernible Di | | | | | |
| 70 | | | | | Nonpai | rametric Dis | tribution Free I | UCLs | | | | |
| 71 72 | | | 0501 | | % CLT UCL | 582.5 | | | | | Bootstrap UCL | 589.2 |
| 73 | | | | Standard Boo 95% Hall's Boo | | 579.6 612.7 | | | 95% | | ootstrap-t UCL Bootstrap UCL | 602.8 580.1 |
| 74 75 | | | 90% Ch | nebyshev(Mea | an, Sd) UCL | 642.6 | | | 95% Cl | nebyshev(M | ean, Sd) UCL | 703 |
| 76 | | | 97.5% Ch | nebyshev(Mea | an, Sd) UCL | 786.8 | | | 99% Cl | nebyshev(M | ean, Sd) UCL | 951.3 |
| 77 78 | | | | 0E0/ 0: | dontie + LO | | UCL to Use | | | | | |
| 79 | | | | 95% Stud | dent's-t UCL | 590.8 | | | | | | |
| 80 | N | | | | | | ovided to help | | | | | |
| 81 82 | Hov | | | | | | ution, and skev ts; for additiona | | | | | an. |
| | 1100 | .,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,, | nanono result | www. 110t COV | or un rical W | ona aata se | , ioi additione | ar molynt tile | acci illay | Traint to COII | יים ביים היים היים היים היים היים היים ה | w11. |

Appendix C

Laboratory Analytical Reports







Don Malkemus Terraphase Engineering Inc. 610 SW Broadway, Suite 405 Portland, OR 97205

Laboratory Results for: Upper Granite Creek Mines

Dear Don.

Enclosed are the results of the sample(s) submitted to our laboratory October 08, 2024 For your reference, these analyses have been assigned our service request number **K2410639**.

Analyses were performed according to our laboratory's NELAP-approved quality assurance program. The test results meet requirements of the current NELAP standards, where applicable, and except as noted in the laboratory case narrative provided. For a specific list of NELAP-accredited analytes, refer to the certifications section at www.alsglobal.com. All results are intended to be considered in their entirety, and ALS Group USA Corp. dba ALS Environmental (ALS) is not responsible for use of less than the complete report. Results apply only to the items submitted to the laboratory for analysis and individual items (samples) analyzed, as listed in the report.

Please contact me if you have any questions. My extension is 3376. You may also contact me via email at Mark.Harris@alsglobal.com.

Respectfully submitted,

noe D. Oak

ALS Group USA, Corp. dba ALS Environmental

Mark Harris

Project Manager



Narrative Documents

ALS Environmental—Kelso Laboratory 1317 South 13th Avenue, Kelso, WA 98626 Phone (360) 577-7222 Fax (360) 425-9096 www.alsglobal.com



Client: Terraphase Engineering Inc. Service Request: K2410639

Project: Upper Granite Creek Mines Date Received: 10/08/2024

Sample Matrix: Soil

CASE NARRATIVE

All analyses were performed consistent with the quality assurance program of ALS Environmental. This report contains analytical results for samples for the Tier II level requested by the client.

Sample Receipt:

Twenty soil samples were received for analysis at ALS Environmental on 10/08/2024. Any discrepancies upon initial sample inspection are annotated on the sample receipt and preservation form included within this report. The samples were stored at minimum in accordance with the analytical method requirements.

Metals:

Method 6020B, 10/22/2024: The Relative Percent Difference (RPD) for the replicate analysis of Total Lead in sample UUMM-WRA-0.5-2 was outside the normal ALS control limits. The variability in the results was attributed to the heterogeneous character of the sample. Standard mixing techniques were used, but were not sufficient for complete homogenization of this sample.

Method 7471B, 10/15/2024: The Relative Percent Difference (RPD) for the replicate analysis of Mercury in sample UMM-WRB-0.5-1 was outside the normal ALS control limits. The variability in the results was attributed to the heterogeneous character of the sample. Standard mixing techniques were used, but were not sufficient for complete homogenization of this sample.

Approved by Mol D. Oak

Date 10/23/2024



SAMPLE DETECTION SUMMARY

This form includes only detections above the reporting levels. For a full listing of sample results, continue to the Sample Results section of this Report.

| CLIENT ID: LMM-WRB-0.5-3-DS | | Lab | ID: K2410 | 639-001 | | | | | | |
|-------------------------------|----------------------|------|-----------|----------|---------|----------------|--|--|--|--|
| Analyte | Results | Flag | MDL | MRL | Units | Method | | | | |
| Arsenic | 29.1 | | 0.05 | 0.41 | mg/Kg | 6020B | | | | |
| Solids, Total | 95.4 | | | | Percent | 160.3 Modified | | | | |
| CLIENT ID: UUMM-WRA-0.5-2 | | | | | | | | | | |
| Analyte | Results | Flag | MDL | MRL | Units | Method | | | | |
| Arsenic | 1940 | | 1.1 | 8.8 | mg/Kg | 6020B | | | | |
| Solids, Total | 95.2 | | | | Percent | 160.3 Modified | | | | |
| CLIENT ID: UUMM-WRF-0.5-1 | | Lab | ID: K2410 | 639-003 | | | | | | |
| Analyte | Results | Flag | MDL | MRL | Units | Method | | | | |
| Arsenic | 715 | | 0.05 | 0.44 | mg/Kg | 6020B | | | | |
| Solids, Total | 95.8 | | | | Percent | 160.3 Modified | | | | |
| CLIENT ID: UUMM-WRD-0.5-1 | | Lab | ID: K2410 | 639-004 | | | | | | |
| Analyte | Results | Flag | MDL | MRL | Units | Method | | | | |
| Arsenic | 269 | | 0.05 | 0.45 | mg/Kg | 6020B | | | | |
| Solids, Total | 96.4 | | | | Percent | 160.3 Modified | | | | |
| CLIENT ID: UUMM-WRA-0.5-3 | Lab ID: K2410639-005 | | | | | | | | | |
| Analyte | Results | Flag | MDL | MRL | Units | Method | | | | |
| Arsenic | 1710 | | 1.1 | 9.1 | mg/Kg | 6020B | | | | |
| Arsenic | 3440 | | 0.6 | 4.9 | mg/Kg | 6020B | | | | |
| Arsenic | 176 | | 0.2 | 1.9 | mg/Kg | 6020B | | | | |
| Lead | 12.6 | | 0.08 | 0.19 | mg/Kg | 6020B | | | | |
| Lead | 340 | | 0.20 | 0.49 | mg/Kg | 6020B | | | | |
| Solids, Total | 94.9 | | | | Percent | 160.3 Modified | | | | |
| CLIENT ID: UUMM-WRA-0.5-3-DUP | | Lab | ID: K2410 | 0639-006 | | | | | | |
| Analyte | Results | Flag | MDL | MRL | Units | Method | | | | |
| Arsenic | 162 | | 0.2 | 2.0 | mg/Kg | 6020B | | | | |
| Arsenic | 1470 | | 1.0 | 8.0 | mg/Kg | 6020B | | | | |
| Arsenic | 3280 | | 0.6 | 5.0 | mg/Kg | 6020B | | | | |
| Lead | 340 | | 0.20 | 0.50 | mg/Kg | 6020B | | | | |
| Lead | 7.14 | | 0.08 | 0.20 | mg/Kg | 6020B | | | | |
| Solids, Total | 94.6 | | | | Percent | 160.3 Modified | | | | |
| CLIENT ID: UUMM-WRA-0.5-3-DS | | Lab | ID: K2410 | 639-007 | | | | | | |
| Analyte | Results | Flag | MDL | MRL | Units | Method | | | | |
| Arsenic | 16.0 | | 0.05 | 0.44 | mg/Kg | 6020B | | | | |
| Solids, Total | 89.4 | | | | Percent | 160.3 Modified | | | | |
| CLIENT ID: UMM-WRB-0.5-2 | | Lab | ID: K2410 | | | | | | | |
| Analyte | Results | Flag | MDL | MRL | Units | Method | | | | |
| Arsenic | 1800 | | 1.0 | 8.2 | mg/Kg | 6020B | | | | |



SAMPLE DETECTION SUMMARY

This form includes only detections above the reporting levels. For a full listing of sample results, continue to the Sample Results section of this Report.

| CLIENT ID: UMM-WRB-0.5-2 | | Lab | ID: K2410 | 0639-008 | | | | | | | | |
|------------------------------|---------|----------------------|-----------|----------|---------|----------------|--|--|--|--|--|--|
| Analyte | Results | Flag | MDL | MRL | Units | Method | | | | | | |
| Solids, Total | 95.4 | | | | Percent | 160.3 Modified | | | | | | |
| CLIENT ID: UMM-WRB-0.5-2-DS | | Lab ID: K2410639-009 | | | | | | | | | | |
| Analyte | Results | Flag | MDL | MRL | Units | Method | | | | | | |
| Arsenic | 79.2 | | 0.05 | 0.45 | mg/Kg | 6020B | | | | | | |
| Solids, Total | 80.9 | | | | Percent | 160.3 Modified | | | | | | |
| CLIENT ID: LMM-WRB-0.5-1 | | Lab | ID: K2410 | 0639-010 | | | | | | | | |
| Analyte | Results | Flag | MDL | MRL | Units | Method | | | | | | |
| Arsenic | 1090 | | 0.05 | 0.42 | mg/Kg | 6020B | | | | | | |
| Solids, Total | 96.1 | | | | Percent | 160.3 Modified | | | | | | |
| CLIENT ID: LMM-WRB-0.5-1-DUP | | Lab | ID: K2410 | 0639-011 | | | | | | | | |
| Analyte | Results | Flag | MDL | MRL | Units | Method | | | | | | |
| Arsenic | 802 | | 0.05 | 0.42 | mg/Kg | 6020B | | | | | | |
| Solids, Total | 96.6 | | | | Percent | 160.3 Modified | | | | | | |
| CLIENT ID: CM-WRC-0.5-4 | | Lab | ID: K2410 | 0639-012 | | | | | | | | |
| Analyte | Results | Flag | MDL | MRL | Units | Method | | | | | | |
| Arsenic | 650 | | 0.6 | 4.9 | mg/Kg | 6020B | | | | | | |
| Arsenic | 292 | | 0.05 | 0.42 | mg/Kg | 6020B | | | | | | |
| Arsenic | 33.1 | | 0.2 | 1.9 | mg/Kg | 6020B | | | | | | |
| Lead | 2.95 | | 0.08 | 0.19 | mg/Kg | 6020B | | | | | | |
| Lead | 10.3 | | 0.20 | 0.49 | mg/Kg | 6020B | | | | | | |
| Solids, Total | 95.6 | | | | Percent | 160.3 Modified | | | | | | |
| CLIENT ID: UMM-WRA-0.5-1 | | Lab | ID: K2410 | 0639-013 | 639-013 | | | | | | | |
| Analyte | Results | Flag | MDL | MRL | Units | Method | | | | | | |
| Arsenic | 1300 | | 1.0 | 8.4 | mg/Kg | 6020B | | | | | | |
| Arsenic | 1590 | | 0.6 | 4.9 | mg/Kg | 6020B | | | | | | |
| Arsenic | 12.7 | | 0.2 | 2.0 | mg/Kg | 6020B | | | | | | |
| Lead | 66.0 | | 0.08 | 0.20 | mg/Kg | 6020B | | | | | | |
| Lead | 249 | | 0.19 | 0.49 | mg/Kg | 6020B | | | | | | |
| Solids, Total | 95.2 | | | | Percent | 160.3 Modified | | | | | | |
| CLIENT ID: UMM-WRA-0.5-3 | | Lab | ID: K2410 | 0639-014 | | | | | | | | |
| Analyte | Results | Flag | MDL | MRL | Units | Method | | | | | | |
| Arsenic | 1210 | | 0.05 | 0.45 | mg/Kg | 6020B | | | | | | |
| Solids, Total | 91.5 | | | | Percent | 160.3 Modified | | | | | | |
| CLIENT ID: UMM-WRA-0.5-1-DS | | | | | | | | | | | | |
| Analyte | Results | Flag | MDL | MRL | Units | Method | | | | | | |
| Arsenic | 37.5 | | 0.05 | 0.41 | mg/Kg | 6020B | | | | | | |
| Solids, Total | 94.4 | | | | Percent | 160.3 Modified | | | | | | |



SAMPLE DETECTION SUMMARY

This form includes only detections above the reporting levels. For a full listing of sample results, continue to the Sample Results section of this Report.

| CLIENT ID: UMM-WRA-0.5-1-DS | | Lab | ID: K2410 | 639-015 | | |
|------------------------------|---------|------|-----------|----------|---------|----------------|
| Analyte | Results | Flag | MDL | MRL | Units | Method |
| CLIENT ID: LMM-WRA-0.5-3 | | Lab | ID: K2410 | 0639-016 | | |
| Analyte | Results | Flag | MDL | MRL | Units | Method |
| Arsenic | 16.6 | | 0.2 | 2.0 | mg/Kg | 6020B |
| Arsenic | 125 | | 0.05 | 0.44 | mg/Kg | 6020B |
| Arsenic | 328 | | 0.6 | 4.9 | mg/Kg | 6020B |
| Lead | 10.8 | | 0.08 | 0.20 | mg/Kg | 6020B |
| Lead | 32.0 | | 0.19 | 0.49 | mg/Kg | 6020B |
| Solids, Total | 91.0 | | | | Percent | 160.3 Modified |
| CLIENT ID: LMM-WRA-0.5-3-DS | | Lab | ID: K2410 | 639-017 | | |
| Analyte | Results | Flag | MDL | MRL | Units | Method |
| Arsenic | 21.6 | | 0.05 | 0.44 | mg/Kg | 6020B |
| Solids, Total | 92.2 | | | | Percent | 160.3 Modified |
| CLIENT ID: LMM-WRA-0.5-4 | | | | | | |
| Analyte | Results | Flag | MDL | MRL | Units | Method |
| Arsenic | 2290 | | 1.1 | 8.8 | mg/Kg | 6020B |
| Solids, Total | 93.8 | | | | Percent | 160.3 Modified |
| CLIENT ID: LMM-WRA-0.5-4-DUP | | Lab | ID: K2410 | 639-019 | | |
| Analyte | Results | Flag | MDL | MRL | Units | Method |
| Arsenic | 2570 | | 1.0 | 8.5 | mg/Kg | 6020B |
| Solids, Total | 93.7 | | | | Percent | 160.3 Modified |
| CLIENT ID: UMM-WRB-0.5-1 | | Lab | ID: K2410 | 639-020 | | |
| Analyte | Results | Flag | MDL | MRL | Units | Method |
| Arsenic | 14000 | | 5 | 41 | mg/Kg | 6020B |
| Lead | 5210 | | 1.6 | 4.1 | mg/Kg | 6020B |
| Mercury | 0.663 | | 0.010 | 0.098 | mg/Kg | 7471B |
| | 96.3 | | | | Percent | 160.3 Modified |



Sample Receipt Information

ALS Environmental—Kelso Laboratory 1317 South 13th Avenue, Kelso, WA 98626 Phone (360) 577-7222 Fax (360) 425-9096 www.alsglobal.com **Project:** Upper Granite Creek Mines/0031.005.001

SAMPLE CROSS-REFERENCE

| SAMPLE # | CLIENT SAMPLE ID | <u>DATE</u> | <u>TIME</u> |
|--------------|--------------------|-------------|-------------|
| K2410639-001 | LMM-WRB-0.5-3-DS | 10/3/2024 | 1050 |
| K2410639-002 | UUMM-WRA-0.5-2 | 10/2/2024 | 1330 |
| K2410639-003 | UUMM-WRF-0.5-1 | 10/2/2024 | 1400 |
| K2410639-004 | UUMM-WRD-0.5-1 | 10/2/2024 | 1350 |
| K2410639-005 | UUMM-WRA-0.5-3 | 10/2/2024 | 1345 |
| K2410639-006 | UUMM-WRA-0.5-3-DUP | 10/2/2024 | 1344 |
| K2410639-007 | UUMM-WRA-0.5-3-DS | 10/2/2024 | 1335 |
| K2410639-008 | UMM-WRB-0.5-2 | 10/2/2024 | 1320 |
| K2410639-009 | UMM-WRB-0.5-2-DS | 10/2/2024 | 1325 |
| K2410639-010 | LMM-WRB-0.5-1 | 10/3/2024 | 1035 |
| K2410639-011 | LMM-WRB-0.5-1-DUP | 10/3/2024 | 1036 |
| K2410639-012 | CM-WRC-0.5-4 | 10/3/2024 | 1627 |
| K2410639-013 | UMM-WRA-0.5-1 | 10/2/2024 | 1215 |
| K2410639-014 | UMM-WRA-0.5-3 | 10/2/2024 | 1150 |
| K2410639-015 | UMM-WRA-0.5-1-DS | 10/2/2024 | 1205 |
| K2410639-016 | LMM-WRA-0.5-3 | 10/3/2024 | 0930 |
| K2410639-017 | LMM-WRA-0.5-3-DS | 10/3/2024 | 0925 |
| K2410639-018 | LMM-WRA-0.5-4 | 10/3/2024 | 0945 |
| K2410639-019 | LMM-WRA-0.5-4-DUP | 10/3/2024 | 0946 |
| K2410639-020 | UMM-WRB-0.5-1 | 10/2/2024 | 1310 |

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| Project Name UN1 Gone Car Mins Project Number 031,005. 001 | T | Т, | _ | | | | | | obal.co | om | | | | T | | 7 | Page 1 of 1 |
| roject Manager Don Malkems | _ | 6 | 797 | | 180D | | | CIRRE | | | | | | | | | . 7 (- |
| ompany Tellyphic Enjoying Inc. | ₂₂ | | | | | | | Γ | † | | | Γ | | 1 | | KILIC | DC 20(|
| | CONTAINERS | | | Total) | | | | Cak | | | | | | | | VU | |
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| ampler Signature Sampler Printed Name | b | 1 | | 3A (Si | A Ex | / Metals T | GrindSub | / Han | | | | | | | | | |
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| Report Requirements Invoice Information P.O.# | | | | | | | | | | | | 2 | Circle | which met | als are to be an | alyzed | |
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| roject Manager Ook Mallems | | | | | | \perp | , , | <u>.</u> | _ | 66 | <u> </u> | · | | | | | | | | | , 2 | 7 | | |
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| M | Dan MI | | | NUMBER | 7470A / Hg | 7471B / Hg | 5020B / IVBA (Sieved Total) | 5020B / Metals T | Grind / GrindSub | SM 2340 B / Hardness | | ~ | | 4 | 2 | Re | emarks | | | | | | | |
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| EB-2024 1005 | tals | 0830 | H20 | 1 | | 7 | | X | | T | | | 1 | | | | * | | | | | | | |
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| LMM-WRB-0.5-1 | 10/3 | 1035 | 50-1 | 2 | | T | | X | 1 | | | | | | | + long | 14060 | PLN | | | | | | |
| LMM-WR3 -0.5-3 | 1013 | 1055 | Soci | Z. | | | | | | | | | 1 | | | 1 b49 | HOLD | _ | | | | | | |
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| Report Requirements | | nformation | | | | | | | | | | | | Cit | rcle wi | hich met | als are to be a | naivzed | | | ***** | | | |
| I. Routine Report: Method Blank, Surrogate, as required | .O.#_ Bill To: <u>^₹</u> ₽ | termhou-con | | | | | | | | | | | | Od C | o C | r Cu | Fe Pb M | Mn Mo | | | | | | |
| ★ II. Report Dup., MS, MSD ——————————————————————————————————— | | | L | | | | | | | Sb | Ва | Be I | | | | | | Mg Mn Mo | | | | | Zn Hg | |
| as required | urnaround | Requireme | nts | pecia | Instru | ction | ıs/Coı | mme | nts: | | | | *Ind | icate | Stat | te Hyd | rocarbon f | rocedure: | AK CA | WIN | orthwest | Other | (Circle | e One) |
| III. CLP Like Summary (no raw data) | 24 hr | 48 hr. | | | | | | | | | | | | | | | | | | | | | | |
| IV. Data Validation Report | 5 Day Standard | | | | | | | | | | | | | | | | | | | | | | | |
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|---|---------------------|---|---|---------------|------------|--------------|------------|--------------|--------------|-------------------|------------------|--|---------|------|---------------|----------|-------|-----------------|---|---------|--------|----------|-------------------|--------------|-----------|---------------------|
| Project Name Upper Grant Creek A | hus Project N | iumber: 0 | 031-005.001 | | Ī | ٦ | 2 | | 008 | | 0000 | | | | | | T | | | | | | | | | 3 . . |
| Project Manager Don Malkey | MUS | ······································ | | | 1 | 2 | 3 | | <u></u> | | Ö | 3 | | | | | ╝ | | | l | | | | <i>/</i> ~, | | |
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| Project Name Viter Grank Creek Mines Project Number 0031.05.001 Project Manager M. W. W. W. W. W. W. W. W. W. W. W. W. W. | | | | | | | 780 | | 80D | | | 1888 1888 | T | | | | | T | | | | | | | | | | | |
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| Phone # (523) 943-0384 email on milk my @Kinghax (m | | | | | F CONTAINERS | | | (Siev | Extra | F SI | ą, | fardn | | | | | | | | | | | | , \ | $\mathcal{N}_{\mathcal{O}}$ |) | | | |
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| On Malkenus | | | | | NUMBER | 7470A / Hg T | 7471B / Hg | 5020B / IVBA (Sieved Total) | 60208 / IVBA Extract | 5020B / Metals T | Grind / GrindSub | SM 2340 B / Hardness | | ~ | e | 4 | ın | | Rem | arks | | | V | V | | 31 | | | |
| CLIENT SAMPLE ID | LABID | | MPLING Time State | Matrix | | | | | | | | | | | | | | | | | | | | | | | | | |
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| 0. | | | | | | | |] | | | | | | | | | | | | | | | | | | | | | |
| Report Requirements Invoice Information P.O.# | | | | | | Circle which metals are to be analyzed | | | | | | | | | | | | | | | | | | | | | | | |
| I. Routine Report: Method Blank, Surrogate, as required P.O.# Bill To: 40@ P(M) IL - GM | | | | | Total Metals: Al (As) (St) Ba Be B Ca (Cd) Co (Cr) Cu Fe (Pb) Mg Mn Mo Ni K (Ag) Na Se Sr Ti Sn V (Zr) (Hg) | | | | | | | | | | | | | | | | | | | | | | | | |
| X II. Report Dup., MS, MSD | · • | | | | | | | Dissolved Metals: Al As Sb Ba Be B Ca Cd Co Cr Cu Fe Pb Mg Mn Mo Ni K Ag Na Se Sr Ti Sn V Zn F | | | | | | | | | | | | | | | Hg | | | | | | |
| as requiredIII. CLP Like Summary | Turnaround Requirements | | | | | | pecial Instructions/Comments: *Indicate State Hydrocarbon Procedure: AK CA WI Northwest Other(Circ | | | | | | | | | | | | | | | Circle O | ne) | | | | | | |
| (no raw data) | 2 | 4 hr. | 48 hr. | | | | | | | | | | | | | | | | | | | | | | | | | | |
| IV. Data Validation Report 5 Day Standard | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| Relinquished By: | Requested Report Date Received By: | | | | | Relinquished By: | | | | | | A Received By: | | | | | | | T | Relinguished By: | | | | | | R | eceived | Bv∙ | |
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| ignature | 178 | | | | nature 7 | | | | | | Signature Mumi Perlessen | | | | | | | S | Signature | | | | Si | Signature | | | | | |
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1317 South 13th Ave, Kelso, WA 98626 Phone (360) 577-7222 / 800-695-7222 / FAX (360) 636-1068

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| Report Requirements | | oice Info | rmation | | | | · | | | | | | | | | Cir | cie wi | hich me | tais are | to be an | lvzed | | | | | | | |
| I. Routine Report: Method Blank, Surrogate, as required | P.O.#_ Bill To: | ap Qtin | aphise. Coa | _ | | | Total | Meta | ıls: A | ı (As |) (St | Ва | a Be | В | Ca (C | | | | | | | o Ni | K (Ag) N | Na Se | Sr Ti Sn | v (Z) | | |
| ✓ II. Report Dup., MS, MSD as required | | | | _ | pecial | | | | | | | Sb | Ba l | | | | | | | | | | | | Se Sr TI | | | |
| III. CLP Like Summary | | | quirement | ts | peciai | HISU | ucuc |)!!S/C | UIIII | nent | S. | | | Ĺ | "Inal | cate | Stai | е нус | rocan | oon Pr | ocedur | e: Ak | CA W | /I Nort | thwest Otl | her | (Circle | e One) |
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| IV. Data Validation Report | _ X _St | tandard | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| ~ | ere received in: (cir | , | ooler Box | E | nvelope | • | Other_ | | · | | NA | |
| Were custod | iy seals on coolers | ? | NA Y (N) | If yes, h | iow mai | ny and | where? | | | | | |
| If present, w | vere custody seals i | ntact? | Y N | If prese | nt, were | they s | gned and d | lated? | | Y | N | |
| | Ţ | | | | | Kara | A 200 - 2 | | | *************************************** | | |
| | Article Colonia | | | | Out c | of temp | N | PM otified | 34 94 | i Karan | | |
| Temp Blank | Sample Temp | IR Gun | Cooler #/COC ID / N | <u> </u> | Indicate | with " | (" If ou | t of temp | Trac | king Numi | ber NA | File |
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| 4.3 | 4-5 | 4 | | | · · · · · · · · · · · · · · · · · · · | | | | | | | |
| Was a Tempe | erature Blank prese | nt in cooler? | NA (Y N | If yes, 1 | otate th | e temp | erature in t | he appropri | ate column | above: | | |
| If no, take th | he temperature of a | representativ | e sample bottle contair | ed with | in the c | ooler; n | otate in the | column "S | ample Tem | p": | 7 | |
| Were sample | s received within the | he method spe | ecified temperature ran | ges? | | | | | N/ | 4 (<u>Y</u> | \int N | |
| = | | - | y as collected? If not, n | - | e conler | # abov | e and notif | v the PM. | KI. | Y | N | |
| | ssue samples were | · | Frozen Partially Ti | | Thaw | | 0 4.74 1.01.1 | , 4.0 - 1.1. | C | | ., | |
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| o. Were 100m | i sterile microbiolo | gy bottles fill | ed exactly to the 100m | I mark? | (_N | A | Y | N | Unde | erfilled | Overfille | a |
| Sa | ımple ID on Bott | ie | Sample | D on | COC | | | | identifi | ed by: | | |
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| 12.2 | 5.5 | W_ | | | | | | | | | | | |
| San | nple ID on Bottle | | | Sample II | D on C | soc | | | | Id | entified by: | | |
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Miscellaneous Forms

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Inorganic Data Qualifiers

- * The result is an outlier. See case narrative.
- # The control limit criteria is not applicable.
- B The analyte was found in the associated method blank at a level that is significant relative to the sample result as defined by the DOD or NELAC standards.
- E The result is an estimate amount because the value exceeded the instrument calibration range.
- I The result is an estimated value
- U The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL.
 DOD-QSM 4.2 definition: Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
- i The MRL/MDL or LOQ/LOD is elevated due to a matrix interference.
- X See case narrative.
- Q See case narrative. One or more quality control criteria was outside the limits.
- H The holding time for this test is immediately following sample collection. The samples were analyzed as soon as possible after receipt by the laboratory.

Metals Data Qualifiers

- # The control limit criteria is not applicable.
- J The result is an estimated value.
- E The percent difference for the serial dilution was greater than 10%, indicating a possible matrix interference in the sample.
- M The duplicate injection precision was not met.
- N The Matrix Spike sample recovery is not within control limits. See case narrative.
- S The reported value was determined by the Method of Standard Additions (MSA).
- U The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL. DOD-QSM 4.2 definition: Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
- W The post-digestion spike for furnace AA analysis is out of control limits, while sample absorbance is less than 50% of spike absorbance.
- i The MRL/MDL or LOQ/LOD is elevated due to a matrix interference.
- X See case narrative.
- + The correlation coefficient for the MSA is less than 0.995.
- Q See case narrative. One or more quality control criteria was outside the limits.

Organic Data Qualifiers

- * The result is an outlier. See case narrative.
- # The control limit criteria is not applicable. See case narrative.
- A A tentatively identified compound, a suspected aldol-condensation product.
- B The analyte was found in the associated method blank at a level that is significant relative to the sample result as defined by the DOD or NELAC standards.
- C The analyte was qualitatively confirmed using GC/MS techniques, pattern recognition, or by comparing to historical data.
- D The reported result is from a dilution.
- E The result is an estimated value over the calibration range.
- J The result is an estimated value between the MDL and the MRL.
- N The result is presumptive. The analyte was tentatively identified, but a confirmation analysis was not performed.
- P The GC or HPLC confirmation criteria was exceeded. The relative percent difference is greater than 40% between the two analytical results.
- U The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL.
 DOD-QSM 4.2 definition: Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
- i The MRL/MDL or LOQ/LOD is elevated due to a chromatographic interference.
- X See case narrative.
- Q See case narrative. One or more quality control criteria was outside the limits.

Additional Petroleum Hydrocarbon Specific Qualifiers

- F The chromatographic fingerprint of the sample matches the elution pattern of the calibration standard.
- L The chromatographic fingerprint of the sample resembles a petroleum product, but the elution pattern indicates the presence of a greater amount of lighter molecular weight constituents than the calibration standard.
- H The chromatographic fingerprint of the sample resembles a petroleum product, but the elution pattern indicates the presence of a greater amount of heavier molecular weight constituents than the calibration standard.
- O The chromatographic fingerprint of the sample resembles an oil, but does not match the calibration standard.
- Y The chromatographic fingerprint of the sample resembles a petroleum product eluting in approximately the correct carbon range, but the elution pattern does not match the calibration standard.
- Z The chromatographic fingerprint does not resemble a petroleum product.

ALS Group USA Corp. dba ALS Environmental (ALS) - Kelso State Certifications, Accreditations, and Licenses

| Agency | Web Site | Number |
|--------------------------|---|-------------|
| Alaska DEH | http://dec.alaska.gov/eh/lab/cs/csapproval.htm | UST-040 |
| Arizona DHS | http://www.azdhs.gov/lab/license/env.htm | AZ0339 |
| Arkansas - DEQ | http://www.adeq.state.ar.us/techsvs/labcert.htm | 88-0637 |
| California DHS (ELAP) | http://www.cdph.ca.gov/certlic/labs/Pages/ELAP.aspx | 2795 |
| DOD ELAP | http://www.denix.osd.mil/edqw/Accreditation/AccreditedLabs.cfm | L16-58-R4 |
| Florida DOH | http://www.doh.state.fl.us/lab/EnvLabCert/WaterCert.htm | E87412 |
| Hawaii DOH | http://health.hawaii.gov/ | - |
| ISO 17025 | http://www.pjlabs.com/ | L16-57 |
| Louisiana DEQ | http://www.deq.louisiana.gov/page/la-lab-accreditation | 03016 |
| Maine DHS | http://www.maine.gov/dhhs/ | WA01276 |
| Minnesota DOH | http://www.health.state.mn.us/accreditation | 053-999-457 |
| Nevada DEP | http://ndep.nv.gov/bsdw/labservice.htm | WA01276 |
| New Jersey DEP | http://www.nj.gov/dep/enforcement/oqa.html | WA005 |
| New York - DOH | https://www.wadsworth.org/regulatory/elap | 12060 |
| | https://deq.nc.gov/about/divisions/water-resources/water-resources-data/water-sciences-home-page/laboratory-certification-branch/non-field-lab- | |
| North Carolina DEQ | certification | 605 |
| Oklahoma DEQ | http://www.deq.state.ok.us/CSDnew/labcert.htm | 9801 |
| Oregon – DEQ (NELAP) | http://public.health.oregon.gov/LaboratoryServices/EnvironmentalLaboratoryAccreditation/Pages/index.aspx | WA100010 |
| South Carolina DHEC | http://www.scdhec.gov/environment/EnvironmentalLabCertification/ | 61002 |
| Texas CEQ | http://www.tceq.texas.gov/field/qa/env_lab_accreditation.html | T104704427 |
| Washington DOE | http://www.ecy.wa.gov/programs/eap/labs/lab-accreditation.html | C544 |
| Wyoming (EPA Region 8) | https://www.epa.gov/region8-waterops/epa-region-8-certified-drinking-water- | - |
| Kelso Laboratory Website | www.alsglobal.com | NA |

Analyses were performed according to our laboratory's NELAP-approved quality assurance program. A complete listing of specific NELAP-certified analytes, can be found in the certification section at www.ALSGlobal.com or at the accreditation bodies web site.

Please refer to the certification and/or accreditation body's web site if samples are submitted for compliance purposes. The states highlighted above, require the analysis be listed on the state certification if used for compliance purposes and if the method/anlayte is offered by that state.

Acronyms

ASTM American Society for Testing and Materials

A2LA American Association for Laboratory Accreditation

CARB California Air Resources Board

CAS Number Chemical Abstract Service registry Number

CFC Chlorofluorocarbon
CFU Colony-Forming Unit

DEC Department of Environmental Conservation

DEQ Department of Environmental Quality

DHS Department of Health Services

DOE Department of Ecology
DOH Department of Health

EPA U. S. Environmental Protection Agency

ELAP Environmental Laboratory Accreditation Program

GC Gas Chromatography

GC/MS Gas Chromatography/Mass Spectrometry

LOD Limit of Detection
LOQ Limit of Quantitation

LUFT Leaking Underground Fuel Tank

M Modified

MCL Maximum Contaminant Level is the highest permissible concentration of a substance

allowed in drinking water as established by the USEPA.

MDL Method Detection Limit
MPN Most Probable Number
MRL Method Reporting Limit

NA Not Applicable
NC Not Calculated

NCASI National Council of the Paper Industry for Air and Stream Improvement

ND Not Detected

NIOSH National Institute for Occupational Safety and Health

PQL Practical Quantitation Limit

RCRA Resource Conservation and Recovery Act

SIM Selected Ion Monitoring

TPH Total Petroleum Hydrocarbons

tr Trace level is the concentration of an analyte that is less than the PQL but greater than or

equal to the MDL.

Analyst Summary report

Client: Terraphase Engineering Inc.

Project: Upper Granite Creek Mines/0031.005.001

Service Request: K2410639

Sample Name: LMM-WRB-0.5-3-DS

Lab Code: K2410639-001

Sample Matrix: Soil

Date Collected: 10/3/24 **Date Received:** 10/8/24

Analysis Method Extracted/Digested By Analyzed By

160.3 Modified ZBIBI

6020B KLAWSON JCHAN

Sample Name: UUMM-WRA-0.5-2 Date Collected: 10/2/24

Lab Code: K2410639-002 **Date Received:** 10/8/24

Sample Matrix: Soil

Analysis Method Extracted/Digested By Analyzed By

160.3 Modified ZBIBI

6020B KLAWSON JCHAN

Sample Name: UUMM-WRF-0.5-1 Date Collected: 10/2/24

Lab Code: K2410639-003 **Date Received:** 10/8/24

Sample Matrix: Soil

Analysis Method Extracted/Digested By Analyzed By

160.3 Modified ZBIBI

6020B KLAWSON JCHAN

Sample Name: UUMM-WRD-0.5-1 Date Collected: 10/2/24

Lab Code: K2410639-004 **Date Received:** 10/8/24

Sample Matrix: Soil

Analysis Method Extracted/Digested By Analyzed By

160.3 Modified ZBIBI

6020B KLAWSON JCHAN

Analyst Summary report

Client: Terraphase Engineering Inc.

Project: Upper Granite Creek Mines/0031.005.001

Service Request: K2410639

Sample Name: UUMM-WRA-0.5-3 Date Collected: 10/2/24

Lab Code: K2410639-005 **Date Received:** 10/8/24

Sample Matrix: Soil

Analysis Method Extracted/Digested By Analyzed By

160.3 Modified ZBIBI

6020B MSOLADEY JCHAN 6020B KLAWSON JCHAN

Sample Name: UUMM-WRA-0.5-3-DUP Date Collected: 10/2/24

Lab Code: K2410639-006 **Date Received:** 10/8/24

Sample Matrix: Soil

Analysis Method Extracted/Digested By Analyzed By

160.3 Modified ZBIBI

6020B KLAWSON JCHAN 6020B MSOLADEY JCHAN

Sample Name: UUMM-WRA-0.5-3-DS Date Collected: 10/2/24

Lab Code: K2410639-007 **Date Received:** 10/8/24

Sample Matrix: Soil

Analysis Method Extracted/Digested By Analyzed By

160.3 Modified ZBIBI

6020B KLAWSON JCHAN

Sample Name: UMM-WRB-0.5-2 Date Collected: 10/2/24

Lab Code: K2410639-008 **Date Received:** 10/8/24

Sample Matrix: Soil

Analysis Method Extracted/Digested By Analyzed By

160.3 Modified ZBIBI

6020B KLAWSON JCHAN

Analyst Summary report

Client: Terraphase Engineering Inc.

Project: Upper Granite Creek Mines/0031.005.001

Sample Name: UMM-WRB-0.5-2-DS

Lab Code: K2410639-009

Sample Matrix: Soil

Date Collected: 10/2/24 **Date Received:** 10/8/24

Service Request: K2410639

Analysis Method Extracted/Digested By Analyzed By

160.3 Modified ZBIBI

6020B KLAWSON JCHAN

Sample Name: LMM-WRB-0.5-1 Date Collected: 10/3/24

Lab Code: K2410639-010 **Date Received:** 10/8/24

Sample Matrix: Soil

Analysis Method Extracted/Digested By Analyzed By

160.3 Modified ZBIBI

6020B KLAWSON JCHAN

Sample Name: LMM-WRB-0.5-1-DUP Date Collected: 10/3/24

Lab Code: K2410639-011 **Date Received:** 10/8/24

Sample Matrix: Soil

Analysis Method Extracted/Digested By Analyzed By

160.3 Modified ZBIBI

6020B KLAWSON JCHAN

Sample Name: CM-WRC-0.5-4 Date Collected: 10/3/24

Lab Code: K2410639-012 Date Received: 10/8/24

Sample Matrix: Soil

Analysis Method Extracted/Digested By Analyzed By

160.3 Modified ZBIBI

6020B MSOLADEY JCHAN 6020B KLAWSON JCHAN

Analyst Summary report

Client: Terraphase Engineering Inc.

Project: Upper Granite Creek Mines/0031.005.001 Service Request: K2410639

Sample Name: UMM-WRA-0.5-1 Lab Code: K2410639-013

Sample Matrix: Soil **Date Collected:** 10/2/24 Date Received: 10/8/24

ZBIBI

Analyzed By Analysis Method Extracted/Digested By

160.3 Modified

ZBIBI 6020B **MSOLADEY JCHAN** 6020B **KLAWSON JCHAN**

Sample Name: UMM-WRA-0.5-3 **Date Collected:** 10/2/24 Lab Code: K2410639-014 Date Received: 10/8/24

Sample Matrix: Soil

Analyzed By Analysis Method Extracted/Digested By

160.3 Modified

6020B **KLAWSON JCHAN**

Sample Name: UMM-WRA-0.5-1-DS **Date Collected:** 10/2/24

Lab Code: K2410639-015 **Date Received:** 10/8/24

Sample Matrix: Soil

Analyzed By Analysis Method Extracted/Digested By

160.3 Modified **ZBIBI** 6020B **KLAWSON JCHAN**

Sample Name: Date Collected: 10/3/24 LMM-WRA-0.5-3 Lab Code: K2410639-016 Date Received: 10/8/24

Sample Matrix: Soil

Analyzed By Analysis Method Extracted/Digested By

160.3 Modified **ZBIBI**

6020B **KLAWSON JCHAN** 6020B **MSOLADEY JCHAN**

Analyst Summary report

Client: Terraphase Engineering Inc.

Project: Upper Granite Creek Mines/0031.005.001

Date Collected: 10/3/24

Date Received: 10/8/24

Service Request: K2410639

Sample Name: LMM-WRA-0.5-3-DS

Lab Code: K2410639-017

Sample Matrix: Soil

Analysis Method

Extracted/Digested By Analyzed By

160.3 Modified ZBIBI

6020B KLAWSON JCHAN

Sample Name: LMM-WRA-0.5-4 Date Collected: 10/3/24

Lab Code: K2410639-018 **Date Received:** 10/8/24

Sample Matrix: Soil

Analysis Method Extracted/Digested By Analyzed By

160.3 Modified ZBIBI

6020B KLAWSON JCHAN

Sample Name: LMM-WRA-0.5-4-DUP Date Collected: 10/3/24

Lab Code: K2410639-019 **Date Received:** 10/8/24

Sample Matrix: Soil

Analysis Method Extracted/Digested By Analyzed By

160.3 Modified ZBIBI

6020B KLAWSON JCHAN

Sample Name: UMM-WRB-0.5-1 Date Collected: 10/2/24

Lab Code: K2410639-020 Date Received: 10/8/24

Sample Matrix: Soil

Analysis Method Extracted/Digested By Analyzed By

160.3 Modified ZBIBI

6020B KLAWSON JCHAN 7471B KLINN KLINN



Sample Results

ALS Environmental—Kelso Laboratory 1317 South 13th Avenue, Kelso, WA 98626 Phone (360) 577-7222 Fax (360) 425-9096 www.alsglobal.com



Metals

ALS Environmental—Kelso Laboratory 1317 South 13th Avenue, Kelso, WA 98626 Phone (360) 577-7222 Fax (360) 425-9096 www.alsglobal.com

Analytical Report

Client: Terraphase Engineering Inc.

Service Request: K2410639 **Date Collected:** 10/03/24 10:50 Upper Granite Creek Mines/0031.005.001

Project: Date Received: 10/08/24 14:45 **Sample Matrix:** Soil

Sample Name: LMM-WRB-0.5-3-DS Basis: Dry

Lab Code: K2410639-001

| | Analysis | | | | | | | Date | |
|---------------------|----------|--------|-------|------|------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 29.1 | mg/Kg | 0.41 | 0.05 | 5 | 10/22/24 09:54 | 10/10/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Project:

Service Request: K2410639 **Date Collected:** 10/02/24 13:30 Upper Granite Creek Mines/0031.005.001

Date Received: 10/08/24 14:45 **Sample Matrix:** Soil

UUMM-WRA-0.5-2 **Sample Name:** Basis: Dry

Lab Code: K2410639-002

| | Analysis | | | | | | | Date | |
|--------------|----------|--------|-------|-----|-----|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 1940 | mg/Kg | 8.8 | 1.1 | 100 | 10/22/24 10:47 | 10/10/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Upper Granite Creek Mines/0031.005.001

Date Collected: 10/02/24 14:00

Service Request: K2410639

Sample Matrix:

Project:

Soil

Date Received: 10/08/24 14:45

UUMM-WRF-0.5-1 **Sample Name:**

Lab Code: K2410639-003 Basis: Dry

| | Analysis | | | | | | | Date | |
|--------------|----------|--------|-------|------|------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 715 | mg/Kg | 0.44 | 0.05 | 5 | 10/22/24 09:55 | 10/10/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Project:

Service Request: K2410639 **Date Collected:** 10/02/24 13:50 Upper Granite Creek Mines/0031.005.001

Date Received: 10/08/24 14:45 **Sample Matrix:** Soil

Sample Name: UUMM-WRD-0.5-1 Basis: Dry

Lab Code: K2410639-004

| | Analysis | | | | | | | Date | |
|---------------------|----------|--------|-------|------|------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 269 | mg/Kg | 0.45 | 0.05 | 5 | 10/22/24 09:57 | 10/10/24 | |

Analytical Report

Terraphase Engineering Inc. **Client:**

Project:

Service Request: K2410639 **Date Collected:** 10/02/24 13:45 Upper Granite Creek Mines/0031.005.001

Date Received: 10/08/24 14:45 **Sample Matrix:** Soil

UUMM-WRA-0.5-3 **Sample Name:** Basis: Dry

Lab Code: K2410639-005

Total Metals – IVBA Analysis

| | Analysis | | | | | | | Date | |
|--------------|----------|--------|-------|------|------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 3440 | mg/Kg | 4.9 | 0.6 | 50 | 10/22/24 16:04 | 10/17/24 | |
| Lead | 6020B | 340 | mg/Kg | 0.49 | 0.20 | 50 | 10/22/24 16:04 | 10/17/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Upper Granite Creek Mines/0031.005.001

Date Received: 10/08/24 14:45 **Sample Matrix:** Soil

Project:

Sample Name:

UUMM-WRA-0.5-3

Lab Code: K2410639-005 Basis: Dry

Service Request: K2410639 **Date Collected:** 10/02/24 13:45

IVBA Metals

| | Analysis | | | | | | | Date | |
|---------------------|----------|--------|-------|------|------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 176 | mg/Kg | 1.9 | 0.2 | 20 | 10/17/24 11:41 | 10/16/24 | |
| Lead | 6020B | 12.6 | mg/Kg | 0.19 | 0.08 | 20 | 10/17/24 11:41 | 10/16/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Upper Granite Creek Mines/0031.005.001

Service Request: K2410639

Date Collected: 10/02/24 13:45

Sample Matrix:

Soil

Date Received: 10/08/24 14:45

Sample Name:

Project:

Lab Code:

UUMM-WRA-0.5-3

Basis: Dry

K2410639-005

| | Analysis | | | | | | | Date | |
|--------------|----------|--------|-------|-----|-----|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 1710 | mg/Kg | 9.1 | 1.1 | 100 | 10/22/24 10:54 | 10/10/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Service Request: K2410639 **Date Collected:** 10/02/24 13:44 Upper Granite Creek Mines/0031.005.001

Date Received: 10/08/24 14:45 **Sample Matrix:** Soil

UUMM-WRA-0.5-3-DUP **Sample Name:** Basis: Dry

Lab Code: K2410639-006

Project:

Total Metals – IVBA Analysis

| | Analysis | | | | | | | Date | |
|---------------------|----------|--------|-------|------|------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 3280 | mg/Kg | 5.0 | 0.6 | 50 | 10/22/24 16:05 | 10/17/24 | |
| Lead | 6020B | 340 | mg/Kg | 0.50 | 0.20 | 50 | 10/22/24 16:05 | 10/17/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Project:

Service Request: K2410639 **Date Collected:** 10/02/24 13:44 Upper Granite Creek Mines/0031.005.001

Date Received: 10/08/24 14:45 **Sample Matrix:** Soil

Sample Name: UUMM-WRA-0.5-3-DUP Basis: Dry

Lab Code: K2410639-006

IVBA Metals

| | Analysis | | | | | | | Date | |
|--------------|----------|--------|-------|------|------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 162 | mg/Kg | 2.0 | 0.2 | 20 | 10/17/24 11:43 | 10/16/24 | |
| Lead | 6020B | 7.14 | mg/Kg | 0.20 | 0.08 | 20 | 10/17/24 11:43 | 10/16/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Upper Granite Creek Mines/0031.005.001

Sample Matrix:

Soil

UUMM-WRA-0.5-3-DUP

Sample Name: Lab Code:

Project:

K2410639-006

Service Request: K2410639

Date Collected: 10/02/24 13:44

Date Received: 10/08/24 14:45

Basis: Dry

| | Analysis | | | | | | | Date | |
|--------------|----------|--------|-------|-----|-----|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 1470 | mg/Kg | 8.0 | 1.0 | 100 | 10/22/24 10:56 | 10/10/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Project:

Service Request: K2410639 **Date Collected:** 10/02/24 13:35 Upper Granite Creek Mines/0031.005.001

Date Received: 10/08/24 14:45 **Sample Matrix:** Soil

Sample Name: UUMM-WRA-0.5-3-DS Basis: Dry

Lab Code: K2410639-007

| | Analysis | | | | | | | Date | |
|--------------|----------|--------|-------|------|------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 16.0 | mg/Kg | 0.44 | 0.05 | 5 | 10/22/24 10:04 | 10/10/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Upper Granite Creek Mines/0031.005.001

Service Request: K2410639 **Date Collected:** 10/02/24 13:20

Sample Matrix:

Project:

Soil

Date Received: 10/08/24 14:45

UMM-WRB-0.5-2 **Sample Name:**

Lab Code: K2410639-008 Basis: Dry

| | Analysis | | | | | | | Date | |
|--------------|----------|--------|-------|-----|-----|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 1800 | mg/Kg | 8.2 | 1.0 | 100 | 10/22/24 10:57 | 10/10/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Service Request: K2410639 **Date Collected:** 10/02/24 13:25 Upper Granite Creek Mines/0031.005.001

Project: Date Received: 10/08/24 14:45 **Sample Matrix:** Soil

UMM-WRB-0.5-2-DS **Sample Name:** Basis: Dry

Lab Code: K2410639-009

| | Analysis | | | | | | | Date | |
|---------------------|----------|--------|-------|------|------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 79.2 | mg/Kg | 0.45 | 0.05 | 5 | 10/22/24 10:07 | 10/10/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Service Request: K2410639 **Date Collected:** 10/03/24 10:35 Upper Granite Creek Mines/0031.005.001

Project: Date Received: 10/08/24 14:45 **Sample Matrix:** Soil

LMM-WRB-0.5-1 **Sample Name:** Basis: Dry

Lab Code: K2410639-010

| | Analysis | | | | | | | Date | |
|---------------------|----------|--------|-------|------|------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 1090 | mg/Kg | 0.42 | 0.05 | 5 | 10/22/24 10:08 | 10/10/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Upper Granite Creek Mines/0031.005.001

Sample Matrix: Soil

Project:

Sample Name:

LMM-WRB-0.5-1-DUP Basis: Dry

Lab Code: K2410639-011

Total Metals

| | Analysis | | | | | | | Date | |
|---------------------|----------|--------|-------|------|------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 802 | mg/Kg | 0.42 | 0.05 | 5 | 10/22/24 10:09 | 10/10/24 | |

Service Request: K2410639 **Date Collected:** 10/03/24 10:36

Date Received: 10/08/24 14:45

Analytical Report

Client: Terraphase Engineering Inc.

Project:

Service Request: K2410639 **Date Collected:** 10/03/24 16:27 Upper Granite Creek Mines/0031.005.001

Date Received: 10/08/24 14:45 **Sample Matrix:** Soil

CM-WRC-0.5-4 **Sample Name:** Basis: Dry

Lab Code: K2410639-012

Total Metals – IVBA Analysis

| | Analysis | | | | | | | Date | |
|--------------|----------|--------|-------|------|------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 650 | mg/Kg | 4.9 | 0.6 | 50 | 10/22/24 16:07 | 10/17/24 | |
| Lead | 6020B | 10.3 | mg/Kg | 0.49 | 0.20 | 50 | 10/22/24 16:07 | 10/17/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Project:

Service Request: K2410639 **Date Collected:** 10/03/24 16:27 Upper Granite Creek Mines/0031.005.001

Date Received: 10/08/24 14:45 **Sample Matrix:** Soil

Sample Name: CM-WRC-0.5-4 Basis: Dry

Lab Code: K2410639-012

IVBA Metals

| | Analysis | | | | | | | Date | |
|--------------|----------|--------|-------|------|------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 33.1 | mg/Kg | 1.9 | 0.2 | 20 | 10/17/24 11:44 | 10/16/24 | |
| Lead | 6020B | 2.95 | mg/Kg | 0.19 | 0.08 | 20 | 10/17/24 11:44 | 10/16/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Service Request: K2410639 **Date Collected:** 10/03/24 16:27 Upper Granite Creek Mines/0031.005.001

Project: Date Received: 10/08/24 14:45 **Sample Matrix:** Soil

Sample Name: CM-WRC-0.5-4 Basis: Dry

Lab Code: K2410639-012

| | Analysis | | | | | | | Date | |
|--------------|----------|--------|-------|------|------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 292 | mg/Kg | 0.42 | 0.05 | 5 | 10/22/24 10:11 | 10/10/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Project:

Service Request: K2410639 **Date Collected:** 10/02/24 12:15 Upper Granite Creek Mines/0031.005.001

Date Received: 10/08/24 14:45 **Sample Matrix:** Soil

UMM-WRA-0.5-1 **Sample Name:** Basis: Dry

Lab Code: K2410639-013

Total Metals – IVBA Analysis

| | Analysis | | | | | | | Date | |
|--------------|----------|--------|-------|------|------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 1590 | mg/Kg | 4.9 | 0.6 | 50 | 10/22/24 16:08 | 10/17/24 | |
| Lead | 6020B | 249 | mg/Kg | 0.49 | 0.19 | 50 | 10/22/24 16:08 | 10/17/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Upper Granite Creek Mines/0031.005.001

Sample Matrix: Soil

Project:

Sample Name: UMM-WRA-0.5-1

Lab Code: K2410639-013

Service Request: K2410639

Date Collected: 10/02/24 12:15

Date Received: 10/08/24 14:45

Basis: Dry

IVBA Metals

| | Analysis | | | | | | | Date | |
|---------------------|----------|--------|-------|------|------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 12.7 | mg/Kg | 2.0 | 0.2 | 20 | 10/17/24 11:46 | 10/16/24 | |
| Lead | 6020B | 66.0 | mg/Kg | 0.20 | 0.08 | 20 | 10/17/24 11:46 | 10/16/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Service Request: K2410639 **Date Collected:** 10/02/24 12:15 Upper Granite Creek Mines/0031.005.001

Project: Date Received: 10/08/24 14:45 **Sample Matrix:** Soil

UMM-WRA-0.5-1 **Sample Name:** Basis: Dry

Lab Code: K2410639-013

| | Analysis | | | | | | | Date | |
|--------------|----------|--------|-------|-----|-----|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 1300 | mg/Kg | 8.4 | 1.0 | 100 | 10/22/24 10:59 | 10/10/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Service Request: K2410639 **Date Collected:** 10/02/24 11:50 Upper Granite Creek Mines/0031.005.001

Project: Date Received: 10/08/24 14:45 **Sample Matrix:** Soil

Sample Name: UMM-WRA-0.5-3 Basis: Dry

Lab Code: K2410639-014

| | Analysis | | | | | | | Date | |
|--------------|----------|--------|-------|------|------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 1210 | mg/Kg | 0.45 | 0.05 | 5 | 10/22/24 10:17 | 10/10/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Project:

Service Request: K2410639 **Date Collected:** 10/02/24 12:05 Upper Granite Creek Mines/0031.005.001

Date Received: 10/08/24 14:45 **Sample Matrix:** Soil

Sample Name: UMM-WRA-0.5-1-DS Basis: Dry

Lab Code: K2410639-015

| | Analysis | | | | | | | Date | |
|--------------|----------|--------|-------|------|------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 37.5 | mg/Kg | 0.41 | 0.05 | 5 | 10/22/24 10:18 | 10/10/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Project:

Service Request: K2410639 **Date Collected:** 10/03/24 09:30 Upper Granite Creek Mines/0031.005.001

Date Received: 10/08/24 14:45 **Sample Matrix:** Soil

Sample Name: LMM-WRA-0.5-3 Basis: Dry

Lab Code: K2410639-016

Total Metals – IVBA Analysis

| | Analysis | | | | | | | Date | |
|---------------------|----------|--------|-------|------|------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 328 | mg/Kg | 4.9 | 0.6 | 50 | 10/22/24 16:09 | 10/17/24 | |
| Lead | 6020B | 32.0 | mg/Kg | 0.49 | 0.19 | 50 | 10/22/24 16:09 | 10/17/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Upper Granite Creek Mines/0031.005.001

Sample Matrix:

Project:

Sample Name:

Soil

Service Request: K2410639 **Date Collected:** 10/03/24 09:30

Date Received: 10/08/24 14:45

Basis: Dry

LMM-WRA-0.5-3

Lab Code: K2410639-016

IVBA Metals

| | Analysis | | | | | | | Date | |
|---------------------|----------|--------|-------|------|------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 16.6 | mg/Kg | 2.0 | 0.2 | 20 | 10/17/24 11:48 | 10/16/24 | |
| Lead | 6020B | 10.8 | mg/Kg | 0.20 | 0.08 | 20 | 10/17/24 11:48 | 10/16/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Project:

Service Request: K2410639 **Date Collected:** 10/03/24 09:30 Upper Granite Creek Mines/0031.005.001

Date Received: 10/08/24 14:45 **Sample Matrix:** Soil

Sample Name: LMM-WRA-0.5-3 Basis: Dry

Lab Code: K2410639-016

| | Analysis | | | | | | | Date | |
|--------------|----------|--------|-------|------|------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 125 | mg/Kg | 0.44 | 0.05 | 5 | 10/22/24 10:19 | 10/10/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Service Request: K2410639 **Date Collected:** 10/03/24 09:25 Upper Granite Creek Mines/0031.005.001

Project: Sample Matrix: Soil

Date Received: 10/08/24 14:45

Sample Name:

LMM-WRA-0.5-3-DS

Basis: Dry

Lab Code: K2410639-017

| | Analysis | | | | | | | Date | |
|--------------|----------|--------|-------|------|------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 21.6 | mg/Kg | 0.44 | 0.05 | 5 | 10/22/24 10:21 | 10/10/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Upper Granite Creek Mines/0031.005.001

Service Request: K2410639

Date Collected: 10/03/24 09:45

Sample Matrix:

Project:

Lab Code:

Soil

Date Received: 10/08/24 14:45

Sample Name: LMM-WRA-0.5-4 Basis: Dry

K2410639-018

| | Analysis | | | | | | | Date | |
|--------------|----------|--------|-------|-----|-----|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 2290 | mg/Kg | 8.8 | 1.1 | 100 | 10/22/24 11:00 | 10/10/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Upper Granite Creek Mines/0031.005.001

Sample Matrix: Soil

Project:

Sample Name:

LMM-WRA-0.5-4-DUP

Lab Code: K2410639-019 **Service Request:** K2410639

Date Collected: 10/03/24 09:46

Date Received: 10/08/24 14:45

Basis: Dry

| | Analysis | | | | | | | Date | |
|---------------------|----------|--------|-------|-----|-----|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 2570 | mg/Kg | 8.5 | 1.0 | 100 | 10/22/24 10:34 | 10/10/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Project:

Service Request: K2410639 **Date Collected:** 10/02/24 13:10 Upper Granite Creek Mines/0031.005.001

Date Received: 10/08/24 14:45 **Sample Matrix:** Soil

Sample Name: UMM-WRB-0.5-1 Basis: Dry

Lab Code: K2410639-020

| | Analysis | | | | | | | Date | |
|--------------|----------|--------|-------|-------|-------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 14000 | mg/Kg | 41 | 5 | 500 | 10/22/24 10:35 | 10/10/24 | |
| Lead | 6020B | 5210 | mg/Kg | 4.1 | 1.6 | 500 | 10/22/24 10:35 | 10/10/24 | |
| Mercury | 7471B | 0.663 | mg/Kg | 0.098 | 0.010 | 5 | 10/15/24 12:04 | 10/14/24 | |



General Chemistry

ALS Environmental—Kelso Laboratory 1317 South 13th Avenue, Kelso, WA 98626 Phone (360) 577-7222 Fax (360) 425-9096 www.alsglobal.com

Analytical Report

Client: Terraphase Engineering Inc.

Service Request: K2410639 **Date Collected:** 10/03/24 10:50 Upper Granite Creek Mines/0031.005.001

Project:

Sample Matrix: Soil

Sample Name:

LMM-WRB-0.5-3-DS

Lab Code: K2410639-001 Basis: As Received

Date Received: 10/08/24 14:45

| Analyte Name | Analysis Method | Result | Units | MRL | Dil. | Date Analyzed | Q |
|---------------|-----------------|--------|---------|-----|------|----------------|---|
| Solids, Total | 160.3 Modified | 95.4 | Percent | - | 1 | 10/09/24 12:51 | |

Analytical Report

Client: Terraphase Engineering Inc.

Project:

Service Request: K2410639 **Date Collected:** 10/02/24 13:30 Upper Granite Creek Mines/0031.005.001

Date Received: 10/08/24 14:45 **Sample Matrix:** Soil

Sample Name: UUMM-WRA-0.5-2 Basis: As Received

Lab Code: K2410639-002

| Analyte Name | Analysis Method | Result | Units | MRL | Dil. | Date Analyzed | Q |
|---------------------|------------------------|--------|---------|-----|------|----------------|----------|
| Solids Total | 160.3 Modified | 95.2 | Percent | _ | 1 | 10/09/24 12:51 | <u>.</u> |

Analytical Report

Client: Terraphase Engineering Inc.

Service Request: K2410639 **Date Collected:** 10/02/24 14:00 Upper Granite Creek Mines/0031.005.001

Sample Matrix: Soil

Date Received: 10/08/24 14:45

Sample Name:

Project:

UUMM-WRF-0.5-1

Lab Code: K2410639-003 Basis: As Received

| Analyte Name | Analysis Method | Result | Units | MRL | Dil. | Date Analyzed | Q |
|---------------|------------------------|--------|---------|-----|------|----------------|---|
| Solids, Total | 160.3 Modified | 95.8 | Percent | - | 1 | 10/09/24 12:51 | |

Analytical Report

Client: Terraphase Engineering Inc.

Service Request: K2410639 **Date Collected:** 10/02/24 13:50 Upper Granite Creek Mines/0031.005.001

Date Received: 10/08/24 14:45 **Sample Matrix:** Soil

Sample Name: UUMM-WRD-0.5-1 Basis: As Received

Lab Code: K2410639-004

Project:

| Analyte Name | Analysis Method | Result | Units | MRL | Dil. | Date Analyzed | Q |
|---------------|-----------------|--------|---------|-----|------|----------------|---|
| Solids, Total | 160.3 Modified | 96.4 | Percent | - | 1 | 10/09/24 12:51 | |

Analytical Report

Client: Terraphase Engineering Inc.

Service Request: K2410639 **Date Collected:** 10/02/24 13:45 Upper Granite Creek Mines/0031.005.001

Project: Date Received: 10/08/24 14:45 **Sample Matrix:** Soil

Sample Name: UUMM-WRA-0.5-3 Basis: As Received

Lab Code: K2410639-005

| Analyte Name | Analysis Method | Result | Units | MRL | Dil. | Date Analyzed | Q |
|---------------|------------------------|--------|---------|-----|------|----------------|---|
| Solids, Total | 160.3 Modified | 94.9 | Percent | - | 1 | 10/09/24 12:51 | |

Analytical Report

Client: Terraphase Engineering Inc.

Service Request: K2410639

Date Collected: 10/02/24 13:44 **Project:** Upper Granite Creek Mines/0031.005.001 **Date Received:** 10/08/24 14:45 **Sample Matrix:** Soil

UUMM-WRA-0.5-3-DUP **Sample Name:** Basis: As Received

Lab Code: K2410639-006

| Analyte Name | Analysis Method | Result | Units | MRL | Dil. | Date Analyzed | Q |
|---------------------|------------------------|--------|---------|-----|------|----------------|---|
| Solids, Total | 160.3 Modified | 94.6 | Percent | - | 1 | 10/09/24 12:51 | |

Analytical Report

Client: Terraphase Engineering Inc.

Upper Granite Creek Mines/0031.005.001

Date Collected: 10/02/24 13:35

Sample Matrix:

Project:

Lab Code:

Soil

Date Received: 10/08/24 14:45

Service Request: K2410639

Sample Name:

UUMM-WRA-0.5-3-DS

K2410639-007

Basis: As Received

| Analyte Name | Analysis Method | Result | Units | MRL | Dil. | Date Analyzed | Q |
|---------------|------------------------|--------|---------|-----|------|----------------|---|
| Solids, Total | 160.3 Modified | 89.4 | Percent | - | 1 | 10/09/24 12:51 | |

Analytical Report

Client: Terraphase Engineering Inc.

Upper Granite Creek Mines/0031.005.001

Date Collected: 10/02/24 13:20

Service Request: K2410639

Sample Matrix: Soil

~ ...

Date Received: 10/08/24 14:45

Sample Name:

Project:

UMM-WRB-0.5-2

Lab Code: K2410639-008

Basis: As Received

| Analyte Name | Analysis Method | Result | Units | MRL | Dil. | Date Analyzed | Q |
|---------------|-----------------|--------|---------|-----|------|----------------|---|
| Solids, Total | 160.3 Modified | 95.4 | Percent | - | 1 | 10/09/24 12:51 | |

Analytical Report

Client: Terraphase Engineering Inc.

Service Request: K2410639 **Date Collected:** 10/02/24 13:25 Upper Granite Creek Mines/0031.005.001

Date Received: 10/08/24 14:45 **Sample Matrix:** Soil

Sample Name: UMM-WRB-0.5-2-DS Basis: As Received

Lab Code: K2410639-009

Project:

| Analyte Name | Analysis Method | Result | Units | MRL | Dil. | Date Analyzed | Q |
|---------------|-----------------|--------|---------|-----|------|----------------|---|
| Solids, Total | 160.3 Modified | 80.9 | Percent | - | 1 | 10/09/24 12:51 | |

Analytical Report

Client: Terraphase Engineering Inc.

Service Request: K2410639 **Date Collected:** 10/03/24 10:35 Upper Granite Creek Mines/0031.005.001

Project: Date Received: 10/08/24 14:45 **Sample Matrix:** Soil

Sample Name: LMM-WRB-0.5-1 Basis: As Received

Lab Code: K2410639-010

| Analyte Name | Analysis Method | Result | Units | MRL | Dil. | Date Analyzed | Q |
|---------------|------------------------|--------|---------|-----|------|----------------|---|
| Solids, Total | 160.3 Modified | 96.1 | Percent | - | 1 | 10/09/24 12:51 | |

Analytical Report

Client: Terraphase Engineering Inc.

Service Request: K2410639 **Date Collected:** 10/03/24 10:36 Upper Granite Creek Mines/0031.005.001

Sample Matrix: Soil

Project:

Sample Name: LMM-WRB-0.5-1-DUP Basis: As Received

Lab Code: K2410639-011

Inorganic Parameters

| Analyte Name | Analysis Method | Result | Units | MRL | Dil. | Date Analyzed | Q |
|---------------|------------------------|--------|---------|-----|------|----------------|---|
| Solids, Total | 160.3 Modified | 96.6 | Percent | - | 1 | 10/09/24 12:51 | |

Date Received: 10/08/24 14:45

Analytical Report

Client: Terraphase Engineering Inc.

Service Request: K2410639

Date Collected: 10/03/24 16:27 **Project:** Upper Granite Creek Mines/0031.005.001 **Date Received:** 10/08/24 14:45

Sample Matrix: Soil

CM-WRC-0.5-4 **Sample Name:** Basis: As Received

Lab Code: K2410639-012

| Analyte Name | Analysis Method | Result | Units | MRL | Dil. | Date Analyzed | Q |
|---------------|------------------------|--------|---------|-----|------|----------------|---|
| Solids, Total | 160.3 Modified | 95.6 | Percent | - | 1 | 10/09/24 12:51 | |

Analytical Report

Client: Terraphase Engineering Inc.

Project:

Service Request: K2410639 **Date Collected:** 10/02/24 12:15 Upper Granite Creek Mines/0031.005.001

Date Received: 10/08/24 14:45 **Sample Matrix:** Soil

Sample Name: UMM-WRA-0.5-1 Basis: As Received

Lab Code: K2410639-013

| Analyte Name | Analysis Method | Result | Units | MRL | Dil. | Date Analyzed | Q |
|---------------|------------------------|--------|---------|-----|------|----------------|---|
| Solids, Total | 160.3 Modified | 95.2 | Percent | - | 1 | 10/09/24 12:51 | |

Analytical Report

Client: Terraphase Engineering Inc.

Project:

Service Request: K2410639 **Date Collected:** 10/02/24 11:50 Upper Granite Creek Mines/0031.005.001

Date Received: 10/08/24 14:45 **Sample Matrix:** Soil

Sample Name: UMM-WRA-0.5-3 Basis: As Received

Lab Code: K2410639-014

| Analyte Name | Analysis Method | Result | Units | MRL | Dil. | Date Analyzed | Q |
|---------------|-----------------|--------|---------|-----|------|----------------|---|
| Solids, Total | 160.3 Modified | 91.5 | Percent | - | 1 | 10/09/24 12:51 | |

Analytical Report

Client: Terraphase Engineering Inc.

Project:

Service Request: K2410639 **Date Collected:** 10/02/24 12:05 Upper Granite Creek Mines/0031.005.001

Date Received: 10/08/24 14:45 **Sample Matrix:** Soil

Sample Name: UMM-WRA-0.5-1-DS Basis: As Received

Lab Code: K2410639-015

| Analyte Name | Analysis Method | Result | Units | MRL | Dil. | Date Analyzed | Q |
|---------------------|------------------------|--------|---------|-----|------|----------------|---|
| Solids, Total | 160.3 Modified | 94.4 | Percent | = | 1 | 10/09/24 12:51 | |

Analytical Report

Client: Terraphase Engineering Inc.

Service Request: K2410639 **Date Collected:** 10/03/24 09:30 Upper Granite Creek Mines/0031.005.001

Project:

Date Received: 10/08/24 14:45 **Sample Matrix:** Soil

Sample Name: LMM-WRA-0.5-3 Basis: As Received

Lab Code: K2410639-016

| Analyte Name | Analysis Method | Result | Units | MRL | Dil. | Date Analyzed | Q |
|---------------|-----------------|--------|---------|-----|------|----------------|---|
| Solids, Total | 160.3 Modified | 91.0 | Percent | - | 1 | 10/09/24 12:51 | |

Analytical Report

Client: Terraphase Engineering Inc.

Upper Granite Creek Mines/0031.005.001

Date Collected: 10/03/24 09:25

Service Request: K2410639

Sample Matrix:

Project:

Sample Name:

Soil

Date Received: 10/08/24 14:45

LMM-WRA-0.5-3-DS

Basis: As Received

Lab Code: K2410639-017

| Analyte Name | Analysis Method | Result | Units | MRL | Dil. | Date Analyzed | Q |
|---------------|------------------------|--------|---------|-----|------|----------------|---|
| Solids, Total | 160.3 Modified | 92.2 | Percent | - | 1 | 10/09/24 12:51 | |

Analytical Report

Client: Terraphase Engineering Inc.

Service Request: K2410639 **Date Collected:** 10/03/24 09:45 Upper Granite Creek Mines/0031.005.001

Date Received: 10/08/24 14:45 Soil

Sample Matrix:

Sample Name: LMM-WRA-0.5-4 Basis: As Received

Lab Code: K2410639-018

Project:

| Analyte Name | Analysis Method | Result | Units | MRL | Dil. | Date Analyzed | Q |
|---------------|-----------------|--------|---------|-----|------|----------------|---|
| Solids, Total | 160.3 Modified | 93.8 | Percent | - | 1 | 10/09/24 12:51 | |

Analytical Report

Client: Terraphase Engineering Inc.

Upper Granite Creek Mines/0031.005.001

Service Request: K2410639 **Date Collected:** 10/03/24 09:46

Project: Upper Grant
Sample Matrix: Soil

Date Received: 10/08/24 14:45

Sample Name:

Lab Code:

LMM-WRA-0.5-4-DUP

K2410639-019

Basis: As Received

| Analyte Name | Analysis Method | Result | Units | MRL | Dil. | Date Analyzed | Q |
|---------------|------------------------|--------|---------|-----|------|----------------|---|
| Solids, Total | 160.3 Modified | 93.7 | Percent | - | 1 | 10/09/24 12:51 | |

Analytical Report

Client: Terraphase Engineering Inc.

Service Request: K2410639

Date Collected: 10/02/24 13:10 **Project:** Upper Granite Creek Mines/0031.005.001 **Date Received:** 10/08/24 14:45 **Sample Matrix:** Soil

Sample Name: UMM-WRB-0.5-1 Basis: As Received

Lab Code: K2410639-020

| Analyte Name | Analysis Method | Result | Units | MRL | Dil. | Date Analyzed | Q |
|---------------|-----------------|--------|---------|-----|------|----------------|---|
| Solids, Total | 160.3 Modified | 96.3 | Percent | - | 1 | 10/09/24 12:51 | |



QC Summary Forms

ALS Environmental—Kelso Laboratory 1317 South 13th Avenue, Kelso, WA 98626 Phone (360) 577-7222 Fax (360) 425-9096 www.alsglobal.com



Metals

ALS Environmental—Kelso Laboratory 1317 South 13th Avenue, Kelso, WA 98626 Phone (360) 577-7222 Fax (360) 425-9096 www.alsglobal.com

Analytical Report

Client: Terraphase Engineering Inc. Service Request: K2410639

Project:Upper Granite Creek Mines/0031.005.001Date Collected: NASample Matrix:SoilDate Received: NA

Sample Name: Method Blank Basis: Dry

Lab Code: KQ2416342-03

| | Analysis | | | | | | | Date | |
|---------------------|----------|--------|-------|------|-------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | ND U | mg/Kg | 0.5 | 0.06 | 5 | 10/22/24 09:44 | 10/10/24 | |
| Lead | 6020B | ND U | mg/Kg | 0.05 | 0.020 | 5 | 10/22/24 09:44 | 10/10/24 | |

Analytical Report

Client: Terraphase Engineering Inc. Service Request: K2410639

Project:Upper Granite Creek Mines/0031.005.001Date Collected: NASample Matrix:SoilDate Received: NA

Sample Name: Method Blank Basis: Dry

Lab Code: KQ2416426-03

| | Analysis | | | | | | | Date | |
|---------------------|----------|--------|-------|------|-------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Mercury | 7471B | ND U | mg/Kg | 0.02 | 0.002 | 1 | 10/15/24 09:02 | 10/14/24 | |

Analytical Report

Client: Terraphase Engineering Inc. Service Request: K2410639

Project:Upper Granite Creek Mines/0031.005.001Date Collected: NASample Matrix:SoilDate Received: NA

Sample Name: Method Blank Basis: Dry

Lab Code: KQ2416652-01

Total Metals – IVBA Analysis

| | Analysis | | | | | | | Date | |
|---------------------|----------|---------|-------|------|-------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | ND U | mg/Kg | 0.5 | 0.06 | 5 | 10/22/24 15:43 | 10/17/24 | |
| Lead | 6020B | 0.043 J | mg/Kg | 0.05 | 0.020 | 5 | 10/22/24 15:43 | 10/17/24 | |

Analytical Report

Client: Terraphase Engineering Inc. Service Request: K2410639

Project:Upper Granite Creek Mines/0031.005.001Date Collected: NASample Matrix:SoilDate Received: NA

Sample Name: Method Blank Basis: Dry

Lab Code: KQ2416789-01

IVBA Metals

| | Analysis | | | | | | | Date | |
|--------------|----------|--------|-------|------|-------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | ND U | mg/Kg | 0.5 | 0.06 | 5 | 10/17/24 10:57 | 10/16/24 | |
| Lead | 6020B | ND U | mg/Kg | 0.05 | 0.020 | 5 | 10/17/24 10:57 | 10/16/24 | |

QA/QC Report

Client: Terraphase Engineering Inc.

Service Request:

K2410639

Project:

Upper Granite Creek Mines/0031.005.001

Date Collected:

10/02/24

Sample Matrix: Soil

Date Received:

10/08/24

Date Analyzed:

10/22/24

Date Extracted:

10/10/24

Matrix Spike Summary

Total Metals

Sample Name:

UUMM-WRA-0.5-2

Units: Basis:

mg/Kg Dry

Lab Code:

K2410639-002

Analysis Method: Prep Method:

6020B

EPA 3050B

Matrix Spike KQ2416342-02

| Analyte Name | Sample Result | Result | Spike Amount | % Rec | % Rec Limits |
|--------------|---------------|--------|--------------|-------|--------------|
| Arsenic | 1940 | 2330 | 88.4 | 440 # | 75-125 |
| Lead | 94.3 | 195 | 88.4 | 114 | 75-125 |

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

Matrix Spike and Matrix Spike Duplicate Data is presented for information purposes only. The matrix may or may not be relevant to samples reported in this report. The laboratory evaluates system performance based on the LCS and LCSD control limits.

Printed 10/23/2024 5:06:15 PM

QA/QC Report

Client: Terraphase Engineering Inc. **Service Request:**

K2410639

Sample Matrix:

Project:

Upper Granite Creek Mines/0031.005.001

Date Collected:

10/02/24

Soil

Date Received:

10/08/24

Date Analyzed: **Date Extracted:** 10/15/24 10/14/24

Matrix Spike Summary

Total Metals

UMM-WRB-0.5-1

Units:

mg/Kg

Lab Code:

K2410639-020

Basis:

Dry

Analysis Method: Prep Method:

Sample Name:

7471B Method

Matrix Spike

KQ2416426-02

Analyte Name Sample Result Result Spike Amount % Rec % Rec Limits 1.25 0.50 118 Mercury 0.66 80-120

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

Matrix Spike and Matrix Spike Duplicate Data is presented for information purposes only. The matrix may or may not be relevant to samples reported in this report. The laboratory evaluates system performance based on the LCS and LCSD control limits.

Printed 10/23/2024 5:06:15 PM

ALS Group USA, Corp.

dba ALS Environmental

QA/QC Report

Client: Terraphase Engineering Inc. **Service Request:** K2410639

Project Upper Granite Creek Mines/0031.005.001 **Date Collected:** 10/02/24

Date Analyzed: 10/22/24

Soil **Sample Matrix:**

Date Received: 10/08/24

Replicate Sample Summary Total Metals

Sample Name: UUMM-WRA-0.5-2 Units: mg/Kg

Lab Code: K2410639-002 Basis: Dry

Duplicate

| | | | | | Sample | | | |
|--------------|----------|-------|-------|--------|--------------|---------|------|-----------|
| | Analysis | | | Sample | KQ2416342-01 | | | |
| Analyte Name | Method | MRL | MDL | Result | Result | Average | RPD | RPD Limit |
| Arsenic | 6020B | 9.2 | 1.1 | 1940 | 2170 | 2060 | 11 | 20 |
| Lead | 6020B | 0.046 | 0.018 | 94.3 | 179 | 137 | 62 * | 20 |

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

ALS Group USA, Corp.

dba ALS Environmental

QA/QC Report

Client: Terraphase Engineering Inc. Service Request: K2410639

Project Upper Granite Creek Mines/0031.005.001 Date Collected: 10/02/24

Sample Matrix: Soil **Date Received:** 10/08/24

Date Analyzed: 10/15/24

Replicate Sample Summary

Total Metals

Sample Name: UMM-WRB-0.5-1 Units: mg/Kg Lab Code: K2410639-020

Basis: Dry

Duplicate

Sample

Analysis Sample KQ2416426-01 **Analyte Name** Method **MRL MDL** Result Result Average **RPD RPD Limit** 7471B Mercury 0.094 0.009 0.663 0.952 0.80836 * 20

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

QA/QC Report

Client: Terraphase Engineering Inc.

Project: Upper Granite Creek Mines/0031.005.001 Date Analyzed: 10/22/24

Sample Matrix: Soil

Lab Control Sample Summary Total Metals

> Units:mg/Kg Basis:Dry

Service Request: K2410639

Lab Control Sample

KQ2416342-04

| Analyte Name | Analytical Method | Result | Spike Amount | % Rec | % Rec Limits |
|--------------|--------------------------|--------|--------------|-------|--------------|
| Arsenic | 6020B | 107 | 100 | 107 | 80-120 |
| Lead | 6020B | 111 | 100 | 111 | 80-120 |

QA/QC Report

Client: Terraphase Engineering Inc.

Service Request: K2410639 **Project:** Upper Granite Creek Mines/0031.005.001 **Date Analyzed:** 10/15/24

Sample Matrix: Soil

> **Lab Control Sample Summary Total Metals**

> > Units:mg/Kg Basis:Dry

Lab Control Sample KQ2416426-04

| Analyte Name | Analytical Method | Result | Spike Amount | % Rec | % Rec Limits |
|---------------------|--------------------------|--------|--------------|-------|--------------|
| Mercury | 7471B | 0.520 | 0.500 | 104 | 80-120 |

QA/QC Report

Client: Terraphase Engineering Inc.

Project: Upper Granite Creek Mines/0031.005.001 Date Analyzed: 10/22/24

Sample Matrix: Soil

Lab Control Sample Summary Total Metals – IVBA Analysis

Units:mg/Kg
Basis:Dry

Service Request: K2410639

Lab Control Sample

KQ2416652-02

| Analyte Name | Analytical Method | Result | Spike Amount | % Rec | % Rec Limits |
|--------------|--------------------------|--------|--------------|-------|--------------|
| Arsenic | 6020B | 108 | 100 | 108 | 80-120 |
| Lead | 6020B | 111 | 100 | 111 | 80-120 |

QA/QC Report

Client: Terraphase Engineering Inc.

Project: Upper Granite Creek Mines/0031.005.001 Date Analyzed: 10/17/24

Sample Matrix: Soil

Lab Control Sample Summary
IVBA Metals

Units:mg/Kg
Basis:Dry

Service Request: K2410639

Lab Control Sample

KQ2416789-02

| Analyte Name | Analytical Method | Result | Spike Amount | % Rec | % Rec Limits |
|--------------|--------------------------|--------|--------------|-------|--------------|
| Arsenic | 6020B | 92.9 | 100 | 93 | 80-120 |
| Lead | 6020B | 105 | 100 | 105 | 80-120 |



General Chemistry

ALS Environmental—Kelso Laboratory 1317 South 13th Avenue, Kelso, WA 98626 Phone (360) 577-7222 Fax (360) 425-9096 www.alsglobal.com

ALS Group USA, Corp.

dba ALS Environmental

QA/QC Report

Client: Terraphase Engineering Inc.

Date Collected: 10/03/24

Project Upper Granite Creek Mines/0031.005.001

Date Received: 10/08/24

Service Request: K2410639

Sample Matrix: Soil

Sample Name:

Lab Code:

Date Analyzed: 10/09/24

Replicate Sample Summary Inorganic Parameters

LMM-WRB-0.5-3-DS

Units: Percent

K2410639-001

Basis: As Received

Duplicate Sample

K2410639-

Sample

001DUP

Analyte Name Analysis Method Result **MRL** Result **RPD** RPD Limit Average Solids, Total 160.3 Modified 95.4 94.9 95.2

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

ALS Group USA, Corp.

dba ALS Environmental

QA/QC Report

Client: Terraphase Engineering Inc. Service Request: K2410639

Project

Upper Granite Creek Mines/0031.005.001

Date Collected: 10/02/24

Sample Matrix:

Soil

Date Received: 10/08/24

Date Analyzed: 10/09/24

Replicate Sample Summary

Inorganic Parameters

Sample Name:

Lab Code:

UMM-WRB-0.5-1

Units: Percent

K2410639-020

Basis: As Received

Duplicate

Sample

K2410639-

Sample

020DUP

Analyte Name

Analysis Method

MRL

Average

RPD

RPD Limit

Result Result Solids, Total 160.3 Modified 96.3 96.5 96.4

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

Printed 10/23/2024 5:06:18 PM

Superset Reference:24-0000711471 rev 00



November 01, 2024

Portland, OR 97205

Terraphase Engineering Inc. 610 SW Broadway, Suite 405

Don Malkemus

ALS Environmental ALS Group USA, Corp 1317 South 13th Avenue Kelso, WA 98626

T:+1 360 577 7222

F: +1 360 636 1068 www.alsglobal.com

Analytical Report for Service Request No: K2410642

Revised Service Request No: K2410642.01

RE: Upper Granite Creek Mines / 0031.005.001

Dear Don,

Enclosed is the revised report of the sample(s) submitted to our laboratory October 08, 2024 For your reference, these analyses have been assigned our service request number **K2410642**.

The bio accessibility values are now included.

Analyses were performed according to our laboratory's NELAP-approved quality assurance program. The test results meet requirements of the current NELAP standards, where applicable, and except as noted in the laboratory case narrative provided. For a specific list of NELAP-accredited analytes, refer to the certifications section at www.alsglobal.com. All results are intended to be considered in their entirety, and ALS Group USA Corp. dba ALS Environmental (ALS) is not responsible for use of less than the complete report. Results apply only to the items submitted to the laboratory for analysis and individual items (samples) analyzed, as listed in the report.

We apologize for any inconvenience this may have created.

Please contact me if you have any questions. My extension is 3376. You may also contact me via email at Mark.Harris@alsglobal.com.

Respectfully submitted,

noe D. Daw

ALS Group USA, Corp. dba ALS Environmental

Mark Harris

Project Manager



ALS Environmental ALS Group USA, Corp 1317 South 13th Avenue Kelso, WA 98626

T: +1 360 577 7222 F: +1 360 636 1068 www.alsglobal.com

Table of Contents

Acronyms

Qualifiers

State Certifications, Accreditations, And Licenses

Case Narrative

Chain of Custody

Total Solids

Metals

Acronyms

ASTM American Society for Testing and Materials

A2LA American Association for Laboratory Accreditation

CARB California Air Resources Board

CAS Number Chemical Abstract Service registry Number

CFC Chlorofluorocarbon
CFU Colony-Forming Unit

DEC Department of Environmental Conservation

DEQ Department of Environmental Quality

DHS Department of Health Services

DOE Department of Ecology
DOH Department of Health

EPA U. S. Environmental Protection Agency

ELAP Environmental Laboratory Accreditation Program

GC Gas Chromatography

GC/MS Gas Chromatography/Mass Spectrometry

LOD Limit of Detection
LOQ Limit of Quantitation

LUFT Leaking Underground Fuel Tank

M Modified

MCL Maximum Contaminant Level is the highest permissible concentration of a substance

allowed in drinking water as established by the USEPA.

MDL Method Detection Limit
MPN Most Probable Number
MRL Method Reporting Limit

NA Not Applicable
NC Not Calculated

NCASI National Council of the Paper Industry for Air and Stream Improvement

ND Not Detected

NIOSH National Institute for Occupational Safety and Health

PQL Practical Quantitation Limit

RCRA Resource Conservation and Recovery Act

SIM Selected Ion Monitoring

TPH Total Petroleum Hydrocarbons

tr Trace level is the concentration of an analyte that is less than the PQL but greater than or

equal to the MDL.

Inorganic Data Qualifiers

- * The result is an outlier. See case narrative.
- # The control limit criteria is not applicable.
- B The analyte was found in the associated method blank at a level that is significant relative to the sample result as defined by the DOD or NELAC standards.
- F. The result is an estimate amount because the value exceeded the instrument calibration range.
- J The result is an estimated value.
- U The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL.
 DOD-QSM 4.2 definition: Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
- i The MRL/MDL or LOQ/LOD is elevated due to a matrix interference.
- X See case narrative.
- Q See case narrative. One or more quality control criteria was outside the limits.
- H The holding time for this test is immediately following sample collection. The samples were analyzed as soon as possible after receipt by the laboratory.

Metals Data Qualifiers

- # The control limit criteria is not applicable.
- J The result is an estimated value.
- E The percent difference for the serial dilution was greater than 10%, indicating a possible matrix interference in the sample.
- M The duplicate injection precision was not met.
- N The Matrix Spike sample recovery is not within control limits. See case narrative.
- S The reported value was determined by the Method of Standard Additions (MSA).
- U The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL. DOD-QSM 4.2 definition: Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
- W The post-digestion spike for furnace AA analysis is out of control limits, while sample absorbance is less than 50% of spike absorbance.
- i The MRL/MDL or LOQ/LOD is elevated due to a matrix interference.
- X See case narrative.
- + The correlation coefficient for the MSA is less than 0.995.
- Q See case narrative. One or more quality control criteria was outside the limits.

Organic Data Qualifiers

- * The result is an outlier. See case narrative.
- # The control limit criteria is not applicable. See case narrative.
- A A tentatively identified compound, a suspected aldol-condensation product.
- B The analyte was found in the associated method blank at a level that is significant relative to the sample result as defined by the DOD or NELAC standards.
- C The analyte was qualitatively confirmed using GC/MS techniques, pattern recognition, or by comparing to historical data.
- D The reported result is from a dilution.
- E The result is an estimated value.
- J The result is an estimated value.
- N The result is presumptive. The analyte was tentatively identified, but a confirmation analysis was not performed.
- P The GC or HPLC confirmation criteria was exceeded. The relative percent difference is greater than 40% between the two analytical results.
- U The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL.
 DOD-QSM 4.2 definition: Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
- i The MRL/MDL or LOQ/LOD is elevated due to a chromatographic interference.
- X See case narrative.
- Q See case narrative. One or more quality control criteria was outside the limits.

Additional Petroleum Hydrocarbon Specific Qualifiers

- F The chromatographic fingerprint of the sample matches the elution pattern of the calibration standard.
- L The chromatographic fingerprint of the sample resembles a petroleum product, but the elution pattern indicates the presence of a greater amount of lighter molecular weight constituents than the calibration standard.
- H The chromatographic fingerprint of the sample resembles a petroleum product, but the elution pattern indicates the presence of a greater amount of heavier molecular weight constituents than the calibration standard.
- O The chromatographic fingerprint of the sample resembles an oil, but does not match the calibration standard.
- Y The chromatographic fingerprint of the sample resembles a petroleum product eluting in approximately the correct carbon range, but the elution pattern does not match the calibration standard.
- Z The chromatographic fingerprint does not resemble a petroleum product.

ALS Group USA Corp. dba ALS Environmental (ALS) - Kelso State Certifications, Accreditations, and Licenses

| Agency | Web Site | Number |
|--------------------------|---|-------------|
| Alaska DEH | http://dec.alaska.gov/eh/lab/cs/csapproval.htm | UST-040 |
| Arizona DHS | http://www.azdhs.gov/lab/license/env.htm | AZ0339 |
| Arkansas - DEQ | http://www.adeq.state.ar.us/techsvs/labcert.htm | 88-0637 |
| California DHS (ELAP) | http://www.cdph.ca.gov/certlic/labs/Pages/ELAP.aspx | 2795 |
| DOD ELAP | http://www.denix.osd.mil/edqw/Accreditation/AccreditedLabs.cfm | L16-58-R4 |
| Florida DOH | http://www.doh.state.fl.us/lab/EnvLabCert/WaterCert.htm | E87412 |
| Hawaii DOH | http://health.hawaii.gov/ | - |
| ISO 17025 | http://www.pjlabs.com/ | L16-57 |
| Louisiana DEQ | http://www.deq.louisiana.gov/page/la-lab-accreditation | 03016 |
| Maine DHS | http://www.maine.gov/dhhs/ | WA01276 |
| Minnesota DOH | http://www.health.state.mn.us/accreditation | 053-999-457 |
| Nevada DEP | http://ndep.nv.gov/bsdw/labservice.htm | WA01276 |
| New Jersey DEP | http://www.nj.gov/dep/enforcement/oqa.html | WA005 |
| New York - DOH | https://www.wadsworth.org/regulatory/elap | 12060 |
| | https://deq.nc.gov/about/divisions/water-resources/water-resources-data/water-sciences-home-page/laboratory-certification-branch/non-field-lab- | |
| North Carolina DEQ | certification | 605 |
| Oklahoma DEQ | http://www.deq.state.ok.us/CSDnew/labcert.htm | 9801 |
| Oregon – DEQ (NELAP) | http://public.health.oregon.gov/LaboratoryServices/EnvironmentalLaboratoryAccreditation/Pages/index.aspx | WA100010 |
| South Carolina DHEC | http://www.scdhec.gov/environment/EnvironmentalLabCertification/ | 61002 |
| Texas CEQ | http://www.tceq.texas.gov/field/qa/env_lab_accreditation.html | T104704427 |
| Washington DOE | http://www.ecy.wa.gov/programs/eap/labs/lab-accreditation.html | C544 |
| Wyoming (EPA Region 8) | https://www.epa.gov/region8-waterops/epa-region-8-certified-drinking-water- | - |
| Kelso Laboratory Website | www.alsglobal.com | NA |

Analyses were performed according to our laboratory's NELAP-approved quality assurance program. A complete listing of specific NELAP-certified analytes, can be found in the certification section at www.ALSGlobal.com or at the accreditation bodies web site.

Please refer to the certification and/or accreditation body's web site if samples are submitted for compliance purposes. The states highlighted above, require the analysis be listed on the state certification if used for compliance purposes and if the method/anlayte is offered by that state.



Case Narrative

ALS Environmental—Kelso Laboratory 1317 South 13th Avenue, Kelso, WA 98626 Phone (360)577-7222 Fax (360)636-1068 www.alsglobal.com



Client:Terraphase Engineering Inc.Service Request: K2410642Project:Upper Granite Creek MinesDate Received: 10/08/2024

Sample Matrix: Soil

CASE NARRATIVE

All analyses were performed consistent with the quality assurance program of ALS Environmental. This report contains analytical results for samples for the Tier II level requested by the client.

Sample Receipt:

Twenty soil samples were received for analysis at ALS Environmental on 10/08/2024. Any discrepancies upon initial sample inspection are annotated on the sample receipt and preservation form included within this report. The samples were stored at minimum in accordance with the analytical method requirements.

Metals:

No significant anomalies were noted with this analysis.

Approved by Moe D. Daw

Date 11/01/2024



Chain of Custody

ALS Environmental—Kelso Laboratory 1317 South 13th Avenue, Kelso, WA 98626 Phone (360)577-7222 Fax (360)636-1068 www.alsglobal.com

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CHAIN OF CUSTODY

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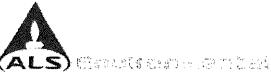
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| EM-WR3-05-1 | - 9 | | 1300 | Soil | 2 | - | | | _ | Х | | • | | | | | | | - | • | |
| EW-PBY -0-2-5 | 9 | 10/5 | 1205 | Soil | 2 | ╫ | \vdash | -× | k | X | | | | | | | | + bag | | | |
| EM-WR6-05-1 | 9 | 1015 | 1240 | Soil | 7 | ╁ | | | | λ | | | | | | | - | ~ 7 | - | | |
| F-WRA-0.5-1 | 7 | 10/5 | 0430 | Soil | Z | 1- | \vdash | | | X | | | | | | | | | | | |
| F-WRO-05-6 | 10 | 1015 | HIO | Seil | 12 | ╁── | \vdash | | | x | | | | | | | - | | - | | |
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| F - DR -0.5-1 | 13 | 16/5 | 1035 | Sail | 12 | ╁ | ╁ | | | J. | | | \dashv | | | - | | | | | |
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| eport Requirements | | oice Inf | ormation | Ì | .1 | <u></u> | | | | | | 1 | | | 1 | | 1 | | | | |
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| ature | Signature | - 0 | | Sign | ature | | 7/ | | | | 8 | gnat | ure | | _ | | | Signature | <u> </u> | Signature | |
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| 10/8 1306 | | | 7 | | | | 7 | 7 | | | | | | | | | | | | | |
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|--|---|--------------|----------------|----------------|---------------|----------|-------------------|-------------|-------------------|------------------|------------------|---|--------------|--------|-------|----------|----------|-------------|----------------|-------------------|------------------|-----------------|
| Project Name Upple Grant Creek M. Project Manager D. AA. 16. | Project N | lumber: O | 031.005.001 | | | Cac | 3 | | 180D | | 8 | 3880 | | | | | | | | | 1063/ | |
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| | | | AMPLING | Matrix | | | | | -6 | Į6. | 9 | l " | | ~ | ~ | *† | ~ | 1101 | IIOIICO | | | |
| CLIENT SAMPLE ID | LABID | | Time State | ļ | | 1 | | | | _ | | | | | _ | | _ | | | 4 | | |
| .GCS-WRA -0.5-4-03 | <u>عا۱</u> | 10 4 | 1222 | 5021 | 2 | | \Box | × | ኡ | | <u> </u> | | | | | | _ | + pal | | | | |
| GCG - WFA - 0.5 - 2 | | 1014 | | 50:1 | 2 | | | ¥ | ۲. | × | | | | | | | _ | + 645 | | | | |
| 1.GCG - WR4 -0.5-1 | 156 | 1614 | 1645 | 1:42 | 2 | | | | | λ | | | | | | | | | | _ | | |
| GC7-494-05-3 | 19 | 1014 | 1150 | Suil | 2 | | | | | X | | | | | | | | | | | | |
| .GC7-6-18-0-5-1 | 7.0 | 1014 | ll12 | 50.1 | 2. | | | | | አ | | | | | | | | | | _ | | |
| T L - 4RA - 0.5-3 | 7700 | 10 4 | 1405 | 50.1 | 2 | | | | | × | | | | | | | | | | | | • |
| - 71 - WRB - 0.5-4 | | 1014 | 1425 | Se. 1 | 2 | | | | | ¥ | | | | | | | | | | | | |
| - TL-WPA-0.5-1-05-2 | | 13 4 | 1400 | 5.:1 | 7 | | | + | ¥ | ¥ | | | | | | | | + 649 | | | | |
| 5H-WKB-0.5-2 | | 10 4 | 1005 | 1:02 | 2 | | | | | X | | | | | | | | | | | | |
| 0.9H-LRC- 0.5-1 | | 1014 | lois | اد به | 2 | | | | | X | | | | | | | | | | | | |
| Report Requirements | | oice Ir | nformation | | | | | | | | | | | | | <u>Ç</u> | rcle v | which meta | s are to be ar | alvzed | | |
| I. Routine Report: Method Blank, Surrogate, as | P.O.#_ | | eraphyx- cov | , | | | Total | Mets | ale. Q | 1 6 | G . | h R | a Re | s R | Ca | Cd (| ີກ ໃ | Or Ou F | e Ph Ma | Mn Mo Ni K Ag N | la Co Cr Ti Co | V 70 He |
| required | 1 5111 10 | · MACE ! | -11-18-11-1 | - | | | | | | | _ | | | | | | | | | | | - |
| II. Report Dup., MS, MSD | *************************************** | | | _ | | | | | | | | 50 | ьа | R6 I | | | | | | Ag Mn Mo Ni K Ag | | - |
| as required | Turnar | ound | Requireme | nts | pecia | IInst | ructio | ons/C | Jom | men | its: | | | | "in | dicate | Sta | ate Hydr | ocarbon P | rocedure: AK CA W | /I Northwest Oth | er (Circle One) |
| III. CLP Like Summary (no raw data) | 2 | 4 hr. Day | 48 hr. | 1 | - | | | | | | | | | | | | | | | | | |
| IV. Data Validation Report | X S | itandard | | | | | | | | | | | | | | | | | | | | |
| V. EDD | | Conventor | ! Report Date | | | | | | | | | | | | | , | | | | | | |
| Relinquished By: | | 77774 | red By: | | Re | ling | uish | ed | Ву: | | T | | F | Rece | ive | d By | - | 1 | Re | linquished By: | R | eceived By: |
| | <u> </u> | | 1 | | | _ | | 1 | | | \bot | | | | | | | | | | | |
| ignature | Signature | F | | Sigr | ature | 0 | 74 | | | | S | ignat V/2 | lane Laya | اً ۲ | >. | de | B | 2n | Signature | | Signature | |
| rinted Name Millemy | Printed, N | | BiL | Prin | ted N | | | Lá | \mathcal{B}_{i} | he | | rinte | | | | | | | Printed Na | ime | Printed Nan | ne |
| im tel | Firm / | 5 | | Fim | | _5 | _ | į | | | TF: | írm \()))ate/⊓ | | Ľ | | 44 | 5 | | Firm | | Firm | |
| ate/Time | Date/Tim | e/0/0 | 8/24 /30 | 6 Date | e/Time | | \\ / ₂ | 24 | 74 | 144 | | ate/ | Time | ······ | | | | | Date/Time | | Date/Time | |
| 10/8 1306 | _ | 7 7 | -, , | | | ,- | , | - 1 | · | | | | | | | | | | | | | |

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|---|------------------------|----------|----------|----------|---|-----------------|------------|---------------------------------------|-----------------------------|-----------|---|
| Tearding | ooler Receipt | and F | rese | | | | s . | ~1 11" | Promp. | 7- | |
| Client levaguese | 01645 | | <u> </u> | Sei | | Request / | (24) | 2646 | | a F | |
| Received: 1018124 Opened: | 018124 | By: _ | Δ | 1_ | Unl | oaded: _ | 1018 | 129 | By: <u></u> | <u> </u> | |
| 1. Samples were received via? USPS | Fed Ex | UPS | D | HL | P | DX. | Court | er) 1 | and Deliv | ered | |
| 2. Samples were received in: (circle) Caol | Box | E | ivelope | | Ot | her | <u> </u> | | | NA . | |
| 3. Were <u>custody seals</u> on coolers? NA | Y (N) I | f yes, h | ow mar | y and | where' | 7 | ., | | | | |
| ' If present, were custody seals intact? | YNI | f presen | it, were | they s | igned a | and dated? | ? | | Y | N | |
| | | | | 9.17. | 1 | | | · · · · · · · · · · · · · · · · · · · | | | |
| | | | Outo | f temp | | PM Notifie | a I | ** | | | |
| | ooler #/COC ID / N/ | 1 | indicate | | | if out of t | | Trackii | ng Numbe | NA_ | Filed |
| 19.6 14.6 -1801 1 | 40510 | | | | | | | | | | |
| 1.8 5.7 | | | | | | | | | | • | |
| (0.0 4.4 | | | | | | | | | | | |
| a.u 14.5 | | | <u>.</u> | | 1 | | | | | | |
| 107 115 | | _ | | | + | | | | | | |
| 4. Was a Temperature Blank present in cooler? NA | A (Y) N | If ves n | otate th | e temp | eratur | e in the an | propriate | column ab | ove: | | |
| If no, take the temperature of a representative sa | _ | • | | - | | - | | | | | |
| 5. Were samples received within the method specifi | - | | | | | | J | NA. | $\left(\mathbf{v} \right)$ | N | |
| If no, were they received on ice and same day as | | - | cooler | # abov | ve and | potify the | РМ | NA |) v | N | |
| · · · · · · · · · · · · · · · · · · · | zen Partially Th | | Thaw | | . • | | - 2121 | |) | | |
| | • | | * | | | | | | | | |
| | le Wrap Gel Pack | Wet | Ice 1 | ry Ice | Sle | eves | | | | | |
| 7. Were custody papers properly filled out (ink, signature) | • | | | | | | | NA | | N | |
| 8. Were samples received in good condition (unbro | | | | | | | | NA | > * | N | |
| Were all sample labels complete (ie, analysis, p. Did all sample labels and tags agree with custod | | | * | | | | | NA NA | Y | N N | |
| 11. Were appropriate bottles/containers and volume | | ete indi | cated? | | | | | NA | \sim | N | |
| 12. Were the pH-preserved bottles (see SMO GEN. | | | | 17 Ind | licate i | n the table | e helow | NA | Y | N | |
| 13. Were VOA vials received without headspace? | - | | mute pr | 4. 2,,,, | .,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,, | | | NA | | N | |
| 14. Was C12/Res negative? | maicale in the table | DEIUW, | | | | | | NA NA | Y | N | |
| 15. Were samples received within the method speci | ified time limit? If n | ot note | to the o | mor ha | low an | d notify th | e PM | (NA | Y | N | |
| 16. Were 100ml sterile microbiology bottles filled | | | - / | } | Y Y | no monny a N | IC I IVI | Under | / | Overfille | .d |
| 16. Were fooms sterne microbiology bottles filled t | exactly to the 100m | mark? | _(^N | A | | 14 | | Onder | - C | | <u> </u> |
| Sample ID on Bottle | Sample | ID on | COC | | | | | Identifie | d by: | | |
| | | | | | | | | | | | |
| | | | ··· | | | | | | | | |
| | | | | | | | | | | | *************************************** |
| | | | | | | | | | | | |
| | Bottle Count | Head- | | | | | Volume | Reager | t Lot | | |
| Sample ID | Bottle Type | space | Broke | рН | Re | agent | added | Num | | initials | Time |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| Notes, Discrepancies, Resolutions: | | | | | | | | | | | |

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SOP: SMO-GEN

Reviewed: NP 1/3/2024

G:\SMO\2024 Forms



Cooler Receipt and Preservation Form

| | T | - | <u> </u> | | | | | e Request <i>K2</i> | | | | |
|--------------------|-------------------|--------------|-------------|---------------|--|---------------|-----------------------|--|----------|--|------------|-------------|
| Temp Blank | Sample Temp | IR Gun | Cooler #/C | OC ID / N | iA | Out Indica | of temp te with ") | PM Notifie (" if out of t | d emp | Tracking Nur | nber NA | File |
| A8: 7.8 | 3.8 | 1801 | | | | | | | | | | |
| 11.2 | 5.5 | W_ | | ··· | | | | | | (************************************ | | |
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| | | | , | | | | | | | | | |
| | | | | | | | | | - | | f · | |
| Sar | mpie ID on Bottie | | | Sample li | D on C | OC | | | ld | entified by: | • | |
| | | | | | | | | | | | | |
| | | | | | | ···· | | | | | | |
| | | | | | | | | | | | | |
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| | | | ottle Count | Out of | | | य संब | <u>. C</u> aranta da Santa da Caranta d | Volume | Reagent Lot | I I | |
| | Sample ID | В | ottle Type | Temp | space | Broke | pН | Reagent | added | Number | Initials | Time |
| | | | | | | | | | | | | |
| | | | | 1 | ······································ | | | | | | | ······ |
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| | ancies & Resol | utions: 10 | <u>ا س</u> | is a | + + | 700 | <u>04</u> | <u>coolers</u> | > 0) | a topo | <u> </u> | •••• |
| tes, Discrep | | 2 ^ ^ | blan | R C | <u>cas</u> | <u> </u> | nde | rtle | SUN | gles, r | <u>lot</u> | |
| stes, Discrep | ples. To | JAK - | | 5 | | | | | | | | ····· |
| San judi | ples. Te | L S | mpl | ا ر () | ten | AP_ | | ······································ | | | | |
| Sam judi | ples. To | S S | ampl | ا <u> </u> | ten | P | | | | | | |
| Sam judi | ples. To | S S | ampl | ا - رق | ten | P | | | | | | |
| Sam judi | des. Te | sing S | ampl | ا <u>. وي</u> | ten | P | | | | | | |
| Sam judi | des. Te | S S | anyol | | tea | AP | | | | | | |
| Sam Sam | ples. To | S S | anyol | | tea | AP | | | | | | |
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G:\SMO\2024 Forms

SOP: SMO-GEN

Reviewed: NP 1/3/2024

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Total Solids

ALS Environmental—Kelso Laboratory 1317 South 13th Avenue, Kelso, WA 98626 Phone (360)577-7222 Fax (360)636-1068 www.alsglobal.com

Analytical Report

Client: Terraphase Engineering Inc.

Date Collected: 10/02/24 - 10/05/24 **Project:** Upper Granite Creek Mines/0031.005.001

Sample Matrix: Soil **Date Received:** 10/8/24

Analysis Method: 160.3 Modified

Units: Percent **Prep Method:** Basis: As Received None

Solids, Total

| Sample Name | Lab Code | Result | MRL | Dil. | Date Analyzed | Q |
|------------------|-----------------------------|--------|-----|------|------------------|---|
| UMM-TLB-0.5-1 | K2410642-001 | 86.4 | - | 1 | 10/10/24 10:19 | |
| UMM-TLB-0.5-4 | K2410642-002 | 91.8 | - | 1 | 10/10/24 10:19 | |
| UMM-TLC-0.5-1 | K2410642-003 | 79.3 | - | 1 | 10/10/24 10:19 | |
| UMM-TLC-0.5-2 | K2410642-004 | 76.8 | - | 1 | 10/10/24 10:19 | |
| UMM-TLA-0.5-6 | K2410642-005 | 91.8 | - | 1 | 10/10/24 10:19 | |
| CEM-WRA-0.5-4-DS | K2410642-006 | 96.8 | - | 1 | 10/10/24 10:19 | |
| CEM-WRB-0.5-1 | K2410642-007 | 96.5 | - | 1 | 10/10/24 10:19 | |
| CEM-WRA-0.5-2 | K2410642-008 | 95.3 | - | 1 | 10/10/24 10:19 | |
| CEM-WRC-0.5-1 | K2410642-009 | 95.1 | - | 1 | 10/10/24 10:19 | |
| GF-WRA-0.5-1 | K2410642-010 | 97.0 | - | 1 | 10/10/24 10:19 | |
| GF-WRD-0.5-6 | K2410642-011 | 95.1 | - | 1 | 10/10/24 10:19 | |
| GF-WRD-0.5-4-DS | K2410642-012 | 97.0 | - | 1 | 10/10/24 10:19 | |
| GF-DR-0.5-1 | K2410642-013 | 97.2 | - | 1 | 10/10/24 10:19 | |
| GC5-WRA-0.5-3 | K2410642-014 | 96.2 | - | 1 | 10/10/24 10:19 | |
| GC5-WRA-0.5-4 | K2410642-015 | 95.8 | - | 1 | 10/10/24 10:19 | |
| GC5-WRA-0.5-4-DS | K2410642-016 | 96.0 | - | 1 | 10/10/24 10:19 | |
| GC6-WRA-0.5-2 | K2410642-017 | 94.4 | - | 1 | 10/10/24 10:19 | |
| GC6-WRA-0.5-1 | K2410642-018 | 93.7 | - | 1 | 10/10/24 10:19 | |
| GC7-WRA-0.5-3 | -3 K2410642-019 95.2 | | - | 1 | 10/10/24 10:19 | |
| GC7-WRB-0.5-1 | K2410642-020 | 96.1 | - | 1 | 10/10/24 10:19 | |

Service Request: K2410642

QA/QC Report

Service Request: K2410642

Client: Terraphase Engineering Inc.

Project Upper Granite Creek Mines/0031.005.001 **Date Collected:**10/02/24 - 10/04/24

Sample Matrix: Soil Date Received: 10/08/24

Analysis Method: 160.3 Modified Units: Percent

Prep Method: None Basis: As Received

Replicate Sample Summary Inorganic Parameters

| Sample Name: | Lab Code: | MRL | Sample Result | Duplicate Result | Average | RPD | RPD Limit | Date Analyzed |
|---------------|-----------------|-----|------------------|---------------------|---------|-----|--------------|------------------|
| UMM-TLB-0.5-1 | K2410642-001DUP | - | 86.4 | 86.5 | 86.5 | <1 | 20 | 10/10/24 |
| GC7-WRB-0.5-1 | K2410642-020DUP | - | 96.1 | 96.3 | 96.2 | <1 | 20 | 10/10/24 |

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

Printed 10/11/2024 8:28:22 AM Superset Reference:24-0000711613 rev 00



Metals

ALS Environmental—Kelso Laboratory 1317 South 13th Avenue, Kelso, WA 98626 Phone (360)577-7222 Fax (360)636-1068 www.alsglobal.com

Analytical Report

Client: Terraphase Engineering Inc.

Project: Upper Granite Creek Mines/0031.005.001

Sample Matrix: Soil

Service Request: K2410642 **Date Collected:** 10/2/2024 **Date Received:** 10/8/2024

Date Extracted: 10/16-10/17/2024 **Date Analyzed:** 10/17-10/22/2024

Bioaccessibility Value Analyte: Arsenic Units: Percent (%)

| Sample Name | Lab Code | Result |
|------------------|--------------|--------|
| UMM-TLB-0.5-1 | K2410642-001 | 41.6 |
| UMM-TLA-0.5-6 | K2410642-005 | 24.3 |
| CEM-WRA-0.5-2 | K2410642-008 | 5.6 |
| GF-WRD-0.5-4-DS | K2410642-012 | 9.0 |
| GC5-WRA-0.5-4-DS | K2410642-016 | 4.7 |
| GC6-WRA-0.5-2 | K2410642-017 | 3.9 |

Analytical Report

Client: Terraphase Engineering Inc.

Project: Upper Granite Creek Mines/0031.005.001

Sample Matrix: Soil

Service Request: K2410642

Date Collected: 10/2/2024

Date Received: 10/8/2024

Date Extracted: 10/16-10/17/2024 **Date Analyzed:** 10/17-10/22/2024

Bioaccessibility Value Analyte: Lead Units: Percent (%)

| Sample Name | Lab Code | Result |
|------------------|--------------|--------|
| UMM-TLB-0.5-1 | K2410642-001 | 28.7 |
| UMM-TLA-0.5-6 | K2410642-005 | 6.2 |
| CEM-WRA-0.5-2 | K2410642-008 | 27.9 |
| GF-WRD-0.5-4-DS | K2410642-012 | 34.9 |
| GC5-WRA-0.5-4-DS | K2410642-016 | 37.5 |
| GC6-WRA-0.5-2 | K2410642-017 | 41.7 |

Analytical Report

Client: Terraphase Engineering Inc.

Project:

Service Request: K2410642 **Date Collected:** 10/02/24 16:30 Upper Granite Creek Mines/0031.005.001

Date Received: 10/08/24 14:45 **Sample Matrix:** Soil

Sample Name: UMM-TLB-0.5-1 Basis: Dry

Lab Code: K2410642-001

Total Metals

| | Analysis | | | | | | | Date | |
|--------------|----------|--------|-------|-----|-----|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 6130 | mg/Kg | 11 | 1 | 100 | 10/22/24 12:10 | 10/10/24 | |
| Lead | 6020B | 1710 | mg/Kg | 1.1 | 0.4 | 100 | 10/22/24 12:10 | 10/10/24 | |
| Mercury | 7471B | 387 | mg/Kg | 11 | 1 | 500 | 10/15/24 13:08 | 10/14/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Project:

Service Request: K2410642 **Date Collected:** 10/02/24 16:30 Upper Granite Creek Mines/0031.005.001

Date Received: 10/08/24 14:45 **Sample Matrix:** Soil

UMM-TLB-0.5-1 **Sample Name:** Basis: Dry

Lab Code: K2410642-001

Total Metals – IVBA Analysis

| | Analysis | | | | | | | Date | |
|--------------|----------|--------|-------|------|------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 4420 | mg/Kg | 4.9 | 0.6 | 50 | 10/22/24 15:53 | 10/17/24 | |
| Lead | 6020B | 840 | mg/Kg | 0.49 | 0.20 | 50 | 10/22/24 15:53 | 10/17/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Project:

Service Request: K2410642 **Date Collected:** 10/02/24 16:30 Upper Granite Creek Mines/0031.005.001

Date Received: 10/08/24 14:45 **Sample Matrix:** Soil

Sample Name: UMM-TLB-0.5-1 Basis: Dry

Lab Code: K2410642-001

IVBA Metals

| | Analysis | | | | | | | Date | |
|--------------|----------|--------|-------|------|------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 1840 | mg/Kg | 2.0 | 0.2 | 20 | 10/17/24 11:29 | 10/16/24 | |
| Lead | 6020B | 241 | mg/Kg | 0.20 | 0.08 | 20 | 10/17/24 11:29 | 10/16/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Service Request: K2410642

Date Collected: 10/02/24 16:45 **Project:** Upper Granite Creek Mines/0031.005.001 **Date Received:** 10/08/24 14:45 **Sample Matrix:** Soil

UMM-TLB-0.5-4 **Sample Name:** Basis: Dry

Lab Code: K2410642-002

Total Metals

| | Analysis | | | | | | | Date | | |
|---------------------|----------|--------|-------|-----|-----|------|----------------|-----------|---|--|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q | |
| Arsenic | 6020B | 1540 | mg/Kg | 8.0 | 1.0 | 100 | 10/22/24 12:18 | 10/10/24 | | |

Analytical Report

Client: Terraphase Engineering Inc.

Project:

Service Request: K2410642 **Date Collected:** 10/02/24 17:00 Upper Granite Creek Mines/0031.005.001

Date Received: 10/08/24 14:45 **Sample Matrix:** Soil

Sample Name: UMM-TLC-0.5-1 Basis: Dry

Lab Code: K2410642-003

Total Metals

| | Analysis | | | | | | | Date | |
|--------------|----------|--------|-------|-----|-----|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 5290 | mg/Kg | 9.9 | 1.2 | 100 | 10/22/24 12:19 | 10/10/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Upper Granite Creek Mines/0031.005.001

Date Collected: 10/02/24 17:15

Sample Matrix:

Project:

Lab Code:

Soil

Date Received: 10/08/24 14:45

Service Request: K2410642

Sample Name:

UMM-TLC-0.5-2 K2410642-004

Basis: Dry

Total Metals

| | Analysis | | | | | | | Date | |
|---------------------|----------|--------|-------|-----|-----|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 4980 | mg/Kg | 10 | 1 | 100 | 10/22/24 12:21 | 10/10/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Service Request: K2410642 **Date Collected:** 10/02/24 15:45 **Project:** Upper Granite Creek Mines/0031.005.001

Date Received: 10/08/24 14:45 **Sample Matrix:** Soil

Sample Name: UMM-TLA-0.5-6 Basis: Dry

Lab Code: K2410642-005

Total Metals

| | Analysis | | | | | | | Date | |
|--------------|----------|--------|-------|------|------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 3270 | mg/Kg | 8.1 | 1.0 | 100 | 10/22/24 11:35 | 10/10/24 | |
| Lead | 6020B | 589 | mg/Kg | 0.81 | 0.33 | 100 | 10/22/24 11:35 | 10/10/24 | |
| Mercury | 7471B | 9.23 | mg/Kg | 0.19 | 0.02 | 10 | 10/15/24 10:28 | 10/14/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Project:

Service Request: K2410642 **Date Collected:** 10/02/24 15:45 Upper Granite Creek Mines/0031.005.001

Date Received: 10/08/24 14:45 **Sample Matrix:** Soil

UMM-TLA-0.5-6 **Sample Name:** Basis: Dry

Lab Code: K2410642-005

Total Metals – IVBA Analysis

| | Analysis | | | | | | | Date | |
|--------------|----------|--------|-------|------|------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 5560 | mg/Kg | 4.9 | 0.6 | 50 | 10/22/24 15:46 | 10/17/24 | |
| Lead | 6020B | 1110 | mg/Kg | 0.49 | 0.20 | 50 | 10/22/24 15:46 | 10/17/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Service Request: K2410642 **Date Collected:** 10/02/24 15:45 **Project:** Upper Granite Creek Mines/0031.005.001

Date Received: 10/08/24 14:45 **Sample Matrix:** Soil

Sample Name: UMM-TLA-0.5-6 Basis: Dry

Lab Code: K2410642-005

IVBA Metals

| | Analysis | | | | | | | Date | |
|--------------|----------|--------|-------|------|------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 1350 | mg/Kg | 2.0 | 0.2 | 20 | 10/17/24 11:22 | 10/16/24 | |
| Lead | 6020B | 69.2 | mg/Kg | 0.20 | 0.08 | 20 | 10/17/24 11:22 | 10/16/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Service Request: K2410642 **Date Collected:** 10/02/24 12:30 Upper Granite Creek Mines/0031.005.001

Project: Date Received: 10/08/24 14:45 **Sample Matrix:** Soil

Sample Name: CEM-WRA-0.5-4-DS Basis: Dry

Lab Code: K2410642-006

Total Metals

| | Analysis | | | | | | | Date | |
|---------------------|----------|--------|-------|------|------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 32.6 | mo/Ko | 0.40 | 0.05 | 5 | 10/22/24 12:03 | 10/10/24 | |

Analytical Report

Service Request: K2410642

Client: Terraphase Engineering Inc.

> **Date Collected:** 10/05/24 13:00 Upper Granite Creek Mines/0031.005.001

Project: Date Received: 10/08/24 14:45 **Sample Matrix:** Soil

Sample Name: CEM-WRB-0.5-1 Basis: Dry

Lab Code: K2410642-007

Total Metals

| | Analysis | | | | | | | Date | |
|--------------|----------|--------|-------|-----|-----|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 151 | mg/Kg | 8.6 | 1.0 | 100 | 10/22/24 11:38 | 10/10/24 | |

Printed 10/22/2024 8:04:37 PM Superset Reference:

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Analytical Report

Client: Terraphase Engineering Inc.

Service Request: K2410642 **Date Collected:** 10/05/24 12:05 Upper Granite Creek Mines/0031.005.001

Project: Date Received: 10/08/24 14:45 **Sample Matrix:** Soil

CEM-WRA-0.5-2 **Sample Name:** Basis: Dry

Lab Code: K2410642-008

Total Metals – IVBA Analysis

| | Analysis | | | | | | | Date | |
|--------------|----------|-------------|-------|------|------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 794 | mg/Kg | 5.0 | 0.6 | 50 | 10/22/24 15:55 | 10/17/24 | |
| Lead | 6020B | 78.5 | mg/Kg | 0.50 | 0.20 | 50 | 10/22/24 15:55 | 10/17/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Service Request: K2410642 **Date Collected:** 10/05/24 12:05 **Project:** Upper Granite Creek Mines/0031.005.001

Date Received: 10/08/24 14:45 **Sample Matrix:** Soil

Sample Name: CEM-WRA-0.5-2 Basis: Dry

Lab Code: K2410642-008

IVBA Metals

| | Analysis | | | | | | | Date | |
|--------------|----------|--------|-------|------|------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 44.5 | mg/Kg | 2.0 | 0.2 | 20 | 10/17/24 11:30 | 10/16/24 | |
| Lead | 6020B | 21.9 | mg/Kg | 0.20 | 0.08 | 20 | 10/17/24 11:30 | 10/16/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Upper Granite Creek Mines/0031.005.001

Date Collected: 10/05/24 12:05

Service Request: K2410642

Sample Matrix:

Project:

Soil

Date Received: 10/08/24 14:45

Basis: Dry

CEM-WRA-0.5-2 **Sample Name:**

Lab Code:

K2410642-008

Total Metals

| | Analysis | | | | | | | Date | |
|---------------------|----------|--------|-------|-----|-----|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 299 | mg/Kg | 8.3 | 1.0 | 100 | 10/22/24 11:39 | 10/10/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Project:

Service Request: K2410642 **Date Collected:** 10/05/24 12:40 Upper Granite Creek Mines/0031.005.001

Date Received: 10/08/24 14:45 **Sample Matrix:** Soil

Sample Name: CEM-WRC-0.5-1 Basis: Dry

Lab Code: K2410642-009

Total Metals

| | Analysis | | | | | | | Date | |
|---------------------|----------|--------|-------|-----|-----|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 110 | mg/Kg | 8.0 | 1.0 | 100 | 10/22/24 11:41 | 10/10/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Project:

Upper Granite Creek Mines/0031.005.001 **Date Collected:** 10/05/24 09:30

Service Request: K2410642

Sample Matrix: Soil Date Received: 10/08/24 14:45

Sample Name: GF-WRA-0.5-1 Basis: Dry

Lab Code: K2410642-010

Total Metals

| | Analysis | | | | | | | Date | |
|---------------------|----------|--------|-------|-----|-----|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 332 | mg/Kg | 7.8 | 0.9 | 100 | 10/22/24 11:42 | 10/10/24 | |

Analytical Report

Service Request: K2410642 **Date Collected:** 10/05/24 11:10

Date Received: 10/08/24 14:45

Client: Terraphase Engineering Inc.

Upper Granite Creek Mines/0031.005.001

Sample Matrix: Soil

Project:

Lab Code:

Sample Name:

GF-WRD-0.5-6 Basis: Dry K2410642-011

Total Metals

| | Analysis | | | | | | | Date | |
|---------------------|----------|--------|-------|-----|-----|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 66.6 | mg/Kg | 7.9 | 0.9 | 100 | 10/22/24 11:44 | 10/10/24 | |

Printed 10/22/2024 8:04:37 PM Superset Reference:

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Analytical Report

Client: Terraphase Engineering Inc.

Project:

Service Request: K2410642 **Date Collected:** 10/05/24 11:05 Upper Granite Creek Mines/0031.005.001

Date Received: 10/08/24 14:45 **Sample Matrix:** Soil

Sample Name: GF-WRD-0.5-4-DS Basis: Dry

Lab Code: K2410642-012

Total Metals – IVBA Analysis

| | Analysis | | | | | | | Date | |
|--------------|----------|--------|-------|------|------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 137 | mg/Kg | 4.9 | 0.6 | 50 | 10/22/24 15:56 | 10/17/24 | |
| Lead | 6020B | 25.6 | mg/Kg | 0.49 | 0.19 | 50 | 10/22/24 15:56 | 10/17/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Service Request: K2410642 **Date Collected:** 10/05/24 11:05 Upper Granite Creek Mines/0031.005.001

Project: Date Received: 10/08/24 14:45 **Sample Matrix:** Soil

Sample Name: GF-WRD-0.5-4-DS Basis: Dry

Lab Code: K2410642-012

IVBA Metals

| | Analysis | | | | | | | Date | |
|--------------|----------|--------|-------|------|------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 12.3 | mg/Kg | 2.0 | 0.2 | 20 | 10/17/24 11:32 | 10/16/24 | |
| Lead | 6020B | 8.94 | mg/Kg | 0.20 | 0.08 | 20 | 10/17/24 11:32 | 10/16/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Project:

Service Request: K2410642 **Date Collected:** 10/05/24 11:05 Upper Granite Creek Mines/0031.005.001

Date Received: 10/08/24 14:45 **Sample Matrix:** Soil

Sample Name: GF-WRD-0.5-4-DS Basis: Dry

Lab Code: K2410642-012

Total Metals

| | Analysis | | | | | | | Date | |
|--------------|----------|--------|-------|-----|-----|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 55.2 | mo/Ko | 8.5 | 1.0 | 100 | 10/22/24 11:45 | 10/10/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Upper Granite Creek Mines/0031.005.001

Sample Matrix: Soil

Date Collected: 10/05/24 10:35

Date Received: 10/08/24 14:45

Basis: Dry

Service Request: K2410642

Sample Name:

GF-DR-0.5-1

Lab Code:

Project:

K2410642-013

Total Metals

Analysis Date Analyte Name Method Result Units MRL MDL Dil. **Date Analyzed Extracted** Q 6020B Arsenic 58.3 mg/Kg 8.4 1.0 100 10/22/24 11:49 10/10/24

Printed 10/22/2024 8:04:37 PM Superset Reference:

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Analytical Report

Client: Terraphase Engineering Inc.

Project:

Service Request: K2410642 **Date Collected:** 10/04/24 16:15 Upper Granite Creek Mines/0031.005.001

Date Received: 10/08/24 14:45 **Sample Matrix:** Soil

Sample Name: GC5-WRA-0.5-3 Basis: Dry

Lab Code: K2410642-014

Total Metals

| | Analysis | | | | | | | Date | |
|---------------------|----------|--------|-------|-----|-----|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 421 | mg/Kg | 8.0 | 1.0 | 100 | 10/22/24 11:51 | 10/10/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Service Request: K2410642 **Date Collected:** 10/04/24 15:54 Upper Granite Creek Mines/0031.005.001

Project: Date Received: 10/08/24 14:45 **Sample Matrix:** Soil

Sample Name: GC5-WRA-0.5-4 Basis: Dry

Lab Code: K2410642-015

Total Metals

| | Analysis | | | | | | | Date | |
|---------------------|----------|--------|-------|-----|-----|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 160 | mg/Kg | 7.8 | 0.9 | 100 | 10/22/24 11:52 | 10/10/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Project:

Service Request: K2410642 **Date Collected:** 10/04/24 15:55 Upper Granite Creek Mines/0031.005.001

Date Received: 10/08/24 14:45 **Sample Matrix:** Soil

Sample Name: GC5-WRA-0.5-4-DS Basis: Dry

Lab Code: K2410642-016

Total Metals – IVBA Analysis

| | Analysis | | | | | | | Date | |
|--------------|----------|--------|-------|------|------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 221 | mg/Kg | 5.0 | 0.6 | 50 | 10/22/24 16:01 | 10/17/24 | |
| Lead | 6020B | 70.4 | mg/Kg | 0.50 | 0.20 | 50 | 10/22/24 16:01 | 10/17/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Service Request: K2410642 **Date Collected:** 10/04/24 15:55 **Project:** Upper Granite Creek Mines/0031.005.001

Date Received: 10/08/24 14:45 **Sample Matrix:** Soil

Sample Name: GC5-WRA-0.5-4-DS Basis: Dry

Lab Code: K2410642-016

IVBA Metals

| | Analysis | | | | | | | Date | |
|--------------|----------|--------|-------|------|------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 10.4 | mg/Kg | 1.9 | 0.2 | 20 | 10/17/24 11:37 | 10/16/24 | |
| Lead | 6020B | 26.4 | mg/Kg | 0.19 | 0.08 | 20 | 10/17/24 11:37 | 10/16/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Project:

Service Request: K2410642 **Date Collected:** 10/04/24 15:55 Upper Granite Creek Mines/0031.005.001

Date Received: 10/08/24 14:45 **Sample Matrix:** Soil

Sample Name: GC5-WRA-0.5-4-DS Basis: Dry

Lab Code: K2410642-016

Total Metals

| | Analysis | | | | | | | Date | |
|--------------|----------|--------|-------|-----|-----|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 81.3 | mg/Kg | 7.9 | 0.9 | 100 | 10/22/24 11:54 | 10/10/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Project:

Service Request: K2410642 **Date Collected:** 10/04/24 14:00 Upper Granite Creek Mines/0031.005.001

Date Received: 10/08/24 14:45 **Sample Matrix:** Soil

GC6-WRA-0.5-2 **Sample Name:** Basis: Dry

Lab Code: K2410642-017

Total Metals – IVBA Analysis

| | Analysis | | | | | | | Date | |
|--------------|----------|--------|-------|------|------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 759 | mg/Kg | 4.9 | 0.6 | 50 | 10/22/24 16:02 | 10/17/24 | |
| Lead | 6020B | 360 | mg/Kg | 0.49 | 0.20 | 50 | 10/22/24 16:02 | 10/17/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Project:

Service Request: K2410642 **Date Collected:** 10/04/24 14:00 Upper Granite Creek Mines/0031.005.001

Date Received: 10/08/24 14:45 **Sample Matrix:** Soil

Sample Name: GC6-WRA-0.5-2 Basis: Dry

Lab Code: K2410642-017

IVBA Metals

| | Analysis | | | | | | | Date | |
|--------------|----------|--------|-------|------|------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 29.3 | mg/Kg | 2.0 | 0.2 | 20 | 10/17/24 11:39 | 10/16/24 | |
| Lead | 6020B | 150 | mg/Kg | 0.20 | 0.08 | 20 | 10/17/24 11:39 | 10/16/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Service Request: K2410642 **Date Collected:** 10/04/24 14:00 **Project:** Upper Granite Creek Mines/0031.005.001

Date Received: 10/08/24 14:45 **Sample Matrix:** Soil

GC6-WRA-0.5-2 **Sample Name:** Basis: Dry

Lab Code: K2410642-017

Total Metals

| | Analysis | | | | | | | Date | |
|---------------------|----------|--------|-------|-----|-----|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 504 | mg/Kg | 8.5 | 1.0 | 100 | 10/22/24 11:55 | 10/10/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Upper Granite Creek Mines/0031.005.001

Date Collected: 10/04/24 10:45

Basis: Dry

Service Request: K2410642

Sample Matrix:

Soil

Date Received: 10/08/24 14:45

Sample Name:

GC6-WRA-0.5-1

Lab Code:

Project:

K2410642-018

Total Metals

| | Analysis | | | | | | | Date | |
|---------------------|----------|--------|-------|-----|-----|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 257 | mg/Kg | 8.5 | 1.0 | 100 | 10/22/24 11:57 | 10/10/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Project:

Service Request: K2410642 **Date Collected:** 10/04/24 11:50 Upper Granite Creek Mines/0031.005.001

Date Received: 10/08/24 14:45 **Sample Matrix:** Soil

Sample Name: GC7-WRA-0.5-3 Basis: Dry

Lab Code: K2410642-019

Total Metals

| | Analysis | | | | | | | Date | |
|--------------|----------|--------|-------|------|------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 26.9 | mg/Kg | 8.5 | 1.0 | 100 | 10/22/24 11:58 | 10/10/24 | |
| Arsenic | 6020B | 26.2 | mg/Kg | 0.43 | 0.05 | 5 | 10/22/24 12:04 | 10/10/24 | |

Printed 10/22/2024 8:04:38 PM Superset Reference:

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Analytical Report

Client: Terraphase Engineering Inc.

Upper Granite Creek Mines/0031.005.001

Date Collected: 10/04/24 11:15

Basis: Dry

Service Request: K2410642

Sample Matrix:

Soil

Date Received: 10/08/24 14:45

Sample Name:

GC7-WRB-0.5-1

Lab Code:

Project:

K2410642-020

Total Metals

| | Analysis | | | | | | | Date | |
|---------------------|----------|--------|-------|------|------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 7.43 | mg/Kg | 0.43 | 0.05 | 5 | 10/22/24 12:09 | 10/10/24 | |

Analytical Report

Client: Terraphase Engineering Inc. Service Request: K2410642

Project:Upper Granite Creek Mines/0031.005.001Date Collected: NASample Matrix:SoilDate Received: NA

Sample Name: Method Blank Basis: Dry

Lab Code: KQ2416652-01

Total Metals – IVBA Analysis

| | Analysis | | | | | | | Date | |
|--------------|----------|---------|-------|------|-------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | ND U | mg/Kg | 0.5 | 0.06 | 5 | 10/22/24 15:43 | 10/17/24 | |
| Lead | 6020B | 0.043 J | mg/Kg | 0.05 | 0.020 | 5 | 10/22/24 15:43 | 10/17/24 | |

Analytical Report

Client: Terraphase Engineering Inc. Service Request: K2410642

Project:Upper Granite Creek Mines/0031.005.001Date Collected: NASample Matrix:SoilDate Received: NA

Sample Name: Method Blank Basis: Dry

Lab Code: KQ2416789-01

IVBA Metals

| | Analysis | | | | | | | Date | |
|--------------|----------|--------|-------|------|-------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | ND U | mg/Kg | 0.5 | 0.06 | 5 | 10/17/24 10:57 | 10/16/24 | |
| Lead | 6020B | ND U | mg/Kg | 0.05 | 0.020 | 5 | 10/17/24 10:57 | 10/16/24 | |

Printed 10/22/2024 8:04:36 PM Superset Reference:

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Analytical Report

Client: Terraphase Engineering Inc. Service Request: K2410642

Project:Upper Granite Creek Mines/0031.005.001Date Collected: NASample Matrix:SoilDate Received: NA

Sample Name: Method Blank Basis: Dry

Lab Code: KQ2416391-03

Total Metals

| | Analysis | | | | | | | Date | |
|--------------|----------|--------|-------|------|-------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 0.07 J | mg/Kg | 0.5 | 0.06 | 5 | 10/22/24 11:05 | 10/10/24 | |
| Lead | 6020B | ND U | mg/Kg | 0.05 | 0.020 | 5 | 10/22/24 11:05 | 10/10/24 | |

Analytical Report

Client: Terraphase Engineering Inc. Service Request: K2410642

Project:Upper Granite Creek Mines/0031.005.001Date Collected: NASample Matrix:SoilDate Received: NA

Sample Name: Method Blank Basis: Dry

Lab Code: KQ2416426-03

Total Metals

| | Analysis | | | | | | | Date | |
|---------------------|----------|--------|-------|------|-------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Mercurv | 7471B | ND U | mg/Kg | 0.02 | 0.002 | 1 | 10/15/24 09:02 | 10/14/24 | |

ALS Group USA, Corp.

dba ALS Environmental

QA/QC Report

Client: Terraphase Engineering Inc. Service Request: K2410642

Project Upper Granite Creek Mines/0031.005.001 Date Collected: 10/02/24

Sample Matrix: Soil Date Received: 10/08/24

Date Analyzed: 10/22/24

Replicate Sample Summary Total Metals – IVBA Analysis

Sample Name: UMM-TLA-0.5-6 Units: mg/Kg

Basis: Dry

Lab Code: K2410642-005

Basis

Duplicate

Sample

| | | | | | Sample | | | |
|--------------|----------|------|------|--------|--------------|---------|-----|-----------|
| | Analysis | | | Sample | KQ2416652-03 | | | |
| Analyte Name | Method | MRL | MDL | Result | Result | Average | RPD | RPD Limit |
| Arsenic | 6020B | 5.0 | 0.6 | 5560 | 6460 | 6010 | 15 | 20 |
| Lead | 6020B | 0.50 | 0.20 | 1110 | 1280 | 1200 | 14 | 20 |

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

ALS Group USA, Corp.

dba ALS Environmental

QA/QC Report

Client: Terraphase Engineering Inc. **Service Request:** K2410642

Project Upper Granite Creek Mines/0031.005.001 **Date Collected:** 10/02/24

Soil **Sample Matrix:**

Lab Code:

Date Received: 10/08/24

Date Analyzed: 10/17/24

Replicate Sample Summary

IVBA Metals

Sample Name: UMM-TLA-0.5-6 Units: mg/Kg

Basis: Dry

K2410642-005

Duplicate

| | Analysis | | | Sample | Sample KQ2416789-04 | | | |
|--------------|----------|------|------|--------|------------------------|---------|-----|------------------|
| Analyte Name | Method | MRL | MDL | Result | Result | Average | RPD | RPD Limit |
| Arsenic | 6020B | 2.0 | 0.2 | 1350 | 1360 | 1360 | <1 | 20 |
| Lead | 6020B | 0.20 | 0.08 | 69.2 | 72.3 | 70.8 | 4 | 20 |

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

ALS Group USA, Corp.

dba ALS Environmental

QA/QC Report

Client: Terraphase Engineering Inc.

Project

Upper Granite Creek Mines/0031.005.001 **Date Collected:** 10/02/24

Soil **Date Received:** 10/08/24 **Sample Matrix:**

Date Analyzed: 10/22/24

Service Request: K2410642

Replicate Sample Summary

Total Metals

Sample Name: UMM-TLB-0.5-1 Units: mg/Kg Lab Code: K2410642-001

Basis: Dry

| | | | | | Duplicate | | | |
|--------------|----------|--------|-------|---------|--------------|----------|--------|-----------|
| | | | | | Sample | | | |
| | Analysis | | | Sample | KQ2416391-01 | | | |
| Analyte Name | Method | MRL | MDL | Result | Result | Average | RPD | RPD Limit |
| | | 111111 | 1,122 | 2105620 | Itebair | riveruge | 111 12 | |
| Arsenic | 6020B | 11 | 1 | 6130 | 7400 | 6770 | 19 | 20 |

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

QA/QC Report

Client: Terraphase Engineering Inc. **Project:**

Upper Granite Creek Mines/0031.005.001

Sample Matrix: Soil

Service Request: Date Collected:

K2410642

10/02/24

Date Received: Date Analyzed: 10/08/24 10/22/24

Date Extracted:

10/17/24

Matrix Spike Summary

Total Metals – IVBA Analysis

Sample Name:

UMM-TLA-0.5-6

Lab Code: K2410642-005

Analysis Method: Prep Method:

6020B

EPA 3050B

Units: Basis: mg/Kg

Dry

Matrix Spike

KQ2416652-04

| Analyte Name | Sample Result | Result | Spike Amount | % Rec | % Rec Limits |
|--------------|---------------|--------|--------------|-------|--------------|
| Arsenic | 5560 | 5980 | 97.0 | 435 # | 75-125 |
| Lead | 1110 | 1250 | 97.0 | 145 # | 75-125 |

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

Matrix Spike and Matrix Spike Duplicate Data is presented for information purposes only. The matrix may or may not be relevant to samples reported in this report. The laboratory evaluates system performance based on the LCS and LCSD control limits.

QA/QC Report

Client: Terraphase Engineering Inc.

Service Request:

K2410642

Project:

Upper Granite Creek Mines/0031.005.001

Date Collected:

10/02/24

Sample Matrix: Soil

1 1

Date Received: Date Analyzed: 10/08/24

Date Extracted:

10/22/24 10/10/24

Matrix Spike Summary

Total Metals

Sample Name: UMM-TLB-0.5-1

Units: Basis:

mg/Kg Dry

Lab Code: Analysis Method: K2410642-001

Prep Method:

6020B

EPA 3050B

Matrix Spike

KQ2416391-02

| Analyte Name | Sample Result | Result | Spike Amount | % Rec | % Rec Limits |
|--------------|---------------|--------|--------------|--------|--------------|
| Arsenic | 6130 | 5760 | 11 | -3268# | 75-125 |
| Lead | 1710 | 1750 | 5.6 | 557 # | 75-125 |

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

Matrix Spike and Matrix Spike Duplicate Data is presented for information purposes only. The matrix may or may not be relevant to samples reported in this report. The laboratory evaluates system performance based on the LCS and LCSD control limits.

QA/QC Report

Client: Terraphase Engineering Inc.

Project: Upper Granite Creek Mines/0031.005.001 Date Analyzed: 10/22/24

Sample Matrix: Soil

Lab Control Sample Summary Total Metals – IVBA Analysis

> Units:mg/Kg Basis:Dry

Service Request: K2410642

Lab Control Sample

KQ2416652-02

| Analyte Name | Analytical Method | Result | Spike Amount | % Rec | % Rec Limits |
|--------------|--------------------------|--------|--------------|-------|--------------|
| Arsenic | 6020B | 108 | 100 | 108 | 80-120 |
| Lead | 6020B | 111 | 100 | 111 | 80-120 |

QA/QC Report

Client: Terraphase Engineering Inc.

Service Request: K2410642 **Project:** Upper Granite Creek Mines/0031.005.001 **Date Analyzed:** 10/17/24

Sample Matrix: Soil

> **Lab Control Sample Summary IVBA Metals**

> > Units:mg/Kg Basis:Dry

Lab Control Sample

KQ2416789-02

| Analyte Name | Analytical Method | Result | Spike Amount | % Rec | % Rec Limits |
|--------------|--------------------------|--------|--------------|-------|--------------|
| Arsenic | 6020B | 92.9 | 100 | 93 | 80-120 |
| Lead | 6020B | 105 | 100 | 105 | 80-120 |

QA/QC Report

Client: Terraphase Engineering Inc.

Service Request: K2410642 **Project:** Upper Granite Creek Mines/0031.005.001 Date Analyzed: 10/22/24

Sample Matrix: Soil

> **Lab Control Sample Summary Total Metals**

> > Units:mg/Kg Basis:Dry

Lab Control Sample

KQ2416391-04

| Analyte Name | Analytical Method | Result | Spike Amount | % Rec | % Rec Limits |
|--------------|--------------------------|--------|--------------|-------|--------------|
| Arsenic | 6020B | 107 | 100 | 107 | 80-120 |
| Lead | 6020B | 113 | 100 | 113 | 80-120 |

Printed 10/22/2024 8:04:38 PM Superset Reference:

QA/QC Report

Client: Terraphase Engineering Inc.

Project: Upper Granite Creek Mines/0031.005.001 Date Analyzed: 10/15/24

Sample Matrix: Soil

Lab Control Sample Summary Total Metals

Units:mg/Kg
Basis:Dry

Service Request: K2410642

Lab Control Sample KQ2416426-04

Analyte NameAnalytical MethodResultSpike Amount% Rec% Rec LimitsMercury7471B0.5200.50010480-120

Printed 10/22/2024 8:04:38 PM Superset Reference:

ALS Group USA, Corp.

dba ALS Environmental QA/QC Report

Client: Terraphase Engineering Inc. Service Request: K2410642

Project:Upper Granite Creek Mines/0031.005.001Date Collected:NALCS Matrix:SoilDate Received:NA

Date Extracted: 10/16/2024 **Date Analyzed:** 10/17/2024

Standard Reference Material (SRM) Summary

Bioaccessible Metals

Sample Name: Standard Reference Material Units: mg/Kg (ppm)

Basis: Dry

Test Notes: Montana II Solids = 97.8%

KQ2416789-03

Lab Code:

Source: NIST 2711a - Montana II Soil

| Analyte | Prep Method | Analysis Method | True Value | Result | Percent Recovery | Control Limits (%) | Result Notes |
|---------|----------------|--------------------|---------------|--------|---------------------|-----------------------|-----------------|
| Lead | EPA 1340 | 6020B | 1300 | 1250 | 96 | 75.2 - 96.2 | |





Don Malkemus Terraphase Engineering Inc. 610 SW Broadway, Suite 405 Portland, OR 97205

Laboratory Results for: Upper Granite Creek Mines

Dear Don.

Enclosed are the results of the sample(s) submitted to our laboratory October 08, 2024 For your reference, these analyses have been assigned our service request number **K2410643**.

Analyses were performed according to our laboratory's NELAP-approved quality assurance program. The test results meet requirements of the current NELAP standards, where applicable, and except as noted in the laboratory case narrative provided. For a specific list of NELAP-accredited analytes, refer to the certifications section at www.alsglobal.com. All results are intended to be considered in their entirety, and ALS Group USA Corp. dba ALS Environmental (ALS) is not responsible for use of less than the complete report. Results apply only to the items submitted to the laboratory for analysis and individual items (samples) analyzed, as listed in the report.

Please contact me if you have any questions. My extension is 3376. You may also contact me via email at Mark.Harris@alsglobal.com.

Respectfully submitted,

noe D. Oak

ALS Group USA, Corp. dba ALS Environmental

Mark Harris

Project Manager



Narrative Documents

ALS Environmental—Kelso Laboratory 1317 South 13th Avenue, Kelso, WA 98626 Phone (360) 577-7222 Fax (360) 425-9096 www.alsglobal.com



Client: Terraphase Engineering Inc. Service Request: K2410643

Project: Upper Granite Creek Mines Date Received: 10/08/2024

Sample Matrix: Soil

CASE NARRATIVE

All analyses were performed consistent with the quality assurance program of ALS Environmental. This report contains analytical results for samples for the Tier II level requested by the client.

Sample Receipt:

Fourteen soil samples were received for analysis at ALS Environmental on 10/08/2024. Any discrepancies upon initial sample inspection are annotated on the sample receipt and preservation form included within this report. The samples were stored at minimum in accordance with the analytical method requirements.

Metals:

Method 6020B, 10/22/2024: The Relative Percent Difference (RPD) for the replicate analysis of Silver in sample TL-WRA-0.5-3 was outside the normal ALS control limits. The variability in the results was attributed to the heterogeneous character of the sample. Standard mixing techniques were used, but were not sufficient for complete homogenization of this sample.

Method 6020B, 10/22/2024: Antimony recoveries are generally low for soil and sediment samples when digested using EPA Method 3050B. Despite anticipated low recoveries, the method is still generally prescribed because of its versatility for general metals analysis. Antimony results (in conjunction with the matrix spike recovery) from this procedure should only be used as indicators to estimate concentrations. The matrix spike recovery of Antimony for sample TL-WRA-0.5-3 was below the ALS control criterion. Since low recoveries resulted from a method defect and were possibly magnified by certain matrix components, no corrective action was appropriate. Alternative procedures that specifically target Antimony are available but were not specified for this project. The associated QA/QC results (e.g. control sample, calibration standards, etc.) indicated the analysis was in control.

Method 6020B, 10/22/2024: The matrix spike recovery of Lead for sample TL-WRA-0.5-3 was outside control criteria. Recovery in the Laboratory Control Sample (LCS) was acceptable, which indicated the analytical batch was in control. No further corrective action was appropriate.

| | 1 (OE V. () OUX | | | |
|-------------|-------------------|--------|------------|--|
| Approved by | | Date _ | 10/23/2024 | |

× -00000



| CLIENT ID: CS-SD-1 | | Lab | ID: K2410 | 643-006 | | |
|---|---|-------------|--|--|--|---|
| Analyte | Results | Flag | MDL | MRL | Units | Method |
| Antimony | 0.26 | | 0.05 | 0.13 | mg/Kg | 6020B |
| Arsenic | 5.8 | | 0.2 | 1.3 | mg/Kg | 6020B |
| Cadmium | 0.234 | | 0.019 | 0.053 | mg/Kg | 6020B |
| Chromium | 7.81 | | 0.16 | 0.53 | mg/Kg | 6020B |
| Lead | 4.12 | | 0.05 | 0.13 | mg/Kg | 6020B |
| Mercury | 0.031 | J | 0.005 | 0.053 | mg/Kg | 7471B |
| Silver | 0.282 | | 0.011 | 0.053 | mg/Kg | 6020B |
| Solids, Total | 34.2 | | | | Percent | 160.3 Modified |
| Zinc | 45.0 | | 0.5 | 1.3 | mg/Kg | 6020B |
| CLIENT ID: CS-SD-2 | | Lab | ID: K2410 | 643-007 | | |
| Analyte | Results | Flag | MDL | MRL | Units | Method |
| Antimony | 0.038 | J | 0.022 | 0.054 | mg/Kg | 6020B |
| Arsenic | 4.52 | | 0.07 | 0.54 | mg/Kg | 6020B |
| Cadmium | 0.038 | | 0.008 | 0.022 | mg/Kg | 6020B |
| Chromium | 2.49 | | 0.07 | 0.22 | mg/Kg | 6020B |
| Lead | 0.927 | | 0.022 | 0.054 | mg/Kg | 6020B |
| Silver | 0.043 | | 0.004 | 0.022 | mg/Kg | 6020B |
| Solids, Total | 76.9 | | | | Percent | 160.3 Modified |
| Zinc | 16.9 | | 0.22 | 0.54 | mg/Kg | 6020B |
| | | | | | 0 0 | |
| CLIENT ID: CS-SD-3 | | | ID: K2410 | | | |
| | Results | Lab Flag | MDL | MRL | Units | Method |
| CLIENT ID: CS-SD-3 Analyte Antimony | Results 0.069 | | MDL 0.025 | MRL 0.063 | Units mg/Kg | 6020B |
| CLIENT ID: CS-SD-3 Analyte Antimony Arsenic | Results 0.069 11.7 | | MDL 0.025 0.08 | MRL 0.063 0.63 | Units mg/Kg mg/Kg | 6020B 6020B |
| CLIENT ID: CS-SD-3 Analyte Antimony Arsenic Cadmium | Results 0.069 11.7 0.062 | | MDL 0.025 0.08 0.009 | MRL 0.063 0.63 0.025 | Units mg/Kg mg/Kg mg/Kg | 6020B 6020B 6020B |
| CLIENT ID: CS-SD-3 Analyte Antimony Arsenic Cadmium Chromium | Results 0.069 11.7 0.062 4.90 | | MDL 0.025 0.08 0.009 0.08 | MRL 0.063 0.63 0.025 0.25 | Units mg/Kg mg/Kg mg/Kg mg/Kg | 6020B 6020B 6020B 6020B |
| CLIENT ID: CS-SD-3 Analyte Antimony Arsenic Cadmium Chromium Lead | Results 0.069 11.7 0.062 4.90 1.53 | | MDL 0.025 0.08 0.009 0.08 0.025 | MRL 0.063 0.63 0.025 0.25 0.063 | Units mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg | 6020B 6020B 6020B 6020B 6020B |
| Analyte Antimony Arsenic Cadmium Chromium Lead Mercury | Results 0.069 11.7 0.062 4.90 1.53 0.923 | | MDL 0.025 0.08 0.009 0.08 0.025 0.003 | MRL 0.063 0.63 0.025 0.25 0.063 0.027 | Units mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg | 6020B 6020B 6020B 6020B 6020B 7471B |
| Analyte Antimony Arsenic Cadmium Chromium Lead Mercury Silver | Results 0.069 11.7 0.062 4.90 1.53 0.923 0.112 | | MDL 0.025 0.08 0.009 0.08 0.025 | MRL 0.063 0.63 0.025 0.25 0.063 | Units mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg | 6020B 6020B 6020B 6020B 6020B 7471B 6020B |
| Analyte Antimony Arsenic Cadmium Chromium Lead Mercury Silver Solids, Total | Results 0.069 11.7 0.062 4.90 1.53 0.923 0.112 69.1 | | MDL 0.025 0.08 0.009 0.08 0.025 0.003 0.005 | MRL 0.063 0.63 0.025 0.25 0.063 0.027 0.025 | Units mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg | 6020B 6020B 6020B 6020B 6020B 7471B 6020B 160.3 Modified |
| Analyte Antimony Arsenic Cadmium Chromium Lead Mercury Silver | Results 0.069 11.7 0.062 4.90 1.53 0.923 0.112 | | MDL 0.025 0.08 0.009 0.08 0.025 0.003 | MRL 0.063 0.63 0.025 0.25 0.063 0.027 | Units mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg | 6020B 6020B 6020B 6020B 6020B 7471B 6020B |
| Analyte Antimony Arsenic Cadmium Chromium Lead Mercury Silver Solids, Total | Results 0.069 11.7 0.062 4.90 1.53 0.923 0.112 69.1 | Flag | MDL 0.025 0.08 0.009 0.08 0.025 0.003 0.005 | MRL 0.063 0.63 0.025 0.25 0.063 0.027 0.025 | Units mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg | 6020B 6020B 6020B 6020B 6020B 7471B 6020B 160.3 Modified |
| Analyte Antimony Arsenic Cadmium Chromium Lead Mercury Silver Solids, Total Zinc CLIENT ID: CS-SD-4 Analyte | Results 0.069 11.7 0.062 4.90 1.53 0.923 0.112 69.1 29.7 | Flag | MDL 0.025 0.08 0.009 0.08 0.025 0.003 0.005 0.25 0 ID: K2410 MDL | MRL 0.063 0.63 0.025 0.25 0.063 0.027 0.025 0.63 0.63 | Units mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg | 6020B 6020B 6020B 6020B 6020B 7471B 6020B 160.3 Modified 6020B |
| Analyte Antimony Arsenic Cadmium Chromium Lead Mercury Silver Solids, Total Zinc CLIENT ID: CS-SD-4 Analyte Antimony | Results 0.069 11.7 0.062 4.90 1.53 0.923 0.112 69.1 29.7 Results 0.892 | Flag | MDL 0.025 0.08 0.009 0.08 0.025 0.003 0.005 0.25 0 ID: K2410 MDL 0.023 | MRL 0.063 0.63 0.025 0.25 0.063 0.027 0.025 0.63 0643-009 MRL 0.058 | Units mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg | 6020B 6020B 6020B 6020B 6020B 7471B 6020B 160.3 Modified 6020B |
| Analyte Antimony Arsenic Cadmium Chromium Lead Mercury Silver Solids, Total Zinc CLIENT ID: CS-SD-4 Analyte Antimony Arsenic | Results 0.069 11.7 0.062 4.90 1.53 0.923 0.112 69.1 29.7 Results 0.892 32.7 | Flag | MDL 0.025 0.08 0.009 0.08 0.025 0.003 0.005 0.25 DID: K2410 MDL 0.023 0.07 | MRL 0.063 0.63 0.025 0.25 0.063 0.027 0.025 0.63 0.63 0.63 0.63 0.63 | Units mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg Mg/Kg Percent mg/Kg Units mg/Kg | 6020B 6020B 6020B 6020B 6020B 7471B 6020B 160.3 Modified 6020B Method 6020B |
| Analyte Antimony Arsenic Cadmium Chromium Lead Mercury Silver Solids, Total Zinc CLIENT ID: CS-SD-4 Analyte Antimony Arsenic Cadmium | Results 0.069 11.7 0.062 4.90 1.53 0.923 0.112 69.1 29.7 Results 0.892 32.7 1.09 | Flag | MDL 0.025 0.08 0.009 0.08 0.025 0.003 0.005 0.25 DID: K2410 MDL 0.023 0.07 0.008 | MRL 0.063 0.63 0.025 0.25 0.063 0.027 0.025 0.63 0643-009 MRL 0.058 0.58 0.023 | Units mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg Percent mg/Kg Units mg/Kg mg/Kg | 6020B 6020B 6020B 6020B 6020B 7471B 6020B 160.3 Modified 6020B Method 6020B 6020B |
| Analyte Antimony Arsenic Cadmium Chromium Lead Mercury Silver Solids, Total Zinc CLIENT ID: CS-SD-4 Analyte Antimony Arsenic | Results 0.069 11.7 0.062 4.90 1.53 0.923 0.112 69.1 29.7 Results 0.892 32.7 1.09 9.05 | Flag | MDL 0.025 0.08 0.009 0.08 0.025 0.003 0.005 0.25 DID: K2410 MDL 0.023 0.07 | MRL 0.063 0.63 0.025 0.025 0.063 0.027 0.025 0.63 0.63 0.63 0.58 0.58 0.023 0.23 | Units mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg Mg/Kg Percent mg/Kg Units mg/Kg | 6020B 6020B 6020B 6020B 6020B 7471B 6020B 160.3 Modified 6020B Method 6020B 6020B 6020B |
| Analyte Antimony Arsenic Cadmium Chromium Lead Mercury Silver Solids, Total Zinc CLIENT ID: CS-SD-4 Analyte Antimony Arsenic Cadmium Chromium Lead | Results 0.069 11.7 0.062 4.90 1.53 0.923 0.112 69.1 29.7 Results 0.892 32.7 1.09 9.05 25.6 | Flag | MDL 0.025 0.08 0.009 0.08 0.025 0.003 0.005 0.25 MDL 0.023 0.07 0.008 0.07 0.023 | MRL 0.063 0.63 0.025 0.25 0.063 0.027 0.025 0.63 0.63 0.058 0.058 0.023 0.058 | Units mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg Percent mg/Kg Units mg/Kg mg/Kg mg/Kg | 6020B 6020B 6020B 6020B 6020B 7471B 6020B 160.3 Modified 6020B Method 6020B 6020B 6020B 6020B 6020B |
| Analyte Antimony Arsenic Cadmium Chromium Lead Mercury Silver Solids, Total Zinc CLIENT ID: CS-SD-4 Analyte Antimony Arsenic Cadmium Chromium Chromium | Results 0.069 11.7 0.062 4.90 1.53 0.923 0.112 69.1 29.7 Results 0.892 32.7 1.09 9.05 | Flag | MDL 0.025 0.08 0.009 0.08 0.025 0.003 0.005 0.25 MDL 0.023 0.07 0.008 0.07 | MRL 0.063 0.63 0.025 0.025 0.063 0.027 0.025 0.63 0.63 0.63 0.58 0.58 0.023 0.23 | Units mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg Percent mg/Kg Units mg/Kg mg/Kg mg/Kg | 6020B 6020B 6020B 6020B 6020B 7471B 6020B 160.3 Modified 6020B Method 6020B 6020B 6020B |



| CLIENT ID: CS-SD-4 | | | | | | | | | | | | | |
|-----------------------|---------|----------------------|-----------|---------|---------|----------------|--|--|--|--|--|--|--|
| Analyte | Results | Flag | MDL | MRL | Units | Method | | | | | | | |
| Solids, Total | 64.9 | | | | Percent | 160.3 Modified | | | | | | | |
| Zinc | 47.2 | | 0.23 | 0.58 | mg/Kg | 6020B | | | | | | | |
| LIENT ID: CS-SD-5 | | Lab | ID: K2410 | 643-010 | | | | | | | | | |
| Analyte | Results | Flag | MDL | MRL | Units | Method | | | | | | | |
| Antimony | 0.146 | | 0.020 | 0.051 | mg/Kg | 6020B | | | | | | | |
| Arsenic | 14.1 | | 0.06 | 0.51 | mg/Kg | 6020B | | | | | | | |
| Cadmium | 0.169 | | 0.007 | 0.020 | mg/Kg | 6020B | | | | | | | |
| Chromium | 5.03 | | 0.06 | 0.20 | mg/Kg | 6020B | | | | | | | |
| Lead | 2.79 | | 0.020 | 0.051 | mg/Kg | 6020B | | | | | | | |
| Mercury | 0.056 | | 0.002 | 0.025 | mg/Kg | 7471B | | | | | | | |
| Silver | 0.582 | | 0.004 | 0.020 | mg/Kg | 6020B | | | | | | | |
| Solids, Total | 71.1 | | | | Percent | 160.3 Modified | | | | | | | |
| Zinc | 32.7 | | 0.20 | 0.51 | mg/Kg | 6020B | | | | | | | |
| LIENT ID: CS-SD-6 | | Lab ID: K2410643-011 | | | | | | | | | | | |
| Analyte | Results | Flag | MDL | MRL | Units | Method | | | | | | | |
| Antimony | 0.147 | | 0.018 | 0.045 | mg/Kg | 6020B | | | | | | | |
| Arsenic | 16.6 | | 0.05 | 0.45 | mg/Kg | 6020B | | | | | | | |
| Cadmium | 0.146 | | 0.006 | 0.018 | mg/Kg | 6020B | | | | | | | |
| Chromium | 4.76 | | 0.05 | 0.18 | mg/Kg | 6020B | | | | | | | |
| Lead | 2.74 | | 0.018 | 0.045 | mg/Kg | 6020B | | | | | | | |
| Mercury | 0.033 | | 0.002 | 0.021 | mg/Kg | 7471B | | | | | | | |
| Silver | 0.200 | | 0.004 | 0.018 | mg/Kg | 6020B | | | | | | | |
| Solids, Total | 82.1 | | | | Percent | 160.3 Modified | | | | | | | |
| Zinc | 37.1 | | 0.18 | 0.45 | mg/Kg | 6020B | | | | | | | |
| LIENT ID: CS-SD-7 | | Lab | ID: K2410 | 643-012 | | | | | | | | | |
| Analyte | Results | Flag | MDL | MRL | Units | Method | | | | | | | |
| Antimony | 0.355 | | 0.019 | 0.048 | mg/Kg | 6020B | | | | | | | |
| Arsenic | 24.2 | | 0.06 | 0.48 | mg/Kg | 6020B | | | | | | | |
| Cadmium | 0.538 | | 0.007 | 0.019 | mg/Kg | 6020B | | | | | | | |
| Chromium | 10.6 | | 0.06 | 0.19 | mg/Kg | 6020B | | | | | | | |
| Lead | 12.1 | | 0.019 | 0.048 | mg/Kg | 6020B | | | | | | | |
| Mercury | 0.097 | | 0.002 | 0.023 | mg/Kg | 7471B | | | | | | | |
| Silver | 1.10 | | 0.004 | 0.019 | mg/Kg | 6020B | | | | | | | |
| Solids, Total | 80.2 | | | | Percent | 160.3 Modified | | | | | | | |
| Zinc | 168 | | 0.19 | 0.48 | mg/Kg | 6020B | | | | | | | |
| LIENT ID: CS-SD-7-DUP | | Lab | ID: K2410 | 643-013 | | | | | | | | | |
| Analyte | Results | Flag | MDL | MRL | Units | Method | | | | | | | |
| Antimony | 0.334 | | 0.022 | 0.054 | mg/Kg | 6020B | | | | | | | |



| CLIENT ID: CS-SD-7-DUP | Lab ID: K2410643-013 | | | | | | | | | | | |
|-----------------------------|----------------------|----------------------|-----------|---------|---------|----------------|--|--|--|--|--|--|
| Analyte | Results | Flag | MDL | MRL | Units | Method | | | | | | |
| Arsenic | 24.3 | | 0.06 | 0.54 | mg/Kg | 6020B | | | | | | |
| Cadmium | 0.446 | | 0.008 | 0.022 | mg/Kg | 6020B | | | | | | |
| Chromium | 9.10 | | 0.06 | 0.22 | mg/Kg | 6020B | | | | | | |
| Lead | 12.8 | | 0.022 | 0.054 | mg/Kg | 6020B | | | | | | |
| Mercury | 0.099 | | 0.002 | 0.024 | mg/Kg | 7471B | | | | | | |
| Silver | 1.62 | | 0.004 | 0.022 | mg/Kg | 6020B | | | | | | |
| Solids, Total | 73.2 | | | | Percent | 160.3 Modified | | | | | | |
| Zinc | 102 | | 0.22 | 0.54 | mg/Kg | 6020B | | | | | | |
| LIENT ID: CS-SD-8 | | Lab ID: K2410643-014 | | | | | | | | | | |
| Analyte | Results | Flag | MDL | MRL | Units | Method | | | | | | |
| Antimony | 0.406 | | 0.023 | 0.058 | mg/Kg | 6020B | | | | | | |
| Arsenic | 35.2 | | 0.07 | 0.58 | mg/Kg | 6020B | | | | | | |
| Cadmium | 0.316 | | 0.008 | 0.023 | mg/Kg | 6020B | | | | | | |
| Chromium | 9.13 | | 0.07 | 0.23 | mg/Kg | 6020B | | | | | | |
| Lead | 10.7 | | 0.023 | 0.058 | mg/Kg | 6020B | | | | | | |
| Mercury | 0.096 | | 0.003 | 0.026 | mg/Kg | 7471B | | | | | | |
| Silver | 1.26 | | 0.005 | 0.023 | mg/Kg | 6020B | | | | | | |
| Solids, Total | 69.0 | | | | Percent | 160.3 Modified | | | | | | |
| Zinc | 103 | | 0.23 | 0.58 | mg/Kg | 6020B | | | | | | |
| LIENT ID: TL-WRA-0.5-3 | Lab ID: K2410643-001 | | | | | | | | | | | |
| Analyte | Results | Flag | MDL | MRL | Units | Method | | | | | | |
| Arsenic | 454 | | 0.05 | 0.42 | mg/Kg | 6020B | | | | | | |
| Solids, Total | 95.0 | | | | Percent | 160.3 Modified | | | | | | |
| LIENT ID: TL-WRB-0.5-4 | | Lab | ID: K2410 | 643-002 | | | | | | | | |
| Analyte | Results | Flag | MDL | MRL | Units | Method | | | | | | |
| Arsenic | 194 | | 0.05 | 0.42 | mg/Kg | 6020B | | | | | | |
| Solids, Total | 95.5 | | | | Percent | 160.3 Modified | | | | | | |
| LIENT ID: TL-WRA-0.5-1-DS-2 | | Lab | ID: K2410 | 643-003 | | | | | | | | |
| Analyte | Results | Flag | MDL | MRL | Units | Method | | | | | | |
| Arsenic | 550 | | 0.6 | 4.9 | mg/Kg | 6020B | | | | | | |
| Arsenic | 14.4 | | 0.2 | 1.9 | mg/Kg | 6020B | | | | | | |
| Arsenic | 267 | | 0.05 | 0.44 | mg/Kg | 6020B | | | | | | |
| Lead | 218 | | 0.19 | 0.49 | mg/Kg | 6020B | | | | | | |
| Lead | 83.3 | | 0.08 | 0.19 | mg/Kg | 6020B | | | | | | |
| Solids, Total | 93.4 | | | | Percent | 160.3 Modified | | | | | | |
| LIENT ID: SH-WRB-0.5-2 | | | ID: K2410 | 643-004 | | | | | | | | |
| Analyte | Results | Flag | MDL | MRL | Units | Method | | | | | | |
| Arsenic | 80.8 | | 0.05 | 0.39 | mg/Kg | 6020B | | | | | | |



| CLIENT ID: SH-WRB-0.5-2 | Lab ID: K2410643-004 | | | | | | | | | | | | |
|-------------------------|----------------------|------|-----------|---------|---------|----------------|--|--|--|--|--|--|--|
| Analyte | Results | Flag | MDL | MRL | Units | Method | | | | | | | |
| Solids, Total | 94.1 | | | | Percent | 160.3 Modified | | | | | | | |
| CLIENT ID: SH-WRC-0.5-1 | | Lab | ID: K2410 | 643-005 | | | | | | | | | |
| Analyte | Results | Flag | MDL | MRL | Units | Method | | | | | | | |
| | | | | | | | | | | | | | |
| Arsenic | 14.4 | | 0.05 | 0.44 | mg/Kg | 6020B | | | | | | | |



Sample Receipt Information

ALS Environmental—Kelso Laboratory 1317 South 13th Avenue, Kelso, WA 98626 Phone (360) 577-7222 Fax (360) 425-9096 www.alsglobal.com Client: Terraphase Engineering Inc. Service Request: K2410643

Project: Upper Granite Creek Mines/0031.005.001

SAMPLE CROSS-REFERENCE

| SAMPLE # | CLIENT SAMPLE ID | <u>DATE</u> | <u>TIME</u> |
|--------------|-------------------|-------------|-------------|
| K2410643-001 | TL-WRA-0.5-3 | 10/4/2024 | 1405 |
| K2410643-002 | TL-WRB-0.5-4 | 10/4/2024 | 1425 |
| K2410643-003 | TL-WRA-0.5-1-DS-2 | 10/4/2024 | 1400 |
| K2410643-004 | SH-WRB-0.5-2 | 10/4/2024 | 1005 |
| K2410643-005 | SH-WRC-0.5-1 | 10/4/2024 | 1015 |
| K2410643-006 | CS-SD-1 | 10/5/2024 | 1006 |
| K2410643-007 | CS-SD-2 | 10/3/2024 | 1505 |
| K2410643-008 | CS-SD-3 | 10/3/2024 | 0900 |
| K2410643-009 | CS-SD-4 | 10/3/2024 | 1424 |
| K2410643-010 | CS-SD-5 | 10/4/2024 | 0930 |
| K2410643-011 | CS-SD-6 | 10/4/2024 | 1521 |
| K2410643-012 | CS-SD-7 | 10/4/2024 | 1335 |
| K2410643-013 | CS-SD-7-DUP | 10/4/2024 | 1340 |
| K2410643-014 | CS-SD-8 | 10/5/2024 | 1030 |

140510

CHAIN OF CUSTODY

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| COC Set 6 of 8 |
| COC# |

1317 South 13th Ave, Keisa, WA 98626 Phone (360) 577-7222 / 800-695-7222 / FAX (360) 636-1068

| (ALS) testates | | | | | | | | 101001 | | | | | obal.co | | | | 2116 | ~~ (300) u | XX-1000 | | | | | Page 1 d |
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| Project Name Upper Granit Creek Min | Project N | | 31.005.001 | | <u> </u> | 9 | 707 | | 80D | | | 0666 | | | | | | | | 7 | | | | - |
| roject Manager Dan Millemy | S | | | | 1 | | 7 | <u> </u> | <u> </u> | | | 8 | igspace | | | | _ | | | | | | _ | |
| Company Terinihari Engin | eer'n Inc | | | | ERS | | | (E | ĺ | | | Calc | | | ļ | | | | | j | | | 200 | |
| Address, City, State Glo Sty Grand | | 105 | | | CONTAINERS | | | ad Total) | ļ " | | | | | | | ĺ | | | | | | 7 | 1001/2 | |
| hone # (503) 943-0394 | email) | on, my Ken | and Okligha | k-Com | | | | (Sieved | Extract | يرا | 9 | ardu | | | ĺ | 1 |] | | | | 7 | γ_{I_O} | w 47 | |
| ampler Signature | | Printed Name | | | 9 | 늘 | 우 | VBA (| MA MA | leta i | Sprin | HH | | | - 1 | 1 | ļ | | | | 1/ | J | | |
| M | Don | Malkem | | _ | NUMBER | 7470A / Hg T | 74718 / Hg | 3020B / IVBA | 5020B / IVBA | 5020B / Metals T | Grind / GrindSub | SM 2340 B / Hardness | | | _ | Ā | ۵ | Re | narks | | * | | 63/3 | |
| CLIENT SAMPLE ID | LABID | Date T | /PLING ime State | Matrix | | | | | - | | | | | | | | | | | | | | • | |
| .GCS - WRA -0.5-4-03 | · | | S22 | 5051 | 2 | | | × | * | | <u> </u> | | | | | | | + pal | | _ | | | , | |
| GCG - WHA - 0.5 - 2 | | 10/4 14 | | Seil | 2 | <u> </u> | | × | N. | * | | | | _ | _ | | | + 647 | | | | | | |
| 1.GCG - WH -0.5-1 | | <u> </u> | ६५९ | soil | 2 | | | | | 7 | <u> </u> | | | | | | \perp | | | _ | | | | |
| 1.GC7 - WHA - 0.5-3 | | | 1150 | suil | 2 | | | | <u> </u> | × | <u> </u> | | | |] | | | | | | | | | |
| i.GC7 - WRB -0.5-1 | | | MZ | Soil | 2. | | | | | ٦ | <u> </u> | | | | _ | | | | | _ | | | | |
| i. T L - VRA - 0.5 - 3 | \ | · · · · · · · · · · · · · · · · · · · | 1415 | 50.1 | 2 | <u></u> | | | <u> </u> | × | <u> </u> | <u> </u> | | | | | | | | _ | | | | • |
| : 9L-6123-05-4 | 7 | lely | ।५२५ | Sail | 2 | | | | | <u> </u> | _ | | | | | | | | | _ | | | | |
| : TL-WPA-0.5-1-05-2 | 3 | 1014 | 1400 | 5.11 | 2 | | | * | 7 | 7 | <u> </u> | | | | | | | + 649 | | | | | | |
| SH-WKB-0.5-2 | Ч | 1.4 | 1005 | 1:02 | 2 | | | | | x | _ | | | |] | | _ | | | | | | | |
| 0.8H-WR(- 0.5-1 | 9 | 1014 | lois | 1:02 | 2 | | | | <u> </u> | × | L. | | | | | | | | | <u> </u> | | | | |
| Report Requirements | | oice Inf | ormation | Ī | | | | | | | | | | | | C | ircle v | which meta | is are to be a | nalvzed | | | | |
| I. Routine Report: Method Blank, Surrogate, as | P.O.# | · madei | MANIX-GOV | √ | | | Total | Met | ais: A | AI 6 | s G | Sb E | 3a B | э В | Ca | Cd (| Co (| Cr Cu I | e Pb Mg | Mn Mo | Ni K Ag | Na Se | Sr Ti Sn V | / Zn Ho |
| required | 511110 | <u> </u> | | | | 0 | | | | | | | | | | | | | | | | | Se Sr Ti Sn | |
| II. Report Dup., MS, MSD as required | | | | _ | pecia | | | | | | | 30 | - Da | DÇ. | | | | | | | | | thwest Other | |
| III. CLP Like Summary (no raw data) | 2 | ound Ro | equireme 48 hr. | nts | pecia | 111121 | IUCLI | Ulian | CON | II I ICI | ns. | | | | Link | ncau | 3 316 | ate riyul | ocarbon r | rocedure. | AN CA | VVI NOI | triwest Other | (Circle On |
| IV. Data Validation Report | X s | itandard | | | | | | | | | | | | | | - | | | | | | | | |
| V. EDD | | | <u></u> | | | | | | | | | | | | | Ţ, | | | | | | | | |
| Relinquished By: | | Requested Re Receive | | | Re | ling | uish | ned | By: | | 7 | | \overline{a} | Rece | eive | d By | - | | R | elinquisi | ned By: | 1 | Rec | eived By: |
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| ignature | Signature | 01 | | | ature | 2 | 1 | <u> </u> | | | 5 | igna | ture LOO ed Na | ا نه | 2 | lo | BL. | n | Signature | | | | Signature | |
| rinted Name Ow Milkwy | | ame LaB | أنك | | ted N | | | فه | Bi | دركم | <u>J</u> | 419 | ed Na | me | , | | | | Printed N | ame | | | Printed Name | |
| im TEI | | <u> </u> | | Firm | 40 | _S | | | | | | 10) jun | 812 | 24 | _1 | 44 | 5 | | Firm | | | | Firm | |
|)ate/Time | Date/Tim | e/0/08 | 124 130 | Date | /Time | e/0/ | × ₆ / | 24 | | 194 | | Date/ | Time | | | | | | Date/Tim | 3 | | | Date/Time | |
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140510

CHAIN OF CUSTODY

| 01, 002, 003 | SR# |
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| | COC Set 🛕 of 🛕 |
| | COC# |

1317 South 13th Ave, Kelso, WA 98626 Phone (360) 577-7222 / 800-695-7222 / FAX (360) 636-1068

| (ALS) Employe | | | | | | | | | | www.a | alsglo | bal.co | m | | | | | , | | | | | | F | Page 1 of | 1 |
|--|--|------------------------|----------|--------------|------------------|------------|---------------------|---------------------|---------------------|------------------|----------------------|-------------------|----------|-----------------|----------|---------------|----------------|-----------|--------|----------|---------|--------|--------------|---------------------------------------|--------------|---|
| Project Name (reck Mine) | Project N | umber: 0031-0+5.001 | | | 6 | } | | 180D | | C | 2000 | | | | | | | | |] | | | 7 | | | |
| Project Manager Don Mal Kumvi | | | |] | | i i | | <u> </u> | | 5 | <u> </u> | <u> </u> | T | —-г | | | | | | | | | 122. | | | |
| Company Termphile Gyineering | Inc. | | | CONTAINERS | | | Total) | l | | | Calc | | | ı | | l | | | | ļ | | | 2 | | | |
| Address, City, State Glo SW Brailwy | Suite 40 | | | Į Į | | | - To I | <u>ت</u> | | | | | | | | | | | | | | | 10 | ı | | |
| Phone # (5%) 448 0384 | email | ··Malkinis Gleccalposs | ·COM | 8 | | | (Siev | Extra | Ŀ \$ | gng | -tardn | | | | İ | | | | | | _ | 1/10 | 00 | | | |
| Sampler Signature | | Printed Name | | # # H | 큠 | ₽ | ₹ | ₹ | Meta | Srind | 186 | | | 1 | 1 | Ì | | | | | (I) | JU" | | | | |
| 111 | Don | , MIKMU | | NUMBER | 7470A / Hg | 7471B / Hg | 020B / IVBA (Sieved | 020B / IVBA Extract | 020B / Metals T | Prind / GrindSub | 3M 2340 B / Hardness | | | | | l | C | Remarl | ko | | Ψ | | 0630 | | | |
| | | SAMPLING | Matrix | | × | - 4 | 8 | 8 | Ж. | Ö | ίδ | - | 73 | | 7 | <u> </u> | Г | Ceman | 7.5 | | | | | | | |
| CLIENT SAMPLE ID | LABID | Date Time State | ! | <u> </u> | | | | | | | | | | | | | | | | | | | | | | |
| 1. (5-50-1 | <u>6</u> | 10/5 1006 | Soil | 2 | | X | \dashv | | X | | | | | | _ | _ | | | | | | | | | | |
| 2. CS - SO-2 | | 1013 1505 | Soil | 2 | | × | | _ | 7 | | | | _ | _ | ļ | _ | | | | | | | | | | |
| 3. CS - SO -3 | <u> </u> | 10 3 0900 | 1518 | 13 | | × | | | X | | | | | } | _ | \dashv | | | · | | | | | | | |
| 4. C3-50 - 4 | 9 | 1013 1424 | ١٠٠٨ | 2 | \vdash | শ | | | X | | | \sqcup | | | _ | _ | | | | | | | | | | |
| 5. Cs -50 - 5 | 10 | 1014 0130 | Seil | 2 | - | X | | | x | | | | | _ | | _ | | | | | | | | | | |
| 6. C S-SD-6 | | 104 1521 | 1305 | 5 | 1 | x | | _ | x | | | | | | _ | | | | | | | | | | | |
| 7. Cs - S D - 7 | 12 | 10 4 1335 | 51:1 | 12 | | X | | | X | | | | | _ | _ | _ | | | | | | | | | | |
| 8. CS - SD - 7 - DUP | 13 | 10 4 1340 | 5021 | 2 | 1 | X | | | X | | | | _ | _ | - | | | | | | | | | | | |
| 9. 5 - 50 - 8 | 14 | 10/5 1030 | Seil | 12 | | _ | | \dashv | X | | | \longrightarrow | | _ | _ | | | | | | | | | | | |
| 10. | · In | oice Information | | <u> </u> | لبا | | | | | L | | | 1 | L | | | | | | <u> </u> | | | | | | 7 |
| Report Requirements 1. Routine Report: Method | P.O.#_ | Oice miorination | | | | | | | | | _ | | | | | | | etals are | | | | | | | | ĺ |
| Blank, Surrogate, as required | Bill To | ep Q'timpuse. | 34M | | | Total | Meta | is: A | 1 6 | 9(S | 9 B | a Be | 8 | Ca (| <u>ල</u> | co ((| ည္ င | Fe (P | gM (g | Mn Mo | Ni K | Ag) Na | Se Sr Tl Sr | 1 N (5) (| t) | ĺ |
| 1. Report Dup., MS, MSD | | and the second | <u> </u> | | Di | ssolv | ed M | etais: | A! | As | Sb | Ва | Ве | B Ca | Cd | Co | Cr | Cu Fe | Pb M | g Mn M | 10 Ni K | K Ag N | a Se Sr Ti | Sn V Zn | Hg | |
| as required | Turna | round Requireme | ents S | Specia | l Inst | uctio | ons/C | Comr | men | ts: | | | | *Inc | licate | e Sta | ate Hy | /drocarl | on Pr | ocedure | : AK C | A WI | Northwest Ot | her | (Circle One) |] |
| III. CLP Like Summary (no raw data) | | 2 4 hr4 8 hr. | | | | | | | | | | | | | | | | | | | | | | | | |
| IV. Data Validation Report | 】 | 5 Day Standard | 1 | | | | | | | | | | | | | | | | | | | | | | | |
| V. EDD | | Requested Report Date | | | | | | | | | | | | | , | | | | | | | | | | | |
| Relinquished By: | | Received By: | | Re | linq | ıish | ed l | Зу: | | Τ. | | F | Repe | | | / : | | T | Rel | inquisl | hed By | y: | Į ,F | Received | By: | ㅓ |
| | | A | | -6 | | _ | } | | | 1/2 | \subseteq | K | <u> </u> | R | ئے | <u> </u> | | <u> </u> | | | | | <u> </u> | | | _ |
| Signature | Signature | A.X | Sign | ature | 7 | 4 | ~ | | | Ž | ignat V <i>Ci</i> | ture OSV | 6 | 201 | -00 | B | e i | Signa | ature | | | | Signature | | | |
| Printed Name A (GMY) | Printed N | iame la Bich | | ed Na | | 1 | aBî | ch | <u> </u> | 4 | rinte | o Na | | }- - | | | عب البياد ا | Print | ed Nar | ne | | * | Printed Na | me | | 1 |
| Firm TEI | Firm | .5 | Firm | AL | 2 | , | | | | Æ | ım - | 181 | 21 | 11 | 4 | 15 | , | Firm | | | | | Firm | · · · · · · · · · · · · · · · · · · · | <u> </u> | 1 |
| Date/Time 1 | Date/Tim | e10]08 24 130 | Date | /Time | ime/0/08/24 /445 | | | | Date/Time Date/Time | | | | | | | Date/Time | | | | | | | | | | |

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| Toomy | Cooler Receipt a | nd Preser | vation F | orm | | | |
|---|---------------------------|--------------------|---------------|----------------------------------|-------------------|-----------|---|
| Client Client | 1016/100 | | | Request K24 | | a F | <u> </u> |
| Received: 1018124 Opened: | 1018124 | Ву: | Uni | loaded: / O | 8129By:_ | | |
| 1. Samples were received via? USPS | Fed Ex UP | S Di | HL I | PDX (E6 | urier Hand Del | ivered | |
| 2. Samples were received in: (circle) | ler Box | Envelope | O | (her | | NA | |
| 3. Were <u>custody seals</u> on coolers? | A Y (N) If | es, how man | y and where | ? | | - | |
| If present, were custody seals intact? | Y N If | oresent, were | they signed | and dated? | Y | N | |
| | Cooler#/COC ID / NA | Out of indicate | | PM Notified If out of temp | Tracking Numb | er NA | Filed |
| 9.6 4.6 -1801 | 140510 | | | | | | |
| 168 5.7 | · | | | | | | |
| (e.0 44 | | | | | | | |
| 9.4 4.5 | | | | | | | |
| 18.3 4.5 | | | | | | | |
| 4. Was a Temperature Blank present in cooler? N | A (Y) N If | yes, notate the | temperatur | e in the appropri | ate column above: | | |
| If no, take the temperature of a representative | sample bottle contained | within the co | oler, notate | in the column "S | ample Temp": |) | |
| 5. Were samples received within the method speci | fied temperature ranges | ? | | | NA (Y | N | |
| If no, were they received on ice and same day a | s collected? If not, nota | ite the cooler | # above and | notify the PM. | (NA) Y | N | |
| If applicable, tissue samples were received: Fr | ozen Partially Than | ved Thawe | d | | | | |
| 6. Packing material: Inserts Baggies Bubl | ole Wrap Gel Packs | Wet Ice D | ry Ice Sle | eves | | | |
| 7. Were custody papers properly filled out (ink, s | igned, etc.)? | | | | NA CY | N | |
| 8. Were samples received in good condition (unb | • | | | | NA SX. | N | |
| 9. Were all sample labels complete (ie, analysis, | • | | | | NA Y | , N | |
| 10. Did all sample labels and tags agree with custo11. Were appropriate bottles/containers and volum | | . idied0 | | | NA Y NA Y | , N N | |
| 12. Were the pH-preserved bottles (see SMO GEN | | | D Indicate | in the table helm | | N N | |
| 13. Were VOA vials received without headspace? | | | i maicale i | in the table betor | NA Y | N | |
| 14. Was C12/Res negative? | matcase in the table be | etow. | | | | N | |
| 15. Were samples received within the method spe- | nified time limit? If not | matata tha ar | ear halanı or | nd notify the DM | NA Y | N | |
| 16. Were 100ml sterile microbiology bottles filled | · | | } | N | | Overfille | A |
| 16. Were foom sterne microbiology bottles fined | exactly to the 100mi m | iark? (N | 4 J | IN | Ondermied | Overifine | u |
| Sample ID on Bottle | Sample II | on COC | | | Identified by: | · | |
| | | | | | | | |
| | | <u></u> | | | | | |
| | <u>L</u> | | | | | | |
| | | <u> </u> | | | | , | _,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,, |
| Sample ID | | ead- pace Broke | pH Re | Volun eagent adde | | initiais | Time |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| Notes, Discrepancies, Resolutions: | _ | | 1 | | | ! | |
| G:\SMO\2024 Forms | SC | OP: SMO-G | EN | | Reviewed: | NP 1/3 | /2024 |

174 of 283



Cooler Receipt and Preservation Form

| Temp Blank | Sample Temp | IR Gun | Cooler #/C | OC ID / | NA . | Out Indica | of tem ate with | Х. | PM Notifie If out of t | | Tracking Nur | nber NA | File |
|-------------------------------|-------------------------|------------|--------------|-------------|---|---------------|--------------------|-----|------------------------------|-----------------|-----------------------|----------|------|
| 12.2 | 3. \$ 5.5 | 1801 | | | | | | | | | | | |
| | | | | | | | | | | | | 7 | |
| San | nple ID on Bottle | | | Sample | ID on C | :oc | | 210 | | id ld | entified by: | | |
| 1941 | | | | | | | | | | | | | |
| | Sample ID | | ottle Count | Out of Temp | Head- | Broke | рН | | Reagent | Volume added | Reagent Lot Number | Initials | Time |
| | | | | | | | | _ | | | | | |
| | | | | | | | | | | | | | |
| stes, Discrep Sum India | pancies & Resolution Te | utions: 10 | blan blan | as a Ne (| it is | HOP 3 L | of nd | er | coolers · He | sylv Sylv | n topo | Not | |
| | | | | | | | | | | | | | |
| | | | | | *************************************** | | | | | | | | |
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G:\SMO\2024 Forms

SOP: SMO-GEN

Reviewed: NP 1/3/2024

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Miscellaneous Forms

ALS Environmental—Kelso Laboratory 1317 South 13th Avenue, Kelso, WA 98626 Phone (360) 577-7222 Fax (360) 425-9096 www.alsglobal.com

Inorganic Data Qualifiers

- * The result is an outlier. See case narrative.
- # The control limit criteria is not applicable.
- B The analyte was found in the associated method blank at a level that is significant relative to the sample result as defined by the DOD or NELAC standards.
- F. The result is an estimate amount because the value exceeded the instrument calibration range.
- I The result is an estimated value
- U The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL.
 DOD-QSM 4.2 definition: Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
- i The MRL/MDL or LOQ/LOD is elevated due to a matrix interference.
- X See case narrative.
- Q See case narrative. One or more quality control criteria was outside the limits.
- H The holding time for this test is immediately following sample collection. The samples were analyzed as soon as possible after receipt by the laboratory.

Metals Data Qualifiers

- # The control limit criteria is not applicable.
- J The result is an estimated value.
- E The percent difference for the serial dilution was greater than 10%, indicating a possible matrix interference in the sample.
- M The duplicate injection precision was not met.
- N The Matrix Spike sample recovery is not within control limits. See case narrative.
- S The reported value was determined by the Method of Standard Additions (MSA).
- U The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL. DOD-QSM 4.2 definition: Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
- W The post-digestion spike for furnace AA analysis is out of control limits, while sample absorbance is less than 50% of spike absorbance.
- i The MRL/MDL or LOQ/LOD is elevated due to a matrix interference.
- X See case narrative.
- + The correlation coefficient for the MSA is less than 0.995.
- Q See case narrative. One or more quality control criteria was outside the limits.

Organic Data Qualifiers

- * The result is an outlier. See case narrative.
- # The control limit criteria is not applicable. See case narrative.
- A A tentatively identified compound, a suspected aldol-condensation product.
- B The analyte was found in the associated method blank at a level that is significant relative to the sample result as defined by the DOD or NELAC standards.
- C The analyte was qualitatively confirmed using GC/MS techniques, pattern recognition, or by comparing to historical data.
- D The reported result is from a dilution.
- E The result is an estimated value over the calibration range.
- J The result is an estimated value between the MDL and the MRL.
- $N \quad \text{ The result is presumptive. The analyte was tentatively identified, but \ a confirmation analysis was not performed.} \\$
- P The GC or HPLC confirmation criteria was exceeded. The relative percent difference is greater than 40% between the two analytical results.
- U The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL.
 DOD-QSM 4.2 definition: Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
- i The MRL/MDL or LOQ/LOD is elevated due to a chromatographic interference.
- X See case narrative.
- Q See case narrative. One or more quality control criteria was outside the limits.

Additional Petroleum Hydrocarbon Specific Qualifiers

- L The chromatographic fingerprint of the sample resembles a petroleum product, but the elution pattern indicates the presence of a greater amount of lighter molecular weight constituents than the calibration standard.
- H The chromatographic fingerprint of the sample resembles a petroleum product, but the elution pattern indicates the presence of a greater amount of heavier molecular weight constituents than the calibration standard.
- O The chromatographic fingerprint of the sample resembles an oil, but does not match the calibration standard.
- Y The chromatographic fingerprint of the sample resembles a petroleum product eluting in approximately the correct carbon range, but the elution pattern does not match the calibration standard.
- Z The chromatographic fingerprint does not resemble a petroleum product.

ALS Group USA Corp. dba ALS Environmental (ALS) - Kelso State Certifications, Accreditations, and Licenses

| Agency | Web Site | Number |
|--------------------------|---|-------------|
| Alaska DEH | http://dec.alaska.gov/eh/lab/cs/csapproval.htm | UST-040 |
| Arizona DHS | http://www.azdhs.gov/lab/license/env.htm | AZ0339 |
| Arkansas - DEQ | http://www.adeq.state.ar.us/techsvs/labcert.htm | 88-0637 |
| California DHS (ELAP) | http://www.cdph.ca.gov/certlic/labs/Pages/ELAP.aspx | 2795 |
| DOD ELAP | http://www.denix.osd.mil/edqw/Accreditation/AccreditedLabs.cfm | L16-58-R4 |
| Florida DOH | http://www.doh.state.fl.us/lab/EnvLabCert/WaterCert.htm | E87412 |
| Hawaii DOH | http://health.hawaii.gov/ | - |
| ISO 17025 | http://www.pjlabs.com/ | L16-57 |
| Louisiana DEQ | http://www.deq.louisiana.gov/page/la-lab-accreditation | 03016 |
| Maine DHS | http://www.maine.gov/dhhs/ | WA01276 |
| Minnesota DOH | http://www.health.state.mn.us/accreditation | 053-999-457 |
| Nevada DEP | http://ndep.nv.gov/bsdw/labservice.htm | WA01276 |
| New Jersey DEP | http://www.nj.gov/dep/enforcement/oqa.html | WA005 |
| New York - DOH | https://www.wadsworth.org/regulatory/elap | 12060 |
| | https://deq.nc.gov/about/divisions/water-resources/water-resources-data/water-sciences-home-page/laboratory-certification-branch/non-field-lab- | |
| North Carolina DEQ | certification | 605 |
| Oklahoma DEQ | http://www.deq.state.ok.us/CSDnew/labcert.htm | 9801 |
| Oregon – DEQ (NELAP) | http://public.health.oregon.gov/LaboratoryServices/EnvironmentalLaboratoryAccreditation/Pages/index.aspx | WA100010 |
| South Carolina DHEC | http://www.scdhec.gov/environment/EnvironmentalLabCertification/ | 61002 |
| Texas CEQ | http://www.tceq.texas.gov/field/qa/env_lab_accreditation.html | T104704427 |
| Washington DOE | http://www.ecy.wa.gov/programs/eap/labs/lab-accreditation.html | C544 |
| Wyoming (EPA Region 8) | https://www.epa.gov/region8-waterops/epa-region-8-certified-drinking-water- | - |
| Kelso Laboratory Website | www.alsglobal.com | NA |

Analyses were performed according to our laboratory's NELAP-approved quality assurance program. A complete listing of specific NELAP-certified analytes, can be found in the certification section at www.ALSGlobal.com or at the accreditation bodies web site.

Please refer to the certification and/or accreditation body's web site if samples are submitted for compliance purposes. The states highlighted above, require the analysis be listed on the state certification if used for compliance purposes and if the method/anlayte is offered by that state.

Acronyms

ASTM American Society for Testing and Materials

A2LA American Association for Laboratory Accreditation

CARB California Air Resources Board

CAS Number Chemical Abstract Service registry Number

CFC Chlorofluorocarbon
CFU Colony-Forming Unit

DEC Department of Environmental Conservation

DEQ Department of Environmental Quality

DHS Department of Health Services

DOE Department of Ecology
DOH Department of Health

EPA U. S. Environmental Protection Agency

ELAP Environmental Laboratory Accreditation Program

GC Gas Chromatography

GC/MS Gas Chromatography/Mass Spectrometry

LOD Limit of Detection
LOQ Limit of Quantitation

LUFT Leaking Underground Fuel Tank

M Modified

MCL Maximum Contaminant Level is the highest permissible concentration of a substance

allowed in drinking water as established by the USEPA.

MDL Method Detection Limit
MPN Most Probable Number
MRL Method Reporting Limit

NA Not Applicable
NC Not Calculated

NCASI National Council of the Paper Industry for Air and Stream Improvement

ND Not Detected

NIOSH National Institute for Occupational Safety and Health

PQL Practical Quantitation Limit

RCRA Resource Conservation and Recovery Act

SIM Selected Ion Monitoring

TPH Total Petroleum Hydrocarbons

tr Trace level is the concentration of an analyte that is less than the PQL but greater than or

equal to the MDL.

Analyst Summary report

Client: Terraphase Engineering Inc.

Project: Upper Granite Creek Mines/0031.005.001

Date Collected: 10/4/24

Date Received: 10/8/24

Service Request: K2410643

Sample Name: TL-WRA-0.5-3 **Lab Code:** K2410643-001

Sample Matrix: Soil

Analysis Method

Extracted/Digested By Analyzed By

160.3 Modified ZBIBI

6020B KLAWSON JCHAN

Sample Name: TL-WRB-0.5-4 Date Collected: 10/4/24

Lab Code: K2410643-002 **Date Received:** 10/8/24

Sample Matrix: Soil

Analysis Method Extracted/Digested By Analyzed By

160.3 Modified ZBIBI

6020B KLAWSON JCHAN

Sample Name: TL-WRA-0.5-1-DS-2 Date Collected: 10/4/24

Lab Code: K2410643-003 **Date Received:** 10/8/24

Sample Matrix: Soil

Analysis Method Extracted/Digested By Analyzed By

160.3 Modified ZBIBI

6020B KLAWSON JCHAN
6020B MSOLADEY JCHAN

Sample Name: SH-WRB-0.5-2 Date Collected: 10/4/24

Lab Code: K2410643-004 Date Received: 10/8/24 Sample Matrix: Soil

Analysis Method Extracted/Digested By Analyzed By

160.3 Modified ZBIBI

6020B KLAWSON JCHAN

Analyst Summary report

Service Request: K2410643

Client: Terraphase Engineering Inc.

Project: Upper Granite Creek Mines/0031.005.001

 Sample Name:
 SH-WRC-0.5-1
 Date Collected:
 10/4/24

 Lab Code:
 K2410643-005
 Date Received:
 10/8/24

Sample Matrix: Soil

Analysis Method Extracted/Digested By Analyzed By

160.3 Modified ZBIBI

6020B KLAWSON JCHAN

Sample Name: CS-SD-1 Date Collected: 10/5/24

Lab Code: K2410643-006 **Date Received:** 10/8/24

Sample Matrix: Soil

Analysis Method Extracted/Digested By Analyzed By

160.3 Modified ZBIBI

6020B KLAWSON JCHAN 7471B KLINN KLINN

Sample Name: CS-SD-2 Date Collected: 10/3/24

Lab Code: K2410643-007 **Date Received:** 10/8/24

Sample Matrix: Soil

Analysis Method Extracted/Digested By Analyzed By

160.3 Modified ZBIBI

6020B KLAWSON JCHAN 7471B KLINN KLINN

Sample Name: CS-SD-3 Date Collected: 10/3/24

Lab Code: K2410643-008 **Date Received:** 10/8/24

Sample Matrix: Soil

Analysis Method Extracted/Digested By Analyzed By

160.3 Modified ZBIBI

6020B KLAWSON JCHAN 7471B KLINN KLINN

Printed 10/23/2024 5:16:32 PM Superset Reference:24-0000711615 rev 00

Analyst Summary report

Service Request: K2410643

Analyzed By

Client: Terraphase Engineering Inc.

Project: Upper Granite Creek Mines/0031.005.001

Sample Name: CS-SD-4 Date Collected: 10/3/24

Lab Code: K2410643-009 **Date Received:** 10/8/24

Sample Matrix: Soil

Analysis Method

Analysis Method Extracted/Digested By Analyzed By

160.3 Modified ZBIBI

6020B KLAWSON JCHAN 7471B KLINN KLINN

Sample Name: CS-SD-5 Date Collected: 10/4/24

Lab Code: K2410643-010 **Date Received:** 10/8/24

Sample Matrix: Soil

Analysis Method Extracted/Digested By Analyzed By

160.3 Modified ZBIBI

6020B KLAWSON JCHAN 7471B KLINN KLINN

Sample Name: CS-SD-6 Date Collected: 10/4/24

Lab Code:K2410643-011Date Received:10/8/24Sample Matrix:Soil

Extracted/Digested By

160.3 Modified ZBIBI

6020B KLAWSON JCHAN 7471B KLINN KLINN

Sample Name: CS-SD-7 Date Collected: 10/4/24

Lab Code: K2410643-012 **Date Received:** 10/8/24

Sample Matrix: Soil

Analysis Method Extracted/Digested By Analyzed By

160.3 Modified ZBIBI

6020B KLAWSON JCHAN 7471B KLINN KLINN

Printed 10/23/2024 5:16:33 PM Superset Reference:24-0000711615 rev 00

Analyst Summary report

Client: Terraphase Engineering Inc. Service Request: K2410643

Project: Upper Granite Creek Mines/0031.005.001

 Sample Name:
 CS-SD-7-DUP
 Date Collected:
 10/4/24

 Lab Code:
 K2410643-013
 Date Received:
 10/8/24

Sample Matrix: Soil

Analysis Method Extracted/Digested By Analyzed By

160.3 Modified ZBIBI

6020B KLAWSON JCHAN 7471B KLINN KLINN

Sample Name: CS-SD-8 Date Collected: 10/5/24

Lab Code: K2410643-014 Date Received: 10/8/24 Sample Matrix: Soil

Analysis Method Extracted/Digested By Analyzed By

160.3 Modified ZBIBI

6020B KLAWSON JCHAN 7471B KLINN KLINN



Sample Results

ALS Environmental—Kelso Laboratory 1317 South 13th Avenue, Kelso, WA 98626 Phone (360) 577-7222 Fax (360) 425-9096 www.alsglobal.com



Metals

ALS Environmental—Kelso Laboratory 1317 South 13th Avenue, Kelso, WA 98626 Phone (360) 577-7222 Fax (360) 425-9096 www.alsglobal.com

Analytical Report

Client: Terraphase Engineering Inc.

Upper Granite Creek Mines/0031.005.001

Date Collected: 10/04/24 14:05

Service Request: K2410643

Sample Matrix:

Project:

Soil

Date Received: 10/08/24 11:45

Sample Name: TL-WRA-0.5-3 Basis: Dry

Lab Code: K2410643-001

| | Analysis | | | | | | | Date | |
|---------------------|----------|--------|-------|------|------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 454 | mg/Kg | 0.42 | 0.05 | 5 | 10/22/24 13:49 | 10/14/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Project:

Service Request: K2410643 **Date Collected:** 10/04/24 14:25 Upper Granite Creek Mines/0031.005.001

Date Received: 10/08/24 11:45 **Sample Matrix:** Soil

Sample Name: TL-WRB-0.5-4 Basis: Dry

Lab Code: K2410643-002

| | Analysis | | | | | | | Date | |
|---------------------|----------|--------|-------|------|------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 194 | mg/Kg | 0.42 | 0.05 | 5 | 10/22/24 13:58 | 10/14/24 | |

Analytical Report

Terraphase Engineering Inc. **Client:**

Project:

Service Request: K2410643 **Date Collected:** 10/04/24 14:00 Upper Granite Creek Mines/0031.005.001

Date Received: 10/08/24 11:45 **Sample Matrix:** Soil

TL-WRA-0.5-1-DS-2 **Sample Name:** Basis: Dry

Lab Code: K2410643-003

Total Metals – IVBA Analysis

| | Analysis | | | | | | | Date | |
|--------------|----------|--------|-------|------|------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 550 | mg/Kg | 4.9 | 0.6 | 50 | 10/22/24 16:11 | 10/17/24 | |
| Lead | 6020B | 218 | mg/Kg | 0.49 | 0.19 | 50 | 10/22/24 16:11 | 10/17/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Project:

Service Request: K2410643 **Date Collected:** 10/04/24 14:00 Upper Granite Creek Mines/0031.005.001

Date Received: 10/08/24 11:45 **Sample Matrix:** Soil

Sample Name: TL-WRA-0.5-1-DS-2 Basis: Dry

Lab Code: K2410643-003

IVBA Metals

| | Analysis | | | | | | | Date | |
|--------------|----------|--------|-------|------|------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 14.4 | mg/Kg | 1.9 | 0.2 | 20 | 10/17/24 11:50 | 10/16/24 | |
| Lead | 6020B | 83.3 | mg/Kg | 0.19 | 0.08 | 20 | 10/17/24 11:50 | 10/16/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Project:

Service Request: K2410643 **Date Collected:** 10/04/24 14:00 Upper Granite Creek Mines/0031.005.001

Date Received: 10/08/24 11:45 **Sample Matrix:** Soil

TL-WRA-0.5-1-DS-2 **Sample Name:** Basis: Dry

Lab Code: K2410643-003

| | Analysis | | | | | | | Date | |
|---------------------|----------|--------|-------|------|------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 267 | mg/Kg | 0.44 | 0.05 | 5 | 10/22/24 14:00 | 10/14/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Upper Granite Creek Mines/0031.005.001

Service Request: K2410643 **Date Collected:** 10/04/24 10:05

Sample Matrix: Soil

opper Grame Creek Willies, 0031.003.00

Date Received: 10/08/24 11:45

Sample Name:

SH-WRB-0.5-2

Lab Code:

Project:

K2410643-004

Basis: Dry

| | Analysis | | | | | | | Date | |
|---------------------|----------|--------|-------|------|------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 80.8 | mg/Kg | 0.39 | 0.05 | 5 | 10/22/24 14:02 | 10/14/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Upper Granite Creek Mines/0031.005.001

Sample Matrix:

Soil

SH-WRC-0.5-1

Sample Name: Lab Code:

Project:

K2410643-005

Service Request: K2410643

Date Collected: 10/04/24 10:15

Date Received: 10/08/24 11:45

Basis: Dry

| | Analysis | | | | | | | Date | |
|---------------------|----------|--------|-------|------|------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 14.4 | mg/Kg | 0.44 | 0.05 | 5 | 10/22/24 14:08 | 10/14/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Service Request: K2410643 **Date Collected:** 10/05/24 10:06 **Project:** Upper Granite Creek Mines/0031.005.001

Date Received: 10/08/24 11:45 **Sample Matrix:** Soil

Sample Name: CS-SD-1 Basis: Dry

Lab Code: K2410643-006

| | Analysis | | | | | | | Date | |
|--------------|----------|---------|-------|-------|-------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Antimony | 6020B | 0.26 | mg/Kg | 0.13 | 0.05 | 5 | 10/22/24 14:10 | 10/14/24 | |
| Arsenic | 6020B | 5.8 | mg/Kg | 1.3 | 0.2 | 5 | 10/22/24 14:10 | 10/14/24 | |
| Cadmium | 6020B | 0.234 | mg/Kg | 0.053 | 0.019 | 5 | 10/22/24 14:10 | 10/14/24 | |
| Chromium | 6020B | 7.81 | mg/Kg | 0.53 | 0.16 | 5 | 10/22/24 14:10 | 10/14/24 | |
| Lead | 6020B | 4.12 | mg/Kg | 0.13 | 0.05 | 5 | 10/22/24 14:10 | 10/14/24 | |
| Mercury | 7471B | 0.031 J | mg/Kg | 0.053 | 0.005 | 1 | 10/15/24 12:21 | 10/14/24 | |
| Silver | 6020B | 0.282 | mg/Kg | 0.053 | 0.011 | 5 | 10/22/24 14:10 | 10/14/24 | |
| Zinc | 6020B | 45.0 | mg/Kg | 1.3 | 0.5 | 5 | 10/22/24 14:10 | 10/14/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Service Request: K2410643 **Date Collected:** 10/03/24 15:05 Upper Granite Creek Mines/0031.005.001

Date Received: 10/08/24 11:45 **Sample Matrix:** Soil

Sample Name: CS-SD-2 Basis: Dry

Lab Code: K2410643-007

Project:

| | Analysis | | | | | | | Date | |
|--------------|----------|---------|-------|-------|-------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Antimony | 6020B | 0.038 J | mg/Kg | 0.054 | 0.022 | 5 | 10/22/24 14:12 | 10/14/24 | |
| Arsenic | 6020B | 4.52 | mg/Kg | 0.54 | 0.07 | 5 | 10/22/24 14:12 | 10/14/24 | |
| Cadmium | 6020B | 0.038 | mg/Kg | 0.022 | 0.008 | 5 | 10/22/24 14:12 | 10/14/24 | |
| Chromium | 6020B | 2.49 | mg/Kg | 0.22 | 0.07 | 5 | 10/22/24 14:12 | 10/14/24 | |
| Lead | 6020B | 0.927 | mg/Kg | 0.054 | 0.022 | 5 | 10/22/24 14:12 | 10/14/24 | |
| Mercury | 7471B | ND U | mg/Kg | 0.024 | 0.002 | 1 | 10/15/24 12:22 | 10/14/24 | |
| Silver | 6020B | 0.043 | mg/Kg | 0.022 | 0.004 | 5 | 10/22/24 14:12 | 10/14/24 | |
| Zinc | 6020B | 16.9 | mg/Kg | 0.54 | 0.22 | 5 | 10/22/24 14:12 | 10/14/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Service Request: K2410643 **Date Collected:** 10/03/24 09:00 **Project:** Upper Granite Creek Mines/0031.005.001

Date Received: 10/08/24 11:45 **Sample Matrix:** Soil

Sample Name: CS-SD-3 Basis: Dry

Lab Code: K2410643-008

| | Analysis | | | | | | | Date | |
|--------------|----------|--------|-------|-------|-------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Antimony | 6020B | 0.069 | mg/Kg | 0.063 | 0.025 | 5 | 10/22/24 14:14 | 10/14/24 | |
| Arsenic | 6020B | 11.7 | mg/Kg | 0.63 | 0.08 | 5 | 10/22/24 14:14 | 10/14/24 | |
| Cadmium | 6020B | 0.062 | mg/Kg | 0.025 | 0.009 | 5 | 10/22/24 14:14 | 10/14/24 | |
| Chromium | 6020B | 4.90 | mg/Kg | 0.25 | 0.08 | 5 | 10/22/24 14:14 | 10/14/24 | |
| Lead | 6020B | 1.53 | mg/Kg | 0.063 | 0.025 | 5 | 10/22/24 14:14 | 10/14/24 | |
| Mercury | 7471B | 0.923 | mg/Kg | 0.027 | 0.003 | 1 | 10/15/24 12:24 | 10/14/24 | |
| Silver | 6020B | 0.112 | mg/Kg | 0.025 | 0.005 | 5 | 10/22/24 14:14 | 10/14/24 | |
| Zinc | 6020B | 29.7 | mg/Kg | 0.63 | 0.25 | 5 | 10/22/24 14:14 | 10/14/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Service Request: K2410643 **Date Collected:** 10/03/24 14:24 **Project:** Upper Granite Creek Mines/0031.005.001

Date Received: 10/08/24 11:45 **Sample Matrix:** Soil

Sample Name: CS-SD-4 Basis: Dry

Lab Code: K2410643-009

| | Analysis | | | | | | | Date | |
|--------------|----------|---------|-------|-------|-------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Antimony | 6020B | 0.892 | mg/Kg | 0.058 | 0.023 | 5 | 10/22/24 14:16 | 10/14/24 | |
| Arsenic | 6020B | 32.7 | mg/Kg | 0.58 | 0.07 | 5 | 10/22/24 14:16 | 10/14/24 | |
| Cadmium | 6020B | 1.09 | mg/Kg | 0.023 | 0.008 | 5 | 10/22/24 14:16 | 10/14/24 | |
| Chromium | 6020B | 9.05 | mg/Kg | 0.23 | 0.07 | 5 | 10/22/24 14:16 | 10/14/24 | |
| Lead | 6020B | 25.6 | mg/Kg | 0.058 | 0.023 | 5 | 10/22/24 14:16 | 10/14/24 | |
| Mercury | 7471B | 0.011 J | mg/Kg | 0.029 | 0.003 | 1 | 10/15/24 12:26 | 10/14/24 | |
| Silver | 6020B | 0.961 | mg/Kg | 0.023 | 0.005 | 5 | 10/22/24 14:16 | 10/14/24 | |
| Zinc | 6020B | 47.2 | mg/Kg | 0.58 | 0.23 | 5 | 10/22/24 14:16 | 10/14/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Service Request: K2410643 **Date Collected:** 10/04/24 09:30 **Project:** Upper Granite Creek Mines/0031.005.001

Date Received: 10/08/24 11:45 **Sample Matrix:** Soil

Sample Name: CS-SD-5 Basis: Dry

Lab Code: K2410643-010

| | Analysis | | | | | | | Date | |
|--------------|----------|--------|-------|-------|-------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Antimony | 6020B | 0.146 | mg/Kg | 0.051 | 0.020 | 5 | 10/22/24 14:18 | 10/14/24 | |
| Arsenic | 6020B | 14.1 | mg/Kg | 0.51 | 0.06 | 5 | 10/22/24 14:18 | 10/14/24 | |
| Cadmium | 6020B | 0.169 | mg/Kg | 0.020 | 0.007 | 5 | 10/22/24 14:18 | 10/14/24 | |
| Chromium | 6020B | 5.03 | mg/Kg | 0.20 | 0.06 | 5 | 10/22/24 14:18 | 10/14/24 | |
| Lead | 6020B | 2.79 | mg/Kg | 0.051 | 0.020 | 5 | 10/22/24 14:18 | 10/14/24 | |
| Mercury | 7471B | 0.056 | mg/Kg | 0.025 | 0.002 | 1 | 10/15/24 12:27 | 10/14/24 | |
| Silver | 6020B | 0.582 | mg/Kg | 0.020 | 0.004 | 5 | 10/22/24 14:18 | 10/14/24 | |
| Zinc | 6020B | 32.7 | mg/Kg | 0.51 | 0.20 | 5 | 10/22/24 14:18 | 10/14/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Service Request: K2410643 **Date Collected:** 10/04/24 15:21 **Project:** Upper Granite Creek Mines/0031.005.001

Date Received: 10/08/24 11:45 **Sample Matrix:** Soil

Sample Name: CS-SD-6 Basis: Dry

Lab Code: K2410643-011

| | Analysis | | | | | | | Date | |
|--------------|----------|--------|-------|-------|-------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Antimony | 6020B | 0.147 | mg/Kg | 0.045 | 0.018 | 5 | 10/22/24 14:20 | 10/14/24 | |
| Arsenic | 6020B | 16.6 | mg/Kg | 0.45 | 0.05 | 5 | 10/22/24 14:20 | 10/14/24 | |
| Cadmium | 6020B | 0.146 | mg/Kg | 0.018 | 0.006 | 5 | 10/22/24 14:20 | 10/14/24 | |
| Chromium | 6020B | 4.76 | mg/Kg | 0.18 | 0.05 | 5 | 10/22/24 14:20 | 10/14/24 | |
| Lead | 6020B | 2.74 | mg/Kg | 0.045 | 0.018 | 5 | 10/22/24 14:20 | 10/14/24 | |
| Mercury | 7471B | 0.033 | mg/Kg | 0.021 | 0.002 | 1 | 10/15/24 12:29 | 10/14/24 | |
| Silver | 6020B | 0.200 | mg/Kg | 0.018 | 0.004 | 5 | 10/22/24 14:20 | 10/14/24 | |
| Zinc | 6020B | 37.1 | mg/Kg | 0.45 | 0.18 | 5 | 10/22/24 14:20 | 10/14/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Service Request: K2410643 **Date Collected:** 10/04/24 13:35 **Project:** Upper Granite Creek Mines/0031.005.001

Date Received: 10/08/24 11:45 **Sample Matrix:** Soil

Sample Name: CS-SD-7 Basis: Dry

Lab Code: K2410643-012

| | Analysis | | | | | | | Date | |
|--------------|----------|--------|-------|-------|-------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Antimony | 6020B | 0.355 | mg/Kg | 0.048 | 0.019 | 5 | 10/22/24 14:21 | 10/14/24 | |
| Arsenic | 6020B | 24.2 | mg/Kg | 0.48 | 0.06 | 5 | 10/22/24 14:21 | 10/14/24 | |
| Cadmium | 6020B | 0.538 | mg/Kg | 0.019 | 0.007 | 5 | 10/22/24 14:21 | 10/14/24 | |
| Chromium | 6020B | 10.6 | mg/Kg | 0.19 | 0.06 | 5 | 10/22/24 14:21 | 10/14/24 | |
| Lead | 6020B | 12.1 | mg/Kg | 0.048 | 0.019 | 5 | 10/22/24 14:21 | 10/14/24 | |
| Mercury | 7471B | 0.097 | mg/Kg | 0.023 | 0.002 | 1 | 10/15/24 12:30 | 10/14/24 | |
| Silver | 6020B | 1.10 | mg/Kg | 0.019 | 0.004 | 5 | 10/22/24 14:21 | 10/14/24 | |
| Zinc | 6020B | 168 | mg/Kg | 0.48 | 0.19 | 5 | 10/22/24 14:21 | 10/14/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Service Request: K2410643 **Date Collected:** 10/04/24 13:40 **Project:** Upper Granite Creek Mines/0031.005.001

Date Received: 10/08/24 11:45 **Sample Matrix:** Soil

Sample Name: CS-SD-7-DUP Basis: Dry

Lab Code: K2410643-013

| | Analysis | | | | | | | Date | |
|--------------|----------|--------|-------|-------|-------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Antimony | 6020B | 0.334 | mg/Kg | 0.054 | 0.022 | 5 | 10/22/24 14:23 | 10/14/24 | |
| Arsenic | 6020B | 24.3 | mg/Kg | 0.54 | 0.06 | 5 | 10/22/24 14:23 | 10/14/24 | |
| Cadmium | 6020B | 0.446 | mg/Kg | 0.022 | 0.008 | 5 | 10/22/24 14:23 | 10/14/24 | |
| Chromium | 6020B | 9.10 | mg/Kg | 0.22 | 0.06 | 5 | 10/22/24 14:23 | 10/14/24 | |
| Lead | 6020B | 12.8 | mg/Kg | 0.054 | 0.022 | 5 | 10/22/24 14:23 | 10/14/24 | |
| Mercury | 7471B | 0.099 | mg/Kg | 0.024 | 0.002 | 1 | 10/15/24 12:35 | 10/14/24 | |
| Silver | 6020B | 1.62 | mg/Kg | 0.022 | 0.004 | 5 | 10/22/24 14:23 | 10/14/24 | |
| Zinc | 6020B | 102 | mg/Kg | 0.54 | 0.22 | 5 | 10/22/24 14:23 | 10/14/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Service Request: K2410643 **Date Collected:** 10/05/24 10:30 **Project:** Upper Granite Creek Mines/0031.005.001

Date Received: 10/08/24 11:45 **Sample Matrix:** Soil

Sample Name: CS-SD-8 Basis: Dry

Lab Code: K2410643-014

| | Analysis | | | | | | | Date | |
|--------------|----------|--------|-------|-------|-------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Antimony | 6020B | 0.406 | mg/Kg | 0.058 | 0.023 | 5 | 10/22/24 14:25 | 10/14/24 | |
| Arsenic | 6020B | 35.2 | mg/Kg | 0.58 | 0.07 | 5 | 10/22/24 14:25 | 10/14/24 | |
| Cadmium | 6020B | 0.316 | mg/Kg | 0.023 | 0.008 | 5 | 10/22/24 14:25 | 10/14/24 | |
| Chromium | 6020B | 9.13 | mg/Kg | 0.23 | 0.07 | 5 | 10/22/24 14:25 | 10/14/24 | |
| Lead | 6020B | 10.7 | mg/Kg | 0.058 | 0.023 | 5 | 10/22/24 14:25 | 10/14/24 | |
| Mercury | 7471B | 0.096 | mg/Kg | 0.026 | 0.003 | 1 | 10/15/24 12:37 | 10/14/24 | |
| Silver | 6020B | 1.26 | mg/Kg | 0.023 | 0.005 | 5 | 10/22/24 14:25 | 10/14/24 | |
| Zinc | 6020B | 103 | mg/Kg | 0.58 | 0.23 | 5 | 10/22/24 14:25 | 10/14/24 | |



General Chemistry

ALS Environmental—Kelso Laboratory 1317 South 13th Avenue, Kelso, WA 98626 Phone (360) 577-7222 Fax (360) 425-9096 www.alsglobal.com

Analytical Report

Client: Terraphase Engineering Inc.

Project:

Service Request: K2410643 **Date Collected:** 10/04/24 14:05 Upper Granite Creek Mines/0031.005.001

Sample Matrix: Soil **Date Received:** 10/08/24 11:45

TL-WRA-0.5-3 **Sample Name:** Basis: As Received

Lab Code: K2410643-001

Inorganic Parameters

Analyte Name Analysis Method Result MRL Dil. **Date Analyzed** Q Units 95.0 Solids, Total 160.3 Modified Percent 10/10/24 15:28

Analytical Report

Client: Terraphase Engineering Inc.

Project:

Service Request: K2410643 **Date Collected:** 10/04/24 14:25 Upper Granite Creek Mines/0031.005.001

Sample Matrix: Soil **Date Received:** 10/08/24 11:45

TL-WRB-0.5-4 **Sample Name:** Basis: As Received

Lab Code: K2410643-002

Inorganic Parameters

Analyte Name Analysis Method Result MRL Dil. **Date Analyzed** Q Units 95.5 Solids, Total 160.3 Modified Percent 10/10/24 15:28

Analytical Report

Terraphase Engineering Inc. **Client:**

K2410643-003

Service Request: K2410643 **Date Collected:** 10/04/24 14:00 Upper Granite Creek Mines/0031.005.001

Sample Matrix: Soil

Project:

Lab Code:

Date Received: 10/08/24 11:45

TL-WRA-0.5-1-DS-2 **Sample Name:**

Basis: As Received

| Analyte Name | Analysis Method | Result | Units | MRL | Dil. | Date Analyzed | Q |
|---------------------|------------------------|--------|---------|-----|------|----------------|----------|
| Solids Total | 160 3 Modified | 93.4 | Percent | _ | 1 | 10/10/24 15:28 | <u>.</u> |

Analytical Report

Client: Terraphase Engineering Inc.

Project:

Upper Granite Creek Mines/0031.005.001 **Date Collected:** 10/04/24 10:05

Sample Matrix: Soil Date Received: 10/08/24 11:45

Sample Name: SH-WRB-0.5-2 Basis: As Received

Lab Code: K2410643-004

Inorganic Parameters

Analyte NameAnalysis MethodResultUnitsMRLDil.Date AnalyzedQSolids, Total160.3 Modified94.1Percent-110/10/24 15:28

Service Request: K2410643

Analytical Report

Client: Terraphase Engineering Inc.

> **Date Collected:** 10/04/24 10:15 Upper Granite Creek Mines/0031.005.001

Soil **Date Received:** 10/08/24 11:45

Sample Matrix:

Project:

SH-WRC-0.5-1 **Sample Name:** Basis: As Received

Lab Code: K2410643-005

Inorganic Parameters

Analyte Name Analysis Method Result MRL Dil. **Date Analyzed** Q Units 92.3 Solids, Total 160.3 Modified Percent 10/10/24 15:28

Service Request: K2410643

Analytical Report

Client: Terraphase Engineering Inc.

Service Request: K2410643 **Date Collected:** 10/05/24 10:06 Upper Granite Creek Mines/0031.005.001

Date Received: 10/08/24 11:45 **Sample Matrix:** Soil

Sample Name: CS-SD-1 Basis: As Received

Lab Code: K2410643-006

Project:

| Analyte Name | Analysis Method | Result | Units | MRL | Dil. | Date Analyzed | Q |
|---------------|-----------------|--------|---------|-----|------|----------------|---|
| Solids, Total | 160.3 Modified | 34.2 | Percent | - | 1 | 10/10/24 15:28 | |

Analytical Report

Client: Terraphase Engineering Inc.

Project:

Service Request: K2410643 **Date Collected:** 10/03/24 15:05 Upper Granite Creek Mines/0031.005.001

Date Received: 10/08/24 11:45 **Sample Matrix:** Soil

CS-SD-2 **Sample Name:** Basis: As Received

Lab Code: K2410643-007

| Analyte Name | Analysis Method | Result | Units | MRL | Dil. | Date Analyzed | Q |
|---------------|------------------------|--------|---------|-----|------|----------------|---|
| Solids, Total | 160.3 Modified | 76.9 | Percent | - | 1 | 10/10/24 15:28 | |

Analytical Report

Client: Terraphase Engineering Inc.

Upper Granite Creek Mines/0031.005.001

Date Collected: 10/03/24 09:00 **Date Received:** 10/08/24 11:45

Sample Matrix:

Soil

Basis: As Received

Service Request: K2410643

Sample Name:

Project:

CS-SD-3

Lab Code: K2410643-008

| Analyte Name | Analysis Method | Result | Units | MRL | Dil. | Date Analyzed | Q |
|---------------|-----------------|--------|---------|-----|------|----------------|---|
| Solids, Total | 160.3 Modified | 69.1 | Percent | - | 1 | 10/10/24 15:28 | |

Analytical Report

Client: Terraphase Engineering Inc.

Terraphase Engineering Inc. Service Request: K2410643

Project: Upper Granite Creek Mines/0031.005.001 Date Collected: 10/03/24 14:24

Sample Matrix: Soil Date Received: 10/08/24 11:45

Sample Name: CS-SD-4 Basis: As Received

Lab Code: K2410643-009

| Analyte Name | Analysis Method | Result | Units | MRL | Dil. | Date Analyzed | Q |
|---------------|-----------------|--------|---------|-----|------|----------------|---|
| Solids, Total | 160.3 Modified | 64.9 | Percent | - | 1 | 10/10/24 15:28 | |

Analytical Report

Client: Terraphase Engineering Inc.

Project:

Upper Granite Creek Mines/0031.005.001 **Date Collected:** 10/04/24 09:30

Sample Matrix: Soil Date Received: 10/08/24 11:45

Sample Name: CS-SD-5 Basis: As Received

Lab Code: K2410643-010

Inorganic Parameters

| Analyte Name | Analysis Method | Result | Units | MRL | Dil. | Date Analyzed | Q |
|---------------|------------------------|--------|---------|-----|------|----------------|---|
| Solids, Total | 160.3 Modified | 71.1 | Percent | - | 1 | 10/10/24 15:28 | |

Service Request: K2410643

Analytical Report

Client: Terraphase Engineering Inc.

Service Request: K2410643

Date Collected: 10/04/24 15:21 **Project:** Upper Granite Creek Mines/0031.005.001 **Date Received:** 10/08/24 11:45 **Sample Matrix:** Soil

CS-SD-6 **Sample Name:** Basis: As Received

Lab Code: K2410643-011

| Analyte Name | Analysis Method | Result | Units | MRL | Dil. | Date Analyzed | Q |
|---------------|------------------------|--------|---------|-----|------|----------------|---|
| Solids, Total | 160.3 Modified | 82.1 | Percent | - | 1 | 10/10/24 15:28 | |

Analytical Report

Client: Terraphase Engineering Inc.

Upper Granite Creek Mines/0031.005.001

Service Request: K2410643

Date Collected: 10/04/24 13:35

Sample Matrix:

Soil

Date Received: 10/08/24 11:45

Sample Name:

Project:

CS-SD-7

Lab Code: K2410643-012 Basis: As Received

| Analyte Name | Analysis Method | Result | Units | MRL | Dil. | Date Analyzed | Q |
|---------------|-----------------|--------|---------|-----|------|----------------|---|
| Solids, Total | 160.3 Modified | 80.2 | Percent | - | 1 | 10/10/24 15:28 | |

Analytical Report

Client: Terraphase Engineering Inc.

Upper Granite Creek Mines/0031.005.001

Service Request: K2410643 **Date Collected:** 10/04/24 13:40

Sample Matrix:

Soil

Date Received: 10/08/24 11:45

Basis: As Received

Sample Name:

Project:

CS-SD-7-DUP

Lab Code:

K2410643-013

Inorganic Parameters

Analyte Name Analysis Method Result Units MRL Dil. **Date Analyzed** Q 73.2 Solids, Total 160.3 Modified Percent 10/10/24 15:28

Analytical Report

Client: Terraphase Engineering Inc.

Project:

Service Request: K2410643 **Date Collected:** 10/05/24 10:30 Upper Granite Creek Mines/0031.005.001

Date Received: 10/08/24 11:45 **Sample Matrix:** Soil

CS-SD-8 **Sample Name:** Basis: As Received

Lab Code: K2410643-014

| Analyte Name | Analysis Method | Result | Units | MRL | Dil. | Date Analyzed | Q |
|---------------|------------------------|--------|---------|-----|------|----------------|---|
| Solids, Total | 160.3 Modified | 69.0 | Percent | = | 1 | 10/10/24 15:28 | |



QC Summary Forms

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Metals

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Analytical Report

Client: Terraphase Engineering Inc. Service Request: K2410643

Project:Upper Granite Creek Mines/0031.005.001Date Collected: NASample Matrix:SoilDate Received: NA

Sample Name: Method Blank Basis: Dry

Lab Code: KQ2416426-03

| | Analysis | | | | | | | Date | |
|--------------|----------|--------|-------|------|-------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Mercury | 7471B | ND U | mg/Kg | 0.02 | 0.002 | 1 | 10/15/24 09:02 | 10/14/24 | |

Analytical Report

Client: Terraphase Engineering Inc. Service Request: K2410643

Project:Upper Granite Creek Mines/0031.005.001Date Collected: NASample Matrix:SoilDate Received: NA

Sample Name: Method Blank Basis: Dry

Lab Code: KQ2416427-03

| | Analysis | | | | | | | Date | |
|--------------|----------|---------|-------|-------|-------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Antimony | 6020B | ND U | mg/Kg | 0.05 | 0.020 | 5 | 10/22/24 14:55 | 10/14/24 | |
| Arsenic | 6020B | ND U | mg/Kg | 0.5 | 0.06 | 5 | 10/22/24 14:55 | 10/14/24 | |
| Cadmium | 6020B | ND U | mg/Kg | 0.020 | 0.007 | 5 | 10/22/24 14:55 | 10/14/24 | |
| Chromium | 6020B | 0.06 J | mg/Kg | 0.20 | 0.06 | 5 | 10/22/24 14:55 | 10/14/24 | |
| Lead | 6020B | 0.036 J | mg/Kg | 0.05 | 0.020 | 5 | 10/22/24 14:55 | 10/14/24 | |
| Silver | 6020B | ND U | mg/Kg | 0.020 | 0.004 | 5 | 10/22/24 14:55 | 10/14/24 | |
| Zinc | 6020B | 0.27 J | mg/Kg | 0.5 | 0.20 | 5 | 10/22/24 14:55 | 10/14/24 | |

Analytical Report

Client: Terraphase Engineering Inc. Service Request: K2410643

Project:Upper Granite Creek Mines/0031.005.001Date Collected: NASample Matrix:SoilDate Received: NA

Sample Name: Method Blank Basis: Dry

Lab Code: KQ2416652-01

Total Metals – IVBA Analysis

| | Analysis | | | | | | | Date | |
|---------------------|----------|---------|-------|------|-------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | ND U | mg/Kg | 0.5 | 0.06 | 5 | 10/22/24 15:43 | 10/17/24 | |
| Lead | 6020B | 0.043 J | mg/Kg | 0.05 | 0.020 | 5 | 10/22/24 15:43 | 10/17/24 | |

Analytical Report

Client: Terraphase Engineering Inc. Service Request: K2410643

Project:Upper Granite Creek Mines/0031.005.001Date Collected: NASample Matrix:SoilDate Received: NA

Sample Name: Method Blank Basis: Dry

Lab Code: KQ2416789-01

IVBA Metals

| | Analysis | | | | | | | Date | |
|--------------|----------|--------|-------|------|-------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | ND U | mg/Kg | 0.5 | 0.06 | 5 | 10/17/24 10:57 | 10/16/24 | |
| Lead | 6020B | ND U | mg/Kg | 0.05 | 0.020 | 5 | 10/17/24 10:57 | 10/16/24 | |

QA/QC Report

Client: Terraphase Engineering Inc.

Upper Granite Creek Mines/0031.005.001

Sample Matrix: Soil

Project:

Service Request: Date Collected:

K2410643

Date Received:

10/04/24 10/08/24

Date Analyzed:

10/22/24

Date Extracted:

10/14/24

Matrix Spike Summary

Total Metals

TL-WRA-0.5-3 Sample Name: Lab Code: K2410643-001

Units: Basis: mg/Kg Dry

Analysis Method: Prep Method:

6020B **EPA 3050B**

Matrix Spike

KQ2416427-02

| Analyte Name | Sample Result | Result | Spike Amount | % Rec | % Rec Limits |
|--------------|---------------|--------|--------------|-------|--------------|
| Antimony | 1.54 | 23.7 | 85.7 | 26 N | 75-125 |
| Arsenic | 454 | 510 | 85.7 | 65 # | 75-125 |
| Cadmium | 12.3 | 20.7 | 8.57 | 97 | 75-125 |
| Chromium | 2.38 | 38.0 | 34.3 | 104 | 75-125 |
| Lead | 183 | 244 | 85.7 | 71 N | 75-125 |
| Silver | 2.80 | 11.4 | 8.57 | 101 | 75-125 |
| Zinc | 517 | 610 | 85.7 | 108 # | 75-125 |

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

Matrix Spike and Matrix Spike Duplicate Data is presented for information purposes only. The matrix may or may not be relevant to samples reported in this report. The laboratory evaluates system performance based on the LCS and LCSD control limits.

Printed 10/23/2024 5:16:36 PM

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QA/QC Report

Client: Terraphase Engineering Inc. **Service Request:** K2410643

Project Upper Granite Creek Mines/0031.005.001 **Date Collected:** 10/04/24 **Date Received:** 10/08/24

Soil **Sample Matrix:**

Date Analyzed: 10/22/24

Replicate Sample Summary

Total Metals

Duplicate

Sample Name: TL-WRA-0.5-3 Units: mg/Kg Lab Code: K2410643-001

Basis: Dry

| Analyte Name | Analysis Method | MRL | MDL | Sample Result | Sample KQ2416427-01 Result | Average | RPD | RPD Limit |
|--------------|--------------------|-------|-------|------------------|----------------------------------|---------|------|-----------|
| Antimony | 6020B | 0.043 | 0.017 | 1.54 | 1.76 | 1.65 | 13 | 20 |
| Arsenic | 6020B | 0.43 | 0.05 | 454 | 453 | 454 | <1 | 20 |
| Cadmium | 6020B | 0.017 | 0.006 | 12.3 | 12.1 | 12.2 | 2 | 20 |
| Chromium | 6020B | 0.17 | 0.05 | 2.38 | 2.33 | 2.36 | 2 | 20 |
| Lead | 6020B | 0.043 | 0.017 | 183 | 177 | 180 | 4 | 20 |
| Silver | 6020B | 0.017 | 0.003 | 2.80 | 3.57 | 3.19 | 24 * | 20 |
| Zinc | 6020B | 0.43 | 0.17 | 517 | 510 | 514 | 1 | 20 |

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

QA/QC Report

Client: Terraphase Engineering Inc.

Project: Upper Granite Creek Mines/0031.005.001 Date Analyzed: 10/15/24

Sample Matrix: Soil

Lab Control Sample Summary Total Metals

Units:mg/Kg
Basis:Dry

Service Request: K2410643

Lab Control Sample KQ2416426-04

Analyte NameAnalytical MethodResultSpike Amount% Rec% Rec LimitsMercury7471B0.5200.50010480-120

QA/QC Report

Client: Terraphase Engineering Inc.

Service Request: K2410643 **Project:** Upper Granite Creek Mines/0031.005.001 Date Analyzed: 10/22/24

Sample Matrix: Soil

Lab Control Sample Summary Total Metals

Units:mg/Kg Basis:Dry

Lab Control Sample

KQ2416427-04

| Analyte Name | Analytical Method | Result | Spike Amount | % Rec | % Rec Limits |
|--------------|--------------------------|--------|--------------|-------|--------------|
| Antimony | 6020B | 99.4 | 100 | 99 | 80-120 |
| Arsenic | 6020B | 105 | 100 | 105 | 80-120 |
| Cadmium | 6020B | 10.3 | 10.0 | 103 | 80-120 |
| Chromium | 6020B | 42.3 | 40.0 | 106 | 80-120 |
| Lead | 6020B | 108 | 100 | 108 | 80-120 |
| Silver | 6020B | 10.5 | 10.0 | 105 | 80-120 |
| Zinc | 6020B | 105 | 100 | 105 | 80-120 |

QA/QC Report

Client: Terraphase Engineering Inc.

Project: Upper Granite Creek Mines/0031.005.001 Date Analyzed: 10/22/24

Sample Matrix: Soil

Lab Control Sample Summary Total Metals – IVBA Analysis

Units:mg/Kg
Basis:Dry

Service Request: K2410643

Lab Control Sample

KQ2416652-02

| Analyte Name | Analytical Method | Result | Spike Amount | % Rec | % Rec Limits |
|--------------|--------------------------|--------|--------------|-------|--------------|
| Arsenic | 6020B | 108 | 100 | 108 | 80-120 |
| Lead | 6020B | 111 | 100 | 111 | 80-120 |

QA/QC Report

Client: Terraphase Engineering Inc.

Project: Upper Granite Creek Mines/0031.005.001 Date Analyzed: 10/17/24

Sample Matrix: Soil

Lab Control Sample Summary
IVBA Metals

Units:mg/Kg Basis:Dry

Service Request: K2410643

Lab Control Sample

KQ2416789-02

| Analyte Name | Analytical Method | Result | Spike Amount | % Rec | % Rec Limits |
|--------------|--------------------------|--------|--------------|-------|--------------|
| Arsenic | 6020B | 92.9 | 100 | 93 | 80-120 |
| Lead | 6020B | 105 | 100 | 105 | 80-120 |



General Chemistry

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QA/QC Report

Client: Terraphase Engineering Inc.

Service Request: K2410643

Project Upper Granite Creek Mines/0031.005.001

Date Collected: 10/04/24

Sample Matrix: Soil

Lab Code:

Date Received: 10/08/24 **Date Analyzed:** 10/10/24

Replicate Sample Summary

Inorganic Parameters

Sample Name: TL-WRA-0.5-3

Units: Percent

Ba

Basis: As Received

K2410643-001 **Duplicate**

Sample

K2410643-

. 00

Sample

001DUP

Analyte NameAnalysis MethodMRLResultResultAverageRPDRPD LimitSolids, Total160.3 Modified-95.094.694.8<1</td>20

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

ALS Group USA, Corp.

dba ALS Environmental

QA/QC Report

Client: Terraphase Engineering Inc. Service Request: K2410643

Project

Upper Granite Creek Mines/0031.005.001

Date Collected: 10/05/24

Sample Matrix:

Soil

Date Received: 10/08/24

Date Analyzed: 10/10/24

Replicate Sample Summary

Inorganic Parameters

Sample Name:

CS-SD-8

Units: Percent

Lab Code:

K2410643-014

Basis: As Received

Duplicate

Sample

K2410643-

Sample

014DUP

Analyte Name Solids, Total

Analysis Method 160.3 Modified

MRL

Result 69.0

Result 69.5

Average 69.3

RPD

RPD Limit

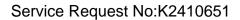
Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

Printed 10/23/2024 5:16:39 PM

Superset Reference:24-0000711615 rev 00





Don Malkemus Terraphase Engineering Inc. 610 SW Broadway, Suite 405 Portland, OR 97205

Laboratory Results for: Upper Granite Creek Mines

Dear Don.

Enclosed are the results of the sample(s) submitted to our laboratory October 08, 2024 For your reference, these analyses have been assigned our service request number **K2410651**.

Analyses were performed according to our laboratory's NELAP-approved quality assurance program. The test results meet requirements of the current NELAP standards, where applicable, and except as noted in the laboratory case narrative provided. For a specific list of NELAP-accredited analytes, refer to the certifications section at www.alsglobal.com. All results are intended to be considered in their entirety, and ALS Group USA Corp. dba ALS Environmental (ALS) is not responsible for use of less than the complete report. Results apply only to the items submitted to the laboratory for analysis and individual items (samples) analyzed, as listed in the report.

Please contact me if you have any questions. My extension is 3376. You may also contact me via email at Mark.Harris@alsglobal.com.

Respectfully submitted,

noe D. Oar

ALS Group USA, Corp. dba ALS Environmental

Mark Harris

Project Manager



Narrative Documents

ALS Environmental—Kelso Laboratory 1317 South 13th Avenue, Kelso, WA 98626 Phone (360) 577-7222 Fax (360) 425-9096 www.alsglobal.com



Client:Terraphase Engineering Inc.Service Request: K2410651Project:Upper Granite Creek MinesDate Received: 10/08/2024

Sample Matrix: Water

CASE NARRATIVE

All analyses were performed consistent with the quality assurance program of ALS Environmental. This report contains analytical results for samples for the Tier II level requested by the client.

Sample Receipt:

Twelve water samples were received for analysis at ALS Environmental on 10/08/2024. Any discrepancies upon initial sample inspection are annotated on the sample receipt and preservation form included within this report. The samples were stored at minimum in accordance with the analytical method requirements.

Metals:

No significant anomalies were noted with this analysis.

Approved by Moe D. Dark

Date 10/22/2024



SAMPLE DETECTION SUMMARY

This form includes only detections above the reporting levels. For a full listing of sample results, continue to the Sample Results section of this Report.

| CLIENT ID: CS-SW-1 | | Lab | ID: K2410 | 651-004 | | |
|--|---------|------|-----------|---------|-------|-----------|
| Analyte | Results | Flag | MDL | MRL | Units | Method |
| Antimony | 0.036 | J | 0.020 | 0.050 | ug/L | 6020B |
| Arsenic | 0.36 | J | 0.09 | 0.50 | ug/L | 6020B |
| Calcium | 5590 | | 6 | 20 | ug/L | 6020B |
| Chromium | 0.11 | J | 0.03 | 0.20 | ug/L | 6020B |
| Hardness, Total as CaCO3 | 18.1 | | 0.023 | 0.09 | mg/L | SM 2340 B |
| Lead | 0.013 | J | 0.006 | 0.020 | ug/L | 6020B |
| Magnesium | 996 | | 2 | 10 | ug/L | 6020B |
| CLIENT ID: CS-SW-2 | | Lab | ID: K2410 | 651-005 | | |
| Analyte | Results | Flag | MDL | MRL | Units | Method |
| Antimony | 0.025 | J | 0.020 | 0.050 | ug/L | 6020B |
| Arsenic | 0.67 | | 0.09 | 0.50 | ug/L | 6020B |
| Calcium | 6070 | | 6 | 20 | ug/L | 6020B |
| Chromium | 0.11 | J | 0.03 | 0.20 | ug/L | 6020B |
| Hardness, Total as CaCO3 | 19.7 | | 0.023 | 0.09 | mg/L | SM 2340 B |
| Lead | 0.012 | J | 0.006 | 0.020 | ug/L | 6020B |
| Magnesium | 1110 | | 2 | 10 | ug/L | 6020B |
| LIENT ID: CS-SW-2-Dup | | Lab | ID: K2410 | 651-006 | | |
| Analyte | Results | Flag | MDL | MRL | Units | Method |
| Antimony | 0.031 | J | 0.020 | 0.050 | ug/L | 6020B |
| Arsenic | 0.61 | | 0.09 | 0.50 | ug/L | 6020B |
| Calcium | 5920 | | 6 | 20 | ug/L | 6020B |
| Chromium | 0.11 | J | 0.03 | 0.20 | ug/L | 6020B |
| Hardness, Total as CaCO3 | 19.3 | | 0.023 | 0.09 | mg/L | SM 2340 B |
| Lead | 0.007 | J | 0.006 | 0.020 | ug/L | 6020B |
| Magnesium | 1090 | | 2 | 10 | ug/L | 6020B |
| LIENT ID: CS-SW-3 | | Lab | ID: K2410 | 651-007 | | |
| Analyte | Results | Flag | MDL | MRL | Units | Method |
| Antimony | 0.038 | J | 0.020 | 0.050 | ug/L | 6020B |
| Arsenic | 0.87 | | 0.09 | 0.50 | ug/L | 6020B |
| Calcium | 6490 | | 6 | 20 | ug/L | 6020B |
| Chromium | 0.12 | J | 0.03 | 0.20 | ug/L | 6020B |
| Hardness, Total as CaCO3 | 21.0 | | 0.023 | 0.09 | mg/L | SM 2340 B |
| Lead | 0.012 | J | 0.006 | 0.020 | ug/L | 6020B |
| Magnesium | 1170 | | 2 | 10 | ug/L | 6020B |
| LIENT ID: CS-SW-4 | | Lab | ID: K2410 | 651-008 | | |
| Analyte | Results | Flag | MDL | MRL | Units | Method |
| ······································ | | | | | | |

0.09

0.50

ug/L

6020B

0.92

Arsenic



SAMPLE DETECTION SUMMARY

| CLIENT ID: CS-SW-4 | | Lak | ID: K2410 | 651-008 | | |
|--------------------------|---------|------|-----------|---------|-------|-----------|
| Analyte | Results | Flag | MDL | MRL | Units | Method |
| Calcium | 8410 | | 6 | 20 | ug/L | 6020B |
| Chromium | 0.14 | J | 0.03 | 0.20 | ug/L | 6020B |
| Hardness, Total as CaCO3 | 27.5 | | 0.023 | 0.09 | mg/L | SM 2340 B |
| Magnesium | 1590 | | 2 | 10 | ug/L | 6020B |
| LIENT ID: CS-SW-5 | | Lak | ID: K2410 | | | |
| Analyte | Results | Flag | MDL | MRL | Units | Method |
| Antimony | 0.098 | | 0.020 | 0.050 | ug/L | 6020B |
| Arsenic | 1.78 | | 0.09 | 0.50 | ug/L | 6020B |
| Cadmium | 0.010 | J | 0.008 | 0.020 | ug/L | 6020B |
| Calcium | 9550 | | 6 | 20 | ug/L | 6020B |
| Chromium | 0.11 | J | 0.03 | 0.20 | ug/L | 6020B |
| Hardness, Total as CaCO3 | 31.8 | | 0.023 | 0.09 | mg/L | SM 2340 B |
| Lead | 0.018 | J | 0.006 | 0.020 | ug/L | 6020B |
| Magnesium | 1930 | | 2 | 10 | ug/L | 6020B |
| Zinc | 1.8 | J | 0.5 | 2.0 | ug/L | 6020B |
| LIENT ID: CS-SW-6 | | Lak | ID: K2410 | 651-010 | | |
| Analyte | Results | Flag | MDL | MRL | Units | Method |
| Antimony | 0.076 | | 0.020 | 0.050 | ug/L | 6020B |
| Arsenic | 2.04 | | 0.09 | 0.50 | ug/L | 6020B |
| Calcium | 9710 | | 6 | 20 | ug/L | 6020B |
| Chromium | 0.11 | J | 0.03 | 0.20 | ug/L | 6020B |
| Hardness, Total as CaCO3 | 32.3 | | 0.023 | 0.09 | mg/L | SM 2340 B |
| Lead | 0.013 | J | 0.006 | 0.020 | ug/L | 6020B |
| Magnesium | 1960 | | 2 | 10 | ug/L | 6020B |
| Zinc | 0.7 | J | 0.5 | 2.0 | ug/L | 6020B |
| LIENT ID: CS-SW-7 | | Lat | ID: K2410 | 651-011 | | |
| Analyte | Results | Flag | MDL | MRL | Units | Method |
| Antimony | 0.104 | | 0.020 | 0.050 | ug/L | 6020B |
| Arsenic | 1.99 | | 0.09 | 0.50 | ug/L | 6020B |
| Cadmium | 0.019 | J | 0.008 | 0.020 | ug/L | 6020B |
| Calcium | 10900 | | 6 | 20 | ug/L | 6020B |
| Chromium | 0.09 | J | 0.03 | 0.20 | ug/L | 6020B |
| Hardness, Total as CaCO3 | 36.3 | | 0.023 | 0.09 | mg/L | SM 2340 B |
| Lead | 0.022 | | 0.006 | 0.020 | ug/L | 6020B |
| Magnesium | 2200 | | 2 | 10 | ug/L | 6020B |
| Magneolam | | | | | | |

0.5

2.0

ug/L

6020B

8.0

Zinc



SAMPLE DETECTION SUMMARY

This form includes only detections above the reporting levels. For a full listing of sample results, continue to the Sample Results section of this Report.

| | Lab ID: K2410651-012 | | | | | | | | | | | |
|---------|---|----------------|---|---|------------------------------------|--|--|--|--|--|--|--|
| Results | Flag | MDL | MRL | Units | Method | | | | | | | |
| 0.108 | | 0.020 | 0.050 | ug/L | 6020B | | | | | | | |
| 2.21 | | 0.09 | 0.50 | ug/L | 6020B | | | | | | | |
| 0.020 | J | 0.008 | 0.020 | ug/L | 6020B | | | | | | | |
| 10900 | | 6 | 20 | ug/L | 6020B | | | | | | | |
| 0.11 | J | 0.03 | 0.20 | ug/L | 6020B | | | | | | | |
| 36.7 | | 0.023 | 0.09 | mg/L | SM 2340 B | | | | | | | |
| 0.084 | | 0.006 | 0.020 | ug/L | 6020B | | | | | | | |
| 2310 | | 2 | 10 | ug/L | 6020B | | | | | | | |
| 0.8 | J | 0.5 | 2.0 | ug/L | 6020B | | | | | | | |
| | Lab ID: K2410651-001 | | | | | | | | | | | |
| Results | Flag | MDL | MRL | Units | Method | | | | | | | |
| 0.64 | | 0.09 | 0.50 | ug/L | 6020B | | | | | | | |
| | Lab | ID: K2410 | 651-002 | | | | | | | | | |
| Results | Flag | MDL | MRL | Units | Method | | | | | | | |
| 3.12 | | 0.09 | 0.50 | ug/L | 6020B | | | | | | | |
| | Lab | ID: K2410 | 651-003 | | | | | | | | | |
| Results | Flag | MDL | MRL | Units | Method | | | | | | | |
| 0.11 | J | 0.09 | 0.50 | ug/L | 6020B | | | | | | | |
| | 0.108 2.21 0.020 10900 0.11 36.7 0.084 2310 0.8 Results 0.64 Results 3.12 | Results Flag | Results Flag MDL 0.108 0.020 2.21 0.09 0.020 J 0.008 10900 6 0.11 J 0.03 36.7 0.023 0.084 0.006 2310 2 0.8 J 0.5 Lab ID: K2410 | Results Flag MDL MRL 0.108 0.020 0.050 2.21 0.09 0.50 0.020 J 0.008 0.020 10900 6 20 0.11 J 0.03 0.20 36.7 0.023 0.09 0.084 0.006 0.020 2310 2 10 0.8 J 0.5 2.0 Lab ID: K2410651-001 Results Flag MDL MRL 3.12 0.09 0.50 Lab ID: K2410651-003 Results Flag MDL MRL 3.12 0.09 0.50 | Results Flag MDL MRL Units | | | | | | | |



Sample Receipt Information

ALS Environmental—Kelso Laboratory 1317 South 13th Avenue, Kelso, WA 98626 Phone (360) 577-7222 Fax (360) 425-9096 www.alsglobal.com Client: Terraphase Engineering Inc. Service Request:K2410651

Project: Upper Granite Creek Mines/0031.005.001

SAMPLE CROSS-REFERENCE

| CLIENT SAMPLE ID | <u>DATE</u> | <u>TIME</u> |
|------------------|--|--|
| EB-2024 1003 | 10/5/2024 | 0830 |
| EB-2024 1004 | 10/4/2024 | 0800 |
| EB-2024 1005 | 10/5/2024 | 0830 |
| CS-SW-1 | 10/5/2024 | 1004 |
| CS-SW-2 | 10/3/2024 | 1700 |
| CS-SW-2-Dup | 10/3/2024 | 1701 |
| CS-SW-3 | 10/3/2024 | 1600 |
| CS-SW-4 | 10/3/2024 | 1419 |
| CS-SW-5 | 10/4/2024 | 0925 |
| CS-SW-6 | 10/4/2024 | 1523 |
| CS-SW-7 | 10/4/2024 | 1334 |
| CS-SW-8 | 10/5/2024 | 1035 |
| | EB-2024 1003 EB-2024 1004 EB-2024 1005 CS-SW-1 CS-SW-2 CS-SW-2-Dup CS-SW-3 CS-SW-4 CS-SW-5 CS-SW-6 CS-SW-7 | EB-2024 1003 10/5/2024 EB-2024 1004 10/4/2024 EB-2024 1005 10/5/2024 CS-SW-1 10/5/2024 CS-SW-2 10/3/2024 CS-SW-2-Dup 10/3/2024 CS-SW-3 10/3/2024 CS-SW-4 10/3/2024 CS-SW-5 10/4/2024 CS-SW-6 10/4/2024 CS-SW-7 10/4/2024 |

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CHAIN OF CUSTODY

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| SR#_/(24/06) |
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| COC Set 2 of 8 |
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Page 1 of 1

| oject Name Upper Ganik Crack Mins Project Number: 0131. 015-801 | | | | | | | 28D 180D | | | C C C C C C C C C C C C C C C C C C C | | | | | | | 1 | | | | | | • | r ugc | 1 01 1 | | | |
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| one # (503) 9us -0384 | email o | dn.malk | emse terrapo | U. COM | | | | (Siev | Extra | <u>ب</u> | ąŋ. | lardı | | | | | | | | 1 | | | | | | | | |
| npler Signature | | rinted Nam | | | 유 | Hg H | 윤 | VBA | WBA | Meta | GrindSub | 1/80 | | | | | | | | | | | | | | | | |
| M | Don | Malk | | | NUMBER | 7470A1Hg | 7471B / Hg | 50208 / IVBA (Sieved | 60208 / IVBA Extract | 5020B / Metals | Grind / G | SM 2340 B / Hardness | <u> </u> | | | <u>v</u> | | Re | marks | | | | | | | | | |
| CLIENT SAMPLE ID | LABID | | MPLING Fime State | Matrix | | | | | · | | | | | | | | | | | | | | | | | | | |
| EB-2029 1003 | | 10/5 | 0830 | H20 | 1 | | | | | X | | | | | | | | | | | | | | | | | | |
| EB-20241004 | | 1014 | 0800 | H20 | 1 | | | | | × | | | | | | | | | | | | | | | • | | | |
| EB-2024 1005 | | tal5 | 0830 | H20 | 1 | | | | | X | | | | | | | | | | | | | | | | | | |
| UMM-628-05-4 | | 10(5 | 1335 | 50.11 | 7. | | | | | | | | | | | | | 1- pJ. | | | | | | | | | | |
| 1MA-WRB-0.5-2 | | 10 2 | 134 | 50.1 | 2 | | | | | X | | | | | | | | | | - 11 | | | | | | | | |
| -MA-620-0-5-2 | | 1013 | 1045 | Soil | 2 | | | | | | | | | | | | | + 69 | 1 HOL | 0 | | | | | | | | |
| 1MM - 4RB-0.5-2-05 | | 10/2 | 1325 | Soil | ٦ | | | | | X | | | | | | | | + 690 | <u> </u> | | | | | | | | | |
| MM - WRB - 0.5-1 | | 10/3 | 1035 | Sall | 2 | | | | | × | | | | | | | | + 1000 | 4106 | | | | | | | | | |
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| LAM- WEB -0.5-1-04? | | 10/3 | | Seil | 2 | | | | | <u> </u> | | | |] | | | Ì | | | | | | | | | | | |
| leport Requirements | | ice Inf | ormation | | | | | | | | | | | | | Ω | ircle | which met | als are to b | e analy | zed | | | | | | | |
| Routine Report: Method Blank, Surrogate, as required | P.O.#_ Bill To: | ape to | inhise con | | | | | | | - | _ | | | | | | | | | | | | | | TI Sn | | - | |
| II. Report Dup., MS, MSD | | | | _ | ···· | | | | | | | Sb | Ва | Be | | | | | | | | | | | Sr TI S | | n Hg | |
| as required III. CLP Like Summary (no raw data) | 24 5 [| hr. Day | equiremer 48 hr. | nts | pecia | i instr | uctio | ins/C | Jomr | neni | s; | | | | rinc | dicat | e St | ate Hyd | rocarboi | n Proc | edure: / | AK CA | Wi | Northw | est Othe | € [| _(Circle | One) |
| IV. Data Validation Report | Sta | andard | | | | | | | | | | | | | | | | | | | | | | | | | | |
| V. EDD | | Requested Re | eport Date | | | | | | | | | | | | | | | | | | | | | | | | | |
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| ature | Signature | | | Sign | ature | | | | | | Si | gnat | ure |) M | R | ed | Cer | Bly | Signatu | re | | | | Sign | ature | | | |
| on Malkemo | Printed Na | me La | Bih | | ed Na | | <i></i> | cit | 3; J | c | | 415 | } | me | | | | 3 | Printed | Name |) | | | Prin | ted Name | 9 | | |
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CHAIN OF CUSTODY

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| SR#_ | 1641067 |
| COC Set_ | 1 of 4 |
| COC# | • • |

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| (MLS) | | www.alsglobal.com | | | | | | | | | | | | | | Р | 'age 1 | i of 1 | | | | | | | | | | |
|--|--------------------|---------------------------|---------------------|----------|------------------------|----------------------|------------------|------------------|----------------------|----------|-------------|-------------|--------------|------|------|-------|----------|-----------|------------|---------|-----------|-------|------|---------|---|--------------|----------|---|
| roject Name V Netz Gmik Creek Min roject Manager Dm MIKM | Project N | iumber:003 | 1.00 5.001 | | | 6 | 78 78 78 | | 180D | | Coco | 282 | | | | | | | | | | | | | | | | |
| roject Manager On MJKmi | ა | | | |] " | | \ | <u> </u> | | | | <u></u> | | | | _ | | | | | | | | | | | | |
| ompany Terraphex Engineering | Inc | | | | CONTAINERS | | | tal) | | | | Calc | | | | | | | | | | | | | | | | |
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| ampler Signature | | 1 P | 무 | ₽ | ΑBΑ | ₩. | Veta | rindS | 8/1 | | | | | | | | | | | | | | | | | | | |
| M | | NUMBER (| 7470A / Hg | 7471B/Hg | 80208 / IVBA | BO20B / IVBA Extract | 50208 / Metals T | Grind / GrindSub | SM 2340 B / Hardness | - | | 3 | 4 | LO. | Re | emark | S | | | | | | | | | | | |
| CLIENT SAMPLE ID | LABID | SAM Date T | IPLING ime State | | | | | | | | | | | | | | | | | | | | | | | | | |
| C5-5W-1 | | | 103E 1004 | HZO | 1 | χ | | | | Χ̈́ | | X | | | | | | | | | | | | | | | | |
| (5-5V-2 | | 10/3 | \ 700 700 | H20 | ١ | X | | | | X | | ፠ | | | | | | | | | | | | | | | | |
| C5-54-Z-1019 | | 1013 | 1701 | H20 | 1 | X | | | | X | | λ | | | | | | | |] | | | | | | | | |
| C5-5W-3 | | 1013 | 1600 | 420 | 1 | 7 | | | | * | | λ | | | | | | | | | | | | | | | | |
| C5-56-4 | | 10 3 | 1419 | H70 | 1 | X | | | | 4 |] | X | | | | | | | | | | | | | | | | |
| C5-5W-5 | | 10/4 | 0925 | H20 | 1 | k | | | | 4 | | አ | | | | | | | | | | | | | | | | |
| C5-5W-6 | | 10/4 | 1523 | H20 | 1 | X | | | | x | | ス | | | | | | | | | | | | | | | | |
| C5-5W-7 | | 1014 | 1334 | HLO | 1 | x | | | | + | | x | | | | | | | | | | | | | | | | |
| C5-5W-8 | | 1015 | 1035 | HŁO | 1 | <u>}</u> | | | | X | | × | | | | | | | | | | | | | | | | |
| | |] | |] | <u> </u> | | | | | | | | | | | | | | | | | | | | | | | |
| Report Requirements | | oice Info | ormation | | | | | | | | | | | | | 9 | ircle: | which met | ais are to | be anal | /zed | | | | | | | |
| I. Routine Report: Method Blank, Surrogate, as required | P.O.#_ Bill To: | ap@tein | phole. com | | | | | | | _ | - | | | | | - | | | | | /in Mo N | _ | - | | | | | |
| | | | | | | Di | ssolv | ed M | etals: | Af | As | Sb | Ba | Be I | B C | a Co | d Co | Cr C | u Fe P | b Mg | Mn Mo | Ni K | Ag N | a Se | Sr TI Sr | V Zn | Hg | |
| as required | Turnar | ound Re | equireme | nts S | pecia | ii insti | ructio | ons/C | Comr | ment | s: | | | | *Inc | dica | e St | ate Hyd | rocarbo | n Pro | cedure: / | AK CA | WI I | Northwe | est Othe | r <u>(</u> (| Circle C |)ne) |
| _ III. CLP Like Summary (no raw data) | 2 | 4 hr. | 48 hr. | "" | | | | | | | | | | | | | | | | | | | | | | | | |
| IV. Data Validation Report | | Day tandard | | | | | | | | | | | | | | | | | | | | | | | | | | |
| _V. EDD | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Relinquished By: | | Requested Rep Received | | | Re | ling | uish | ed E | 3v: | | Т | | F | ₹ece | eive | d B | <i>-</i> | | r —— | Reli | nquishe | d Bv: | | Т | Red | eived | Rv. | |
| / _ / | • | | . . | | | | | A | - , . | | 1, | Λ | • | ۔۔۔۔ | | | | | | | | · y · | | | ,110 | ,civca | y. | |
| nature | Signature Sig | | | | | Ź | 7 | 2 | | | $ \Lambda $ | gnat Li | V (0) | . 0 |)e_ | le | S5 | en | Signat | | | | | Sign | ature | | | |
| | | | | | ed Ni | ame | Lat | د د ل | <i></i> | | P | inted TV | d Na | me | | | | | Printed | Nam | e | | | Print | ed Name | | | *************************************** |
| TEI Firm ALS Firm | | | | | | _ | | | | | Fi | m / | 812 | 24 | JL. | 14 | 5 | | Firm | | | | | Firm | *************************************** | | | |
| e/Time | Date/Time | 10/08/ | 14 /306 | ے Date | ite/Time 12/08/24 1445 | | | | | | | ate/1 | ime | | | | | | Date/T | ime | | | | Date | /Time | | | |
| 10/8 1306 | | | . , | | | , | | | | | | | | | | | | | | | | | | | | | | |

| | Sample ID | | Bottle Count Bottle Type | Head- space | ace Broke pi | | Reagent | Volume leagent added | | Lot er | nitiais | Time |
|--------------------|---|------------------|---|----------------|---------------|-----------------------------|-------------------|-------------------------|------------|---------------------------|--------------|----------------|
| Sa | mple ID on Bott | ile . | Sample | e ID on | COC | - | | | Identified | by: | | |
| Were 100m | l sterile microbiolo | gy bottles fille | d exactly to the 100m | nl mark? | (N | A | Y N | | Underfi | lled O | verfille | i |
| | *** | the method sp | ecified time limit? If | not, nota | te the er | xor belo | ow and notify | the PM | (NA) | Y | N | |
| | es negative? | | | | | | | | NA | Y | N | |
| - | - | | ? Indicate in the tabl | | hi | A151651 | | | (NA) | Y | N | |
| | | | mes received for the t N SOP) received at th | | | 19 Indi | rate in the tah | le helow | NA NA | Y | N N | |
| ` | ole labels and tags | | - • " | | nns Jn | | | | NA NA | Y | N | |
| Were all sar | nple labels comple | te (ie, analysis | , preservation, etc.)? | | | | | | NA | 5 | N | |
| | es received in good | | - | | | | | | NA | ₹. | N | |
| - | iterial: <i>Inserts</i> ly papers properly | | - | is we | <u>IÇE</u> YL | ry ice | Sleeves | | NA | (v) | N | |
| - | - | _ | bble Wrap Gel Pack | | - | | C/ | | | | | |
| | sue samples were | - | rozen Partially Ti | | Thaw | | , min nonly u | O # 171. | |) | • | |
| • | | • | as collected? If not, r | • | conier | # ahove | and notify th | e PM | MA | \ Y | N | |
| | _ | - | ified temperature ran | | iii die et | MICI, IN | Julic III IIIC CO | ignin sa | NA | $\left(\mathbf{v}\right)$ | N | |
| - | erature Blank prese | | NA (Y N sample bottle contain | | | _ | rature in the a | | | ve: | | |
| 6.3 | 4.5 | 4 | | 16 | | _ 4 | | | | | | |
| <u>.Ц</u> | 4.5 | | | | | | | | | | | |
| 0.0 | 4.4 | | | | | | - | | | | | |
| ·S | 5.7 | | | | | | 1 | | | | * | - |
| 4_ | 7.0 | 1601 | 140510 | | | | | | | | | |
| np Blank | Sample Temp | IR Gun | Cooler #/COC ID / N | A | indicate | with X | " If out of | temp | Trackin | g Number | NA_ | Filed |
| | <u> </u> | | * | | | ftemp | Notifi | 23.00 | * | | | |
| | | | | | | ् <i>र</i> ार ४.२.५५,७३, | | | | | | T |
| f present, w | ere custody seals in | ntact? | Y N | If preser | it, were | they sig | aned and dated | 1? | | Y | N | |
| Vere <u>custod</u> | y seals on coolers? | ? | NA Y (N) | If yes, h | ow man | y and w | here? | | · | | | |
| Samples we | ere received in: (cir | cle) 🕜 | oler Box | E | nvelope | | Other | | | | NA | |
| Samples we | re received via? | USPS | Fed Ex | UPS | D. | HL | PDX | Cour | rier) H | and Delive | ered | |
| eived: <u>10</u> | 18124 | Opened: _ | 1018124 | By: _ | Δ | K_ | _Unioaded: _ | 1015 | 1129 | By: <u></u> | 4 | |
| nt | iera, | nes | <u>e</u> | | | Sen | rice Request | K24 <u>/ (</u> | 0651 | | 1 | > |
| | <u> </u> | ~1 | Cooler Receipt | t and F | orese | rvatio | n Form | _ | ~ > | | | 7 |
| | | | | | | | | | | | PM// | Ol Emm |

| Sample ID on Bottle | Sample | e ID on | COC | | | Identified by: | | | | | | | | | |
|------------------------------------|-----------------------------|----------------|----------|----|--------|-----------------|-----------------------|-----------|-------|--|--|--|--|--|--|
| | | | | | | | | | | | | | | | |
| Sample ID | Bottle Count Bottle Type | Head- space | Broke | На | Reagen | Volume added | Reagent Lot Number | initials | Time | | | | | | |
| | | - | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| | <u> </u> | <u> </u> | <u> </u> | L | | | | | L | | | | | | |
| Notes, Discrepancies, Resolutions: | | | | | ··· | | | | | | | | | | |
| G:\SMO\2024 Forms | | SOP: S | MO-G | EN | | | Reviewe | d: NP 1/3 | /2024 | | | | | | |

1.



Cooler Receipt and Preservation Form

| ent | Terra | kna | <u> </u> | | | | _Servi | ce F | Request K2 | 4 | <u> </u> | | |
|---------------|-------------------|---------------------------------------|-------------|------------------|-------------|---------------|--|-------------|------------------------------|----------|---------------------------------------|--------------------------------|-------------|
| Temp Blank | Sample Temp | IR Gun | Cooler #/C | OC ID / I | NA | Out indica | of temp | x• | PM Notifie if out of t | d emp | Tracking Nur | nber NA | Filed |
| H8. 7.8 | 3.8 | 1801 | | | | | | | | | | | |
| 12.2 | 5.5 | V | | · | | | | | | | · · · · · · · · · · · · · · · · · · · | NAME AND ADDRESS OF THE PARTY. | |
| | | | | | | | | | | | | (| |
| San | npie ID on Bottle | | | Sample | ID on C | OC | | | | <u> </u> | dentified by: | | |
| | | | | | | | | | | | | | |
| | | | ottle Count | | Head- | | | | | Volume | Reagent Lot | | |
| 10. | Sample ID | B | ottle Type | Temp | space | Broke | рН | | Reagent | added | Number | Initials | Time |
| | | | | | | | | | | | | | |
| otes, Discrep | ancies & Resol | utions: _\(| د س | <u> </u> 25 a | <u></u> | TOP | 0F | (| Coolers | >o | n topo | £ | |
| Saw | ples. Te | mp | blan | RI | <u> </u> | <u> </u> | nd | er | - He | SUN | uples, 1 | \ot_ | |
| india | certire, | & S | gun | <u>()</u> | ten | MP. | | | | | | | |
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| G:\SMO' | \2024 Forms | | | | SOP. | SMO- | GEN | | | | Reviewe | d- ND 1/3 | 1/2024 |

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Miscellaneous Forms

ALS Environmental—Kelso Laboratory 1317 South 13th Avenue, Kelso, WA 98626 Phone (360) 577-7222 Fax (360) 425-9096 www.alsglobal.com

Inorganic Data Qualifiers

- * The result is an outlier. See case narrative.
- # The control limit criteria is not applicable.
- B The analyte was found in the associated method blank at a level that is significant relative to the sample result as defined by the DOD or NELAC standards.
- E The result is an estimate amount because the value exceeded the instrument calibration range.
- I The result is an estimated value
- U The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL.
 DOD-QSM 4.2 definition: Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
- i The MRL/MDL or LOQ/LOD is elevated due to a matrix interference.
- X See case narrative.
- Q See case narrative. One or more quality control criteria was outside the limits.
- H The holding time for this test is immediately following sample collection. The samples were analyzed as soon as possible after receipt by the laboratory.

Metals Data Qualifiers

- # The control limit criteria is not applicable.
- J The result is an estimated value.
- E The percent difference for the serial dilution was greater than 10%, indicating a possible matrix interference in the sample.
- M The duplicate injection precision was not met.
- N The Matrix Spike sample recovery is not within control limits. See case narrative.
- S The reported value was determined by the Method of Standard Additions (MSA).
- U The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL. DOD-QSM 4.2 definition: Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
- W The post-digestion spike for furnace AA analysis is out of control limits, while sample absorbance is less than 50% of spike absorbance.
- i The MRL/MDL or LOQ/LOD is elevated due to a matrix interference.
- X See case narrative.
- + The correlation coefficient for the MSA is less than 0.995.
- Q See case narrative. One or more quality control criteria was outside the limits.

Organic Data Qualifiers

- * The result is an outlier. See case narrative.
- # The control limit criteria is not applicable. See case narrative.
- A A tentatively identified compound, a suspected aldol-condensation product.
- B The analyte was found in the associated method blank at a level that is significant relative to the sample result as defined by the DOD or NELAC standards.
- C The analyte was qualitatively confirmed using GC/MS techniques, pattern recognition, or by comparing to historical data.
- D The reported result is from a dilution.
- E The result is an estimated value over the calibration range.
- J The result is an estimated value between the MDL and the MRL.
- N The result is presumptive. The analyte was tentatively identified, but a confirmation analysis was not performed.
- P The GC or HPLC confirmation criteria was exceeded. The relative percent difference is greater than 40% between the two analytical results.
- U The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL.
 DOD-QSM 4.2 definition: Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
- i The MRL/MDL or LOQ/LOD is elevated due to a chromatographic interference.
- X See case narrative.
- Q See case narrative. One or more quality control criteria was outside the limits.

Additional Petroleum Hydrocarbon Specific Qualifiers

- F The chromatographic fingerprint of the sample matches the elution pattern of the calibration standard.
- L The chromatographic fingerprint of the sample resembles a petroleum product, but the elution pattern indicates the presence of a greater amount of lighter molecular weight constituents than the calibration standard.
- H The chromatographic fingerprint of the sample resembles a petroleum product, but the elution pattern indicates the presence of a greater amount of heavier molecular weight constituents than the calibration standard.
- O The chromatographic fingerprint of the sample resembles an oil, but does not match the calibration standard.
- Y The chromatographic fingerprint of the sample resembles a petroleum product eluting in approximately the correct carbon range, but the elution pattern does not match the calibration standard.
- Z The chromatographic fingerprint does not resemble a petroleum product.

ALS Group USA Corp. dba ALS Environmental (ALS) - Kelso State Certifications, Accreditations, and Licenses

| Agency | Web Site | Number |
|--------------------------|---|-------------|
| Alaska DEH | http://dec.alaska.gov/eh/lab/cs/csapproval.htm | UST-040 |
| Arizona DHS | http://www.azdhs.gov/lab/license/env.htm | AZ0339 |
| Arkansas - DEQ | http://www.adeq.state.ar.us/techsvs/labcert.htm | 88-0637 |
| California DHS (ELAP) | http://www.cdph.ca.gov/certlic/labs/Pages/ELAP.aspx | 2795 |
| DOD ELAP | http://www.denix.osd.mil/edqw/Accreditation/AccreditedLabs.cfm | L16-58-R4 |
| Florida DOH | http://www.doh.state.fl.us/lab/EnvLabCert/WaterCert.htm | E87412 |
| Hawaii DOH | http://health.hawaii.gov/ | - |
| ISO 17025 | http://www.pjlabs.com/ | L16-57 |
| Louisiana DEQ | http://www.deq.louisiana.gov/page/la-lab-accreditation | 03016 |
| Maine DHS | http://www.maine.gov/dhhs/ | WA01276 |
| Minnesota DOH | http://www.health.state.mn.us/accreditation | 053-999-457 |
| Nevada DEP | http://ndep.nv.gov/bsdw/labservice.htm | WA01276 |
| New Jersey DEP | http://www.nj.gov/dep/enforcement/oqa.html | WA005 |
| New York - DOH | https://www.wadsworth.org/regulatory/elap | 12060 |
| | https://deq.nc.gov/about/divisions/water-resources/water-resources-data/water-sciences-home-page/laboratory-certification-branch/non-field-lab- | |
| North Carolina DEQ | certification | 605 |
| Oklahoma DEQ | http://www.deq.state.ok.us/CSDnew/labcert.htm | 9801 |
| Oregon – DEQ (NELAP) | http://public.health.oregon.gov/LaboratoryServices/EnvironmentalLaboratoryAccreditation/Pages/index.aspx | WA100010 |
| South Carolina DHEC | http://www.scdhec.gov/environment/EnvironmentalLabCertification/ | 61002 |
| Texas CEQ | http://www.tceq.texas.gov/field/qa/env_lab_accreditation.html | T104704427 |
| Washington DOE | http://www.ecy.wa.gov/programs/eap/labs/lab-accreditation.html | C544 |
| Wyoming (EPA Region 8) | https://www.epa.gov/region8-waterops/epa-region-8-certified-drinking-water- | - |
| Kelso Laboratory Website | www.alsglobal.com | NA |

Analyses were performed according to our laboratory's NELAP-approved quality assurance program. A complete listing of specific NELAP-certified analytes, can be found in the certification section at www.ALSGlobal.com or at the accreditation bodies web site.

Please refer to the certification and/or accreditation body's web site if samples are submitted for compliance purposes. The states highlighted above, require the analysis be listed on the state certification if used for compliance purposes and if the method/anlayte is offered by that state.

Acronyms

ASTM American Society for Testing and Materials

A2LA American Association for Laboratory Accreditation

CARB California Air Resources Board

CAS Number Chemical Abstract Service registry Number

CFC Chlorofluorocarbon
CFU Colony-Forming Unit

DEC Department of Environmental Conservation

DEQ Department of Environmental Quality

DHS Department of Health Services

DOE Department of Ecology
DOH Department of Health

EPA U. S. Environmental Protection Agency

ELAP Environmental Laboratory Accreditation Program

GC Gas Chromatography

GC/MS Gas Chromatography/Mass Spectrometry

LOD Limit of Detection
LOQ Limit of Quantitation

LUFT Leaking Underground Fuel Tank

M Modified

MCL Maximum Contaminant Level is the highest permissible concentration of a substance

allowed in drinking water as established by the USEPA.

MDL Method Detection Limit
MPN Most Probable Number
MRL Method Reporting Limit

NA Not Applicable
NC Not Calculated

NCASI National Council of the Paper Industry for Air and Stream Improvement

ND Not Detected

NIOSH National Institute for Occupational Safety and Health

PQL Practical Quantitation Limit

RCRA Resource Conservation and Recovery Act

SIM Selected Ion Monitoring

TPH Total Petroleum Hydrocarbons

tr Trace level is the concentration of an analyte that is less than the PQL but greater than or

equal to the MDL.

Analyst Summary report

Client: Terraphase Engineering Inc.

Project: Upper Granite Creek Mines/0031.005.001 Service Request: K2410651

Sample Name: EB-2024 1003 Lab Code: K2410651-001

Sample Matrix: Water **Date Collected:** 10/5/24 Date Received: 10/8/24

Analyzed By Extracted/Digested By Analysis Method 6020B **MCHATTICK ABOYER**

Sample Name: EB-2024 1004 **Date Collected:** 10/4/24

Lab Code: K2410651-002 Date Received: 10/8/24

Sample Matrix: Water

Analyzed By Extracted/Digested By Analysis Method

6020B **MCHATTICK ABOYER**

Sample Name: EB-2024 1005 **Date Collected:** 10/5/24

Lab Code: K2410651-003 Date Received: 10/8/24

Sample Matrix: Water

Analysis Method Extracted/Digested By Analyzed By

6020B **MCHATTICK ABOYER**

Sample Name: CS-SW-1 **Date Collected:** 10/5/24

Lab Code: K2410651-004 Date Received: 10/8/24 Sample Matrix: Water

Analyzed By Analysis Method Extracted/Digested By

6020B **MCHATTICK ABOYER** 7470A **KLINN KLINN**

Analyst Summary report

Client: Terraphase Engineering Inc.

Project: Upper Granite Creek Mines/0031.005.001 Service Request: K2410651

Sample Name: CS-SW-2

Lab Code: K2410651-005

Sample Matrix: Water **Date Collected:** 10/3/24

Date Received: 10/8/24

Analysis Method

6020B 7470A

Analyzed By Extracted/Digested By MCHATTICK ABOYER KLINN KLINN

Sample Name: CS-SW-2-Dup Lab Code: K2410651-006

Sample Matrix: Water **Date Collected:** 10/3/24 **Date Received:** 10/8/24

Analysis Method

6020B 7470A **Extracted/Digested By MCHATTICK**

ABOYER KLINN

Sample Name: CS-SW-3

Lab Code: K2410651-007 Water

KLINN

Sample Matrix:

Date Collected: 10/3/24 Date Received: 10/8/24

Analysis Method

6020B

7470A

Extracted/Digested By MCHATTICK KLINN

Analyzed By ABOYER KLINN

Analyzed By

CS-SW-4 **Sample Name:**

K2410651-008

Sample Matrix: Water **Date Collected:** 10/3/24 Date Received: 10/8/24

Analysis Method

6020B 7470A

Lab Code:

Extracted/Digested By

MCHATTICK **ABOYER KLINN KLINN**

Analyzed By

Analyst Summary report

Client: Terraphase Engineering Inc.

Project: Upper Granite Creek Mines/0031.005.001

Date Collected: 10/4/24

Date Received: 10/8/24

Service Request: K2410651

Sample Name: CS-SW-5

Lab Code: K2410651-009

Sample Matrix: Water

Analysis Method

Extracted/Digested By Analyzed By

6020B MCHATTICK ABOYER 7470A KLINN KLINN

Sample Name: CS-SW-6 Date Collected: 10/4/24

Lab Code: K2410651-010 **Date Received:** 10/8/24

Sample Matrix: Water

Analysis Method Extracted/Digested By Analyzed By

6020B MCHATTICK ABOYER 7470A KLINN KLINN

Sample Name: CS-SW-7 Date Collected: 10/4/24

Lab Code: K2410651-011 **Date Received:** 10/8/24

Sample Matrix: Water

Analysis Method Extracted/Digested By Analyzed By

6020B MCHATTICK ABOYER 7470A KLINN KLINN

Sample Name: CS-SW-8 Date Collected: 10/5/24

Lab Code: K2410651-012 **Date Received:** 10/8/24

Sample Matrix: Water

Analysis Method Extracted/Digested By Analyzed By

6020B MCHATTICK ABOYER 7470A KLINN KLINN



Sample Results

ALS Environmental—Kelso Laboratory 1317 South 13th Avenue, Kelso, WA 98626 Phone (360) 577-7222 Fax (360) 425-9096 www.alsglobal.com



Metals

ALS Environmental—Kelso Laboratory 1317 South 13th Avenue, Kelso, WA 98626 Phone (360) 577-7222 Fax (360) 425-9096 www.alsglobal.com

Analytical Report

Client: Terraphase Engineering Inc.

Upper Granite Creek Mines/0031.005.001

Service Request: K2410651

Date Collected: 10/05/24 08:30

Sample Matrix: Water

Date Received: 10/08/24 14:45

Sample Name:

EB-2024 1003

Basis: NA

Lab Code:

Project:

K2410651-001

| | Analysis | | | | | | | Date | |
|--------------|----------|--------|-------|------|------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 0.64 | ug/L | 0.50 | 0.09 | 1 | 10/21/24 16:32 | 10/18/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Upper Granite Creek Mines/0031.005.001

Service Request: K2410651 **Date Collected:** 10/04/24 08:00

Date Received: 10/08/24 14:45 Water

Sample Name: EB-2024 1004 Basis: NA

Lab Code: K2410651-002

Project:

Sample Matrix:

| | Analysis | | | | | | | Date | |
|--------------|----------|--------|-------|------|------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 3.12 | 11g/L | 0.50 | 0.09 | 1 | 10/21/24 16:34 | 10/18/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Project:

Sample Matrix:

Upper Granite Creek Mines/0031.005.001

Date Collected: 10/05/24 08:30

Service Request: K2410651

Water **Date Received:** 10/08/24 14:45

Sample Name: EB-2024 1005 Basis: NA

Lab Code: K2410651-003

| | Analysis | | | | | | | Date | |
|--------------|----------|--------|-------|------|------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 0.11 J | ug/L | 0.50 | 0.09 | 1 | 10/21/24 16:36 | 10/18/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Service Request: K2410651 **Date Collected:** 10/05/24 10:04

Project: Upper Granite Creek Mines/0031.005.001 **Sample Matrix:** Water

Date Received: 10/08/24 14:45

CS-SW-1 **Sample Name:** Basis: NA

Lab Code: K2410651-004

Hardness by ICP-AES Calculation 20th Ed.

Analysis

| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Q |
|--------------------------|-----------|--------|-------|------|-------|------|----------------------|---|
| Hardness, Total as CaCO3 | SM 2340 B | 18.1 | mg/L | 0.09 | 0.023 | 1 | 10/21/24 16:39 | |

Analytical Report

Client: Terraphase Engineering Inc.

Service Request: K2410651 **Date Collected:** 10/05/24 10:04 **Project:** Upper Granite Creek Mines/0031.005.001

Date Received: 10/08/24 14:45 **Sample Matrix:** Water

Sample Name: CS-SW-1 Basis: NA

Lab Code: K2410651-004

| | Analysis | | | | | | | Date | |
|--------------|----------|---------|-------|-------|-------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Antimony | 6020B | 0.036 J | ug/L | 0.050 | 0.020 | 1 | 10/21/24 16:39 | 10/18/24 | |
| Arsenic | 6020B | 0.36 J | ug/L | 0.50 | 0.09 | 1 | 10/21/24 16:39 | 10/18/24 | |
| Cadmium | 6020B | ND U | ug/L | 0.020 | 0.008 | 1 | 10/21/24 16:39 | 10/18/24 | |
| Calcium | 6020B | 5590 | ug/L | 20 | 6 | 1 | 10/21/24 16:39 | 10/18/24 | |
| Chromium | 6020B | 0.11 J | ug/L | 0.20 | 0.03 | 1 | 10/21/24 16:39 | 10/18/24 | |
| Lead | 6020B | 0.013 J | ug/L | 0.020 | 0.006 | 1 | 10/21/24 16:39 | 10/18/24 | |
| Magnesium | 6020B | 996 | ug/L | 10 | 2 | 1 | 10/21/24 16:39 | 10/18/24 | |
| Mercury | 7470A | ND U | ug/L | 0.20 | 0.02 | 1 | 10/15/24 09:17 | 10/14/24 | |
| Silver | 6020B | ND U | ug/L | 0.020 | 0.009 | 1 | 10/21/24 16:39 | 10/18/24 | |
| Zinc | 6020B | ND U | ug/L | 2.0 | 0.5 | 1 | 10/21/24 16:39 | 10/18/24 | |

Analytical Report

Client: Terraphase Engineering Inc. **Service Request:** K2410651

Project: Upper Granite Creek Mines/0031.005.001

K2410651-005

Date Collected: 10/03/24 17:00

Sample Matrix: Water **Date Received:** 10/08/24 14:45

Basis: NA

CS-SW-2 **Sample Name:** Lab Code:

Hardness by ICP-AES Calculation 20th Ed.

Analysis

| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Q |
|--------------------------|-----------|--------|-------|------|-------|------|----------------------|---|
| Hardness, Total as CaCO3 | SM 2340 B | 19.7 | mg/L | 0.09 | 0.023 | 1 | 10/21/24 16:53 | |

Analytical Report

Client: Terraphase Engineering Inc.

Project: Upper Granite Creek Mines/0031.005.001 Date Collected: 10/03/24 17:00

Sample Matrix: Water Date Received: 10/08/24 14:45

Sample Name: CS-SW-2 Basis: NA

Lab Code: K2410651-005

Total Metals

| | Analysis | | | | | | | Date | |
|--------------|----------|---------|-------|-------|-------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Antimony | 6020B | 0.025 J | ug/L | 0.050 | 0.020 | 1 | 10/21/24 16:53 | 10/18/24 | |
| Arsenic | 6020B | 0.67 | ug/L | 0.50 | 0.09 | 1 | 10/21/24 16:53 | 10/18/24 | |
| Cadmium | 6020B | ND U | ug/L | 0.020 | 0.008 | 1 | 10/21/24 16:53 | 10/18/24 | |
| Calcium | 6020B | 6070 | ug/L | 20 | 6 | 1 | 10/21/24 16:53 | 10/18/24 | |
| Chromium | 6020B | 0.11 J | ug/L | 0.20 | 0.03 | 1 | 10/21/24 16:53 | 10/18/24 | |
| Lead | 6020B | 0.012 J | ug/L | 0.020 | 0.006 | 1 | 10/21/24 16:53 | 10/18/24 | |
| Magnesium | 6020B | 1110 | ug/L | 10 | 2 | 1 | 10/21/24 16:53 | 10/18/24 | |
| Mercury | 7470A | ND U | ug/L | 0.20 | 0.02 | 1 | 10/15/24 09:22 | 10/14/24 | |
| Silver | 6020B | ND U | ug/L | 0.020 | 0.009 | 1 | 10/21/24 16:53 | 10/18/24 | |
| Zinc | 6020B | ND U | ug/L | 2.0 | 0.5 | 1 | 10/21/24 16:53 | 10/18/24 | |

Service Request: K2410651

Analytical Report

Client: Terraphase Engineering Inc.

Water

per Granite Creek Mines/0031.005.001 Service Request: K2410651

Date Collected: 10/03/24 17:01

Project: Upper Granite Creek Mines/0031.005.001

Date Received: 10/08/24 14:45

Sample Matrix:

Sample Name:

CS-SW-2-Dup Basis: NA

Lab Code: K2410651-006

Hardness by ICP-AES Calculation 20th Ed.

Analysis

| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Q |
|--------------------------|-----------|--------|-------|------|-------|------|----------------------|---|
| Hardness, Total as CaCO3 | SM 2340 B | 19.3 | mg/L | 0.09 | 0.023 | 1 | 10/21/24 16:55 | |

Analytical Report

Client: Terraphase Engineering Inc.

Service Request: K2410651 Upper Granite Creek Mines/0031.005.001 **Date Collected:** 10/03/24 17:01 **Project:**

Date Received: 10/08/24 14:45 **Sample Matrix:** Water

Sample Name: CS-SW-2-Dup Basis: NA

Lab Code: K2410651-006

| | Analysis | | | | | | | Date | |
|--------------|----------|---------|-------|-------|-------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Antimony | 6020B | 0.031 J | ug/L | 0.050 | 0.020 | 1 | 10/21/24 16:55 | 10/18/24 | |
| Arsenic | 6020B | 0.61 | ug/L | 0.50 | 0.09 | 1 | 10/21/24 16:55 | 10/18/24 | |
| Cadmium | 6020B | ND U | ug/L | 0.020 | 0.008 | 1 | 10/21/24 16:55 | 10/18/24 | |
| Calcium | 6020B | 5920 | ug/L | 20 | 6 | 1 | 10/21/24 16:55 | 10/18/24 | |
| Chromium | 6020B | 0.11 J | ug/L | 0.20 | 0.03 | 1 | 10/21/24 16:55 | 10/18/24 | |
| Lead | 6020B | 0.007 J | ug/L | 0.020 | 0.006 | 1 | 10/21/24 16:55 | 10/18/24 | |
| Magnesium | 6020B | 1090 | ug/L | 10 | 2 | 1 | 10/21/24 16:55 | 10/18/24 | |
| Mercury | 7470A | ND U | ug/L | 0.20 | 0.02 | 1 | 10/15/24 09:23 | 10/14/24 | |
| Silver | 6020B | ND U | ug/L | 0.020 | 0.009 | 1 | 10/21/24 16:55 | 10/18/24 | |
| Zinc | 6020B | ND U | ug/L | 2.0 | 0.5 | 1 | 10/21/24 16:55 | 10/18/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Service Request: K2410651 **Date Collected:** 10/03/24 16:00 Upper Granite Creek Mines/0031.005.001

Sample Matrix: Date Received: 10/08/24 14:45 Water

CS-SW-3 **Sample Name:** Basis: NA

Lab Code: K2410651-007

Project:

Hardness by ICP-AES Calculation 20th Ed.

Analysis

| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Q |
|--------------------------|-----------|--------|-------|------|-------|------|----------------------|---|
| Hardness, Total as CaCO3 | SM 2340 B | 21.0 | mg/L | 0.09 | 0.023 | 1 | 10/21/24 16:57 | |

Analytical Report

Client: Terraphase Engineering Inc.

Service Request: K2410651 **Date Collected:** 10/03/24 16:00 **Project:** Upper Granite Creek Mines/0031.005.001

Date Received: 10/08/24 14:45 **Sample Matrix:** Water

Sample Name: CS-SW-3 Basis: NA

Lab Code: K2410651-007

| | Analysis | | | | | | | Date | |
|--------------|----------|---------|-------|-------|-------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Antimony | 6020B | 0.038 J | ug/L | 0.050 | 0.020 | 1 | 10/21/24 16:57 | 10/18/24 | |
| Arsenic | 6020B | 0.87 | ug/L | 0.50 | 0.09 | 1 | 10/21/24 16:57 | 10/18/24 | |
| Cadmium | 6020B | ND U | ug/L | 0.020 | 0.008 | 1 | 10/21/24 16:57 | 10/18/24 | |
| Calcium | 6020B | 6490 | ug/L | 20 | 6 | 1 | 10/21/24 16:57 | 10/18/24 | |
| Chromium | 6020B | 0.12 J | ug/L | 0.20 | 0.03 | 1 | 10/21/24 16:57 | 10/18/24 | |
| Lead | 6020B | 0.012 J | ug/L | 0.020 | 0.006 | 1 | 10/21/24 16:57 | 10/18/24 | |
| Magnesium | 6020B | 1170 | ug/L | 10 | 2 | 1 | 10/21/24 16:57 | 10/18/24 | |
| Mercury | 7470A | ND U | ug/L | 0.20 | 0.02 | 1 | 10/15/24 09:25 | 10/14/24 | |
| Silver | 6020B | ND U | ug/L | 0.020 | 0.009 | 1 | 10/21/24 16:57 | 10/18/24 | |
| Zinc | 6020B | ND U | ug/L | 2.0 | 0.5 | 1 | 10/21/24 16:57 | 10/18/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Service Request: K2410651 **Date Collected:** 10/03/24 14:19 Upper Granite Creek Mines/0031.005.001

Sample Matrix: Date Received: 10/08/24 14:45 Water

CS-SW-4 **Sample Name:** Basis: NA

Lab Code: K2410651-008

Project:

Hardness by ICP-AES Calculation 20th Ed.

Analysis

| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Q |
|--------------------------|-----------|--------|-------|------|-------|------|----------------------|---|
| Hardness, Total as CaCO3 | SM 2340 B | 27.5 | mg/L | 0.09 | 0.023 | 1 | 10/21/24 16:59 | |

Analytical Report

Client: Terraphase Engineering Inc.

Project: Upper Granite Creek Mines/0031.005.001 Date Collected: 10/03/24 14:19

Sample Matrix: Water Date Received: 10/08/24 14:45

Sample Name: CS-SW-4 Basis: NA

Lab Code: K2410651-008

Total Metals

| | Analysis | | | | | | | Date | |
|--------------|----------|---------|-------|-------|-------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Antimony | 6020B | 0.036 J | ug/L | 0.050 | 0.020 | 1 | 10/21/24 16:59 | 10/18/24 | |
| Arsenic | 6020B | 0.92 | ug/L | 0.50 | 0.09 | 1 | 10/21/24 16:59 | 10/18/24 | |
| Cadmium | 6020B | ND U | ug/L | 0.020 | 0.008 | 1 | 10/21/24 16:59 | 10/18/24 | |
| Calcium | 6020B | 8410 | ug/L | 20 | 6 | 1 | 10/21/24 16:59 | 10/18/24 | |
| Chromium | 6020B | 0.14 J | ug/L | 0.20 | 0.03 | 1 | 10/21/24 16:59 | 10/18/24 | |
| Lead | 6020B | ND U | ug/L | 0.020 | 0.006 | 1 | 10/21/24 16:59 | 10/18/24 | |
| Magnesium | 6020B | 1590 | ug/L | 10 | 2 | 1 | 10/21/24 16:59 | 10/18/24 | |
| Mercury | 7470A | ND U | ug/L | 0.20 | 0.02 | 1 | 10/15/24 09:27 | 10/14/24 | |
| Silver | 6020B | ND U | ug/L | 0.020 | 0.009 | 1 | 10/21/24 16:59 | 10/18/24 | |
| Zinc | 6020B | ND U | ug/L | 2.0 | 0.5 | 1 | 10/21/24 16:59 | 10/18/24 | |

Service Request: K2410651

Analytical Report

Client: Terraphase Engineering Inc.

aphase Engineering Inc. Service Request: K2410651

 Project:
 Upper Granite Creek Mines/0031.005.001
 Date Collected:
 10/04/24 09:25

 Sample Matrix:
 Water
 Date Received:
 10/08/24 14:45

Sample Name: CS-SW-5 Basis: NA

Lab Code: K2410651-009

Hardness by ICP-AES Calculation 20th Ed.

Analysis

| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Q |
|--------------------------|-----------|--------|-------|------|-------|------|----------------------|---|
| Hardness, Total as CaCO3 | SM 2340 B | 31.8 | mg/L | 0.09 | 0.023 | 1 | 10/21/24 17:01 | |

Analytical Report

Client: Terraphase Engineering Inc.

Project: Upper Granite Creek Mines/0031.005.001 Date Collected: 10/04/24 09:25

Sample Matrix: Water Date Received: 10/08/24 14:45

Sample Name: CS-SW-5 Basis: NA

Lab Code: K2410651-009

Total Metals

| | Analysis | | | | | | | Date | |
|--------------|----------|---------|-------|-------|-------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Antimony | 6020B | 0.098 | ug/L | 0.050 | 0.020 | 1 | 10/21/24 17:01 | 10/18/24 | |
| Arsenic | 6020B | 1.78 | ug/L | 0.50 | 0.09 | 1 | 10/21/24 17:01 | 10/18/24 | |
| Cadmium | 6020B | 0.010 J | ug/L | 0.020 | 0.008 | 1 | 10/21/24 17:01 | 10/18/24 | |
| Calcium | 6020B | 9550 | ug/L | 20 | 6 | 1 | 10/21/24 17:01 | 10/18/24 | |
| Chromium | 6020B | 0.11 J | ug/L | 0.20 | 0.03 | 1 | 10/21/24 17:01 | 10/18/24 | |
| Lead | 6020B | 0.018 J | ug/L | 0.020 | 0.006 | 1 | 10/21/24 17:01 | 10/18/24 | |
| Magnesium | 6020B | 1930 | ug/L | 10 | 2 | 1 | 10/21/24 17:01 | 10/18/24 | |
| Mercury | 7470A | ND U | ug/L | 0.20 | 0.02 | 1 | 10/15/24 09:28 | 10/14/24 | |
| Silver | 6020B | ND U | ug/L | 0.020 | 0.009 | 1 | 10/21/24 17:01 | 10/18/24 | |
| Zinc | 6020B | 1.8 J | ug/L | 2.0 | 0.5 | 1 | 10/21/24 17:01 | 10/18/24 | |

Service Request: K2410651

Analytical Report

Client: Terraphase Engineering Inc.

Service Request: K2410651 **Date Collected:** 10/04/24 15:23 Upper Granite Creek Mines/0031.005.001

Sample Matrix: Date Received: 10/08/24 14:45 Water

CS-SW-6 **Sample Name:** Basis: NA

Lab Code: K2410651-010

Project:

Hardness by ICP-AES Calculation 20th Ed.

Analysis

| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Q |
|--------------------------|-----------|--------|-------|------|-------|------|----------------|---|
| Hardness, Total as CaCO3 | SM 2340 B | 32.3 | mg/L | 0.09 | 0.023 | 1 | 10/21/24 17:03 | |

Analytical Report

Client: Terraphase Engineering Inc.

Service Request: K2410651 **Date Collected:** 10/04/24 15:23 **Project:** Upper Granite Creek Mines/0031.005.001

Date Received: 10/08/24 14:45 **Sample Matrix:** Water

Sample Name: CS-SW-6 Basis: NA

Lab Code: K2410651-010

Total Metals

| | Analysis | | | | | | | Date | |
|---------------------|----------|---------|-------|-------|-------|------|----------------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Antimony | 6020B | 0.076 | ug/L | 0.050 | 0.020 | 1 | 10/21/24 17:03 | 10/18/24 | |
| Arsenic | 6020B | 2.04 | ug/L | 0.50 | 0.09 | 1 | 10/21/24 17:03 | 10/18/24 | |
| Cadmium | 6020B | ND U | ug/L | 0.020 | 0.008 | 1 | 10/21/24 17:03 | 10/18/24 | |
| Calcium | 6020B | 9710 | ug/L | 20 | 6 | 1 | 10/21/24 17:03 | 10/18/24 | |
| Chromium | 6020B | 0.11 J | ug/L | 0.20 | 0.03 | 1 | 10/21/24 17:03 | 10/18/24 | |
| Lead | 6020B | 0.013 J | ug/L | 0.020 | 0.006 | 1 | 10/21/24 17:03 | 10/18/24 | |
| Magnesium | 6020B | 1960 | ug/L | 10 | 2 | 1 | 10/21/24 17:03 | 10/18/24 | |
| Mercury | 7470A | ND U | ug/L | 0.20 | 0.02 | 1 | 10/15/24 09:33 | 10/14/24 | |
| Silver | 6020B | ND U | ug/L | 0.020 | 0.009 | 1 | 10/21/24 17:03 | 10/18/24 | |
| Zinc | 6020B | 0.7 J | ug/L | 2.0 | 0.5 | 1 | 10/21/24 17:03 | 10/18/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Service Request: K2410651 **Date Collected:** 10/04/24 13:34 Upper Granite Creek Mines/0031.005.001

Date Received: 10/08/24 14:45 **Sample Matrix:** Water

CS-SW-7 Basis: NA **Sample Name:**

Lab Code: K2410651-011

Project:

Hardness by ICP-AES Calculation 20th Ed.

Analysis

| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Q |
|--------------------------|-----------|--------|-------|------|-------|------|----------------|---|
| Hardness, Total as CaCO3 | SM 2340 B | 36.3 | mg/L | 0.09 | 0.023 | 1 | 10/21/24 17:05 | |

Analytical Report

Client: Terraphase Engineering Inc.

Project: Upper Granite Creek Mines/0031.005.001 Date Collected: 10/04/24 13:34

Sample Matrix: Water Date Received: 10/08/24 14:45

Sample Name: CS-SW-7 Basis: NA

Lab Code: K2410651-011

Total Metals

| | Analysis | | | | | | | Date | |
|---------------------|----------|---------|-------|-------|-------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Antimony | 6020B | 0.104 | ug/L | 0.050 | 0.020 | 1 | 10/21/24 17:05 | 10/18/24 | |
| Arsenic | 6020B | 1.99 | ug/L | 0.50 | 0.09 | 1 | 10/21/24 17:05 | 10/18/24 | |
| Cadmium | 6020B | 0.019 J | ug/L | 0.020 | 0.008 | 1 | 10/21/24 17:05 | 10/18/24 | |
| Calcium | 6020B | 10900 | ug/L | 20 | 6 | 1 | 10/21/24 17:05 | 10/18/24 | |
| Chromium | 6020B | 0.09 J | ug/L | 0.20 | 0.03 | 1 | 10/21/24 17:05 | 10/18/24 | |
| Lead | 6020B | 0.022 | ug/L | 0.020 | 0.006 | 1 | 10/21/24 17:05 | 10/18/24 | |
| Magnesium | 6020B | 2200 | ug/L | 10 | 2 | 1 | 10/21/24 17:05 | 10/18/24 | |
| Mercury | 7470A | ND U | ug/L | 0.20 | 0.02 | 1 | 10/15/24 09:35 | 10/14/24 | |
| Silver | 6020B | ND U | ug/L | 0.020 | 0.009 | 1 | 10/21/24 17:05 | 10/18/24 | |
| Zinc | 6020B | 0.8 J | ug/L | 2.0 | 0.5 | 1 | 10/21/24 17:05 | 10/18/24 | |

Service Request: K2410651

Analytical Report

Client: Terraphase Engineering Inc.

Service Request: K2410651

Date Collected: 10/05/24 10:35 **Project:** Upper Granite Creek Mines/0031.005.001 **Date Received:** 10/08/24 14:45 **Sample Matrix:** Water

CS-SW-8 **Sample Name:** Basis: NA

Lab Code: K2410651-012

Hardness by ICP-AES Calculation 20th Ed.

Analysis

| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Q |
|--------------------------|-----------|--------|-------|------|-------|------|----------------|---|
| Hardness, Total as CaCO3 | SM 2340 B | 36.7 | mg/L | 0.09 | 0.023 | 1 | 10/21/24 17:07 | |

Analytical Report

Client: Terraphase Engineering Inc.

Service Request: K2410651 Upper Granite Creek Mines/0031.005.001 **Date Collected:** 10/05/24 10:35 **Project:**

Date Received: 10/08/24 14:45 **Sample Matrix:** Water

Sample Name: CS-SW-8 Basis: NA

Lab Code: K2410651-012

Total Metals

| | Analysis | | | | | | | Date | |
|--------------|----------|---------|-------|-------|-------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Antimony | 6020B | 0.108 | ug/L | 0.050 | 0.020 | 1 | 10/21/24 17:07 | 10/18/24 | |
| Arsenic | 6020B | 2.21 | ug/L | 0.50 | 0.09 | 1 | 10/21/24 17:07 | 10/18/24 | |
| Cadmium | 6020B | 0.020 J | ug/L | 0.020 | 0.008 | 1 | 10/21/24 17:07 | 10/18/24 | |
| Calcium | 6020B | 10900 | ug/L | 20 | 6 | 1 | 10/21/24 17:07 | 10/18/24 | |
| Chromium | 6020B | 0.11 J | ug/L | 0.20 | 0.03 | 1 | 10/21/24 17:07 | 10/18/24 | |
| Lead | 6020B | 0.084 | ug/L | 0.020 | 0.006 | 1 | 10/21/24 17:07 | 10/18/24 | |
| Magnesium | 6020B | 2310 | ug/L | 10 | 2 | 1 | 10/21/24 17:07 | 10/18/24 | |
| Mercury | 7470A | ND U | ug/L | 0.20 | 0.02 | 1 | 10/15/24 09:36 | 10/14/24 | |
| Silver | 6020B | ND U | ug/L | 0.020 | 0.009 | 1 | 10/21/24 17:07 | 10/18/24 | |
| Zinc | 6020B | 0.8 J | ug/L | 2.0 | 0.5 | 1 | 10/21/24 17:07 | 10/18/24 | |



QC Summary Forms

ALS Environmental—Kelso Laboratory 1317 South 13th Avenue, Kelso, WA 98626 Phone (360) 577-7222 Fax (360) 425-9096 www.alsglobal.com



Metals

ALS Environmental—Kelso Laboratory 1317 South 13th Avenue, Kelso, WA 98626 Phone (360) 577-7222 Fax (360) 425-9096 www.alsglobal.com

Analytical Report

Client: Terraphase Engineering Inc. Service Request: K2410651

Project:Upper Granite Creek Mines/0031.005.001Date Collected: NASample Matrix:WaterDate Received: NA

Sample Name: Method Blank Basis: NA

Lab Code: KQ2416479-01

Total Metals

| | Analysis | | | | | | | Date | |
|--------------|----------|--------|-------|-------|-------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Antimony | 6020B | ND U | ug/L | 0.050 | 0.020 | 1 | 10/21/24 17:13 | 10/18/24 | |
| Arsenic | 6020B | ND U | ug/L | 0.50 | 0.09 | 1 | 10/21/24 17:13 | 10/18/24 | |
| Cadmium | 6020B | ND U | ug/L | 0.020 | 0.008 | 1 | 10/21/24 17:13 | 10/18/24 | |
| Calcium | 6020B | ND U | ug/L | 20 | 6 | 1 | 10/21/24 17:13 | 10/18/24 | |
| Chromium | 6020B | ND U | ug/L | 0.20 | 0.03 | 1 | 10/21/24 17:13 | 10/18/24 | |
| Lead | 6020B | ND U | ug/L | 0.020 | 0.006 | 1 | 10/21/24 17:13 | 10/18/24 | |
| Magnesium | 6020B | ND U | ug/L | 10 | 2 | 1 | 10/21/24 17:13 | 10/18/24 | |
| Silver | 6020B | ND U | ug/L | 0.020 | 0.009 | 1 | 10/21/24 17:13 | 10/18/24 | |
| Zinc | 6020B | ND U | ug/L | 2.0 | 0.5 | 1 | 10/21/24 17:13 | 10/18/24 | |

Analytical Report

Client: Terraphase Engineering Inc. Service Request: K2410651

Project:Upper Granite Creek Mines/0031.005.001Date Collected: NASample Matrix:WaterDate Received: NA

Sample Name: Method Blank Basis: NA

Lab Code: KQ2416532-01

Total Metals

| | Analysis | | | | | | | Date | |
|--------------|----------|--------|--------|------|------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Mercury | 7470A | ND U | 119/[, | 0.20 | 0.02 | 1 | 10/15/24 09:14 | 10/14/24 | |

QA/QC Report

Client: Terraphase Engineering Inc.

Upper Granite Creek Mines/0031.005.001

Sample Matrix: Water

Service Request:
Date Collected:

K2410651

Date Received:

10/05/24 10/08/24

Date Analyzed:

10/21/24

Date Extracted:

10/18/24

Matrix Spike Summary

Total Metals

Sample Name: CS-SW-1

Units: Basis: ug/L NA

Analysis Method:

6020B

Prep Method:

Lab Code:

Project:

EPA CLP ILM04.0

K2410651-004

Matrix Spike

KQ2416479-04

| Analyte Name | Sample Result | Result | Spike Amount | % Rec | % Rec Limits |
|--------------|---------------|--------|--------------|-------|--------------|
| Antimony | 0.036 J | 9.93 | 10.0 | 99 | 75-125 |
| Arsenic | 0.36 J | 51.1 | 50.0 | 101 | 75-125 |
| Cadmium | ND U | 25.8 | 25.0 | 103 | 75-125 |
| Calcium | 5590 | 15900 | 10300 | 100 | 75-125 |
| Chromium | 0.11 J | 10.6 | 10.0 | 105 | 75-125 |
| Lead | 0.013 J | 51.9 | 50.0 | 104 | 75-125 |
| Magnesium | 996 | 11700 | 10300 | 104 | 75-125 |
| Silver | ND U | 13.4 | 12.5 | 107 | 75-125 |
| Zinc | ND U | 24.9 | 25.0 | 100 | 75-125 |

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

Matrix Spike and Matrix Spike Duplicate Data is presented for information purposes only. The matrix may or may not be relevant to samples reported in this report. The laboratory evaluates system performance based on the LCS and LCSD control limits.

Printed 10/22/2024 4:18:38 PM

QA/QC Report

Client: Terraphase Engineering Inc. **Project:**

Upper Granite Creek Mines/0031.005.001

Sample Matrix: Water

Service Request: Date Collected:

K2410651

Date Received:

10/05/24 10/08/24

Date Analyzed:

10/15/24

Date Extracted:

10/14/24

Matrix Spike Summary

Total Metals

CS-SW-1 Sample Name:

K2410651-004

7470A

Units: Basis:

ug/L NA

Analysis Method: Prep Method:

Lab Code:

Method

Matrix Spike

KQ2416532-04

Analyte Name Sample Result Result Spike Amount % Rec % Rec Limits ND U Mercury 4.91

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

Matrix Spike and Matrix Spike Duplicate Data is presented for information purposes only. The matrix may or may not be relevant to samples reported in this report. The laboratory evaluates system performance based on the LCS and LCSD control limits.

Printed 10/22/2024 4:18:38 PM

ALS Group USA, Corp.

dba ALS Environmental

QA/QC Report

Client: Terraphase Engineering Inc.

Service Request: K2410651

Project Upper Granite Creek Mines/0031.005.001

Date Collected: 10/05/24

Sample Matrix: Water

Sample Name:

Date Received: 10/08/24 **Date Analyzed:** 10/21/24

Replicate Sample Summary
Total Metals

CS-SW-1

Units: ug/L

Lab Code: K2410651-004

Basis: NA

Duplicate Sample

| | Analysis | | | Sample | Sample KQ2416479-03 | | | |
|--------------|----------|-------|-------|---------|------------------------|---------|------|------------------|
| Analyte Name | Method | MRL | MDL | Result | Result | Average | RPD | RPD Limit |
| Antimony | 6020B | 0.050 | 0.020 | 0.036 J | 0.027 J | 0.032 | 29 # | 20 |
| Arsenic | 6020B | 0.50 | 0.09 | 0.36 J | 0.33 J | 0.35 | 9 | 20 |
| Cadmium | 6020B | 0.020 | 0.008 | ND U | ND U | ND | - | 20 |
| Calcium | 6020B | 20 | 6 | 5590 | 5530 | 5560 | 1 | 20 |
| Chromium | 6020B | 0.20 | 0.03 | 0.11 J | 0.12 J | 0.12 | 9 | 20 |
| Lead | 6020B | 0.020 | 0.006 | 0.013 J | 0.008 J | 0.011 | 48 # | 20 |
| Magnesium | 6020B | 10 | 2 | 996 | 1020 | 1010 | 2 | 20 |
| Silver | 6020B | 0.020 | 0.009 | ND U | ND U | ND | - | 20 |
| Zinc | 6020B | 2.0 | 0.5 | ND U | ND U | ND | = | 20 |

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

ALS Group USA, Corp.

dba ALS Environmental

QA/QC Report

Client: Terraphase Engineering Inc. Service Request: K2410651

Project Upper Granite Creek Mines/0031.005.001 Date Collected: 10/05/24

Sample Matrix: Water Date Received: 10/08/24

Date Analyzed: 10/15/24

Replicate Sample Summary

Total Metals

Sample Name: CS-SW-1 Units: ug/L

Lab Code: K2410651-004 **Basis:** NA

Duplicate

Sample **VO2416532 03**

Analysis Sample KQ2416532-03 **Analyte Name** Method **MRL MDL** Result Result Average RPD **RPD Limit** 7470A ND U Mercury 0.20 0.02 ND U ND 20

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

QA/QC Report

Client: Terraphase Engineering Inc.

Service Request: K2410651 **Project:** Upper Granite Creek Mines/0031.005.001 **Date Analyzed:** 10/21/24

Sample Matrix: Water

Lab Control Sample Summary Total Metals

Units:ug/L Basis:NA

Lab Control Sample

KQ2416479-02

| Analyte Name | Analytical Method | Result | Spike Amount | % Rec | % Rec Limits |
|--------------|--------------------------|--------|--------------|-------|--------------|
| Antimony | 6020B | 9.49 | 10.0 | 95 | 80-120 |
| Arsenic | 6020B | 50.1 | 50.0 | 100 | 80-120 |
| Cadmium | 6020B | 25.3 | 25.0 | 101 | 80-120 |
| Calcium | 6020B | 10000 | 10300 | 98 | 80-120 |
| Chromium | 6020B | 10.2 | 10.0 | 102 | 80-120 |
| Lead | 6020B | 51.0 | 50.0 | 102 | 80-120 |
| Magnesium | 6020B | 10600 | 10300 | 103 | 80-120 |
| Silver | 6020B | 12.9 | 12.5 | 103 | 80-120 |
| Zinc | 6020B | 25.4 | 25.0 | 101 | 80-120 |

QA/QC Report

Client: Terraphase Engineering Inc.

Service Request: K2410651 **Project:** Upper Granite Creek Mines/0031.005.001 **Date Analyzed:** 10/15/24

Sample Matrix: Water

> **Lab Control Sample Summary Total Metals**

> > Units:ug/L Basis:NA

Lab Control Sample

KQ2416532-02

| Analyte Name | Analytical Method | Result | Spike Amount | % Rec | % Rec Limits |
|--------------|--------------------------|--------|--------------|-------|--------------|
| Mercury | 7470A | 4.68 | 5.00 | 94 | 80-120 |



November 01, 2024

Portland, OR 97205

Terraphase Engineering Inc. 610 SW Broadway, Suite 405

Don Malkemus

ALS Environmental ALS Group USA, Corp 1317 South 13th Avenue Kelso, WA 98626

T:+1 360 577 7222

F: +1 360 636 1068 www.alsglobal.com

Analytical Report for Service Request No: K2410642

Revised Service Request No: K2410642.01

RE: Upper Granite Creek Mines / 0031.005.001

Dear Don,

Enclosed is the revised report of the sample(s) submitted to our laboratory October 08, 2024 For your reference, these analyses have been assigned our service request number **K2410642**.

The bio accessibility values are now included.

Analyses were performed according to our laboratory's NELAP-approved quality assurance program. The test results meet requirements of the current NELAP standards, where applicable, and except as noted in the laboratory case narrative provided. For a specific list of NELAP-accredited analytes, refer to the certifications section at www.alsglobal.com. All results are intended to be considered in their entirety, and ALS Group USA Corp. dba ALS Environmental (ALS) is not responsible for use of less than the complete report. Results apply only to the items submitted to the laboratory for analysis and individual items (samples) analyzed, as listed in the report.

We apologize for any inconvenience this may have created.

Please contact me if you have any questions. My extension is 3376. You may also contact me via email at Mark.Harris@alsglobal.com.

Respectfully submitted,

noe D. Daw

ALS Group USA, Corp. dba ALS Environmental

Mark Harris

Project Manager



ALS Environmental ALS Group USA, Corp 1317 South 13th Avenue Kelso, WA 98626

T: +1 360 577 7222 F: +1 360 636 1068 www.alsglobal.com

Table of Contents

Acronyms

Qualifiers

State Certifications, Accreditations, And Licenses

Case Narrative

Chain of Custody

Total Solids

Metals

Acronyms

ASTM American Society for Testing and Materials

A2LA American Association for Laboratory Accreditation

CARB California Air Resources Board

CAS Number Chemical Abstract Service registry Number

CFC Chlorofluorocarbon
CFU Colony-Forming Unit

DEC Department of Environmental Conservation

DEQ Department of Environmental Quality

DHS Department of Health Services

DOE Department of Ecology
DOH Department of Health

EPA U. S. Environmental Protection Agency

ELAP Environmental Laboratory Accreditation Program

GC Gas Chromatography

GC/MS Gas Chromatography/Mass Spectrometry

LOD Limit of Detection
LOQ Limit of Quantitation

LUFT Leaking Underground Fuel Tank

M Modified

MCL Maximum Contaminant Level is the highest permissible concentration of a substance

allowed in drinking water as established by the USEPA.

MDL Method Detection Limit
MPN Most Probable Number
MRL Method Reporting Limit

NA Not Applicable
NC Not Calculated

NCASI National Council of the Paper Industry for Air and Stream Improvement

ND Not Detected

NIOSH National Institute for Occupational Safety and Health

PQL Practical Quantitation Limit

RCRA Resource Conservation and Recovery Act

SIM Selected Ion Monitoring

TPH Total Petroleum Hydrocarbons

tr Trace level is the concentration of an analyte that is less than the PQL but greater than or

equal to the MDL.

Inorganic Data Qualifiers

- * The result is an outlier. See case narrative.
- # The control limit criteria is not applicable.
- B The analyte was found in the associated method blank at a level that is significant relative to the sample result as defined by the DOD or NELAC standards.
- F. The result is an estimate amount because the value exceeded the instrument calibration range.
- J The result is an estimated value.
- U The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL.
 DOD-QSM 4.2 definition: Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
- i The MRL/MDL or LOQ/LOD is elevated due to a matrix interference.
- X See case narrative.
- Q See case narrative. One or more quality control criteria was outside the limits.
- H The holding time for this test is immediately following sample collection. The samples were analyzed as soon as possible after receipt by the laboratory.

Metals Data Qualifiers

- # The control limit criteria is not applicable.
- J The result is an estimated value.
- E The percent difference for the serial dilution was greater than 10%, indicating a possible matrix interference in the sample.
- M The duplicate injection precision was not met.
- N The Matrix Spike sample recovery is not within control limits. See case narrative.
- S The reported value was determined by the Method of Standard Additions (MSA).
- U The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL. DOD-QSM 4.2 definition: Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
- W The post-digestion spike for furnace AA analysis is out of control limits, while sample absorbance is less than 50% of spike absorbance.
- i The MRL/MDL or LOQ/LOD is elevated due to a matrix interference.
- X See case narrative.
- + The correlation coefficient for the MSA is less than 0.995.
- Q See case narrative. One or more quality control criteria was outside the limits.

Organic Data Qualifiers

- * The result is an outlier. See case narrative.
- # The control limit criteria is not applicable. See case narrative.
- A A tentatively identified compound, a suspected aldol-condensation product.
- B The analyte was found in the associated method blank at a level that is significant relative to the sample result as defined by the DOD or NELAC standards.
- C The analyte was qualitatively confirmed using GC/MS techniques, pattern recognition, or by comparing to historical data.
- D The reported result is from a dilution.
- E The result is an estimated value.
- J The result is an estimated value.
- N The result is presumptive. The analyte was tentatively identified, but a confirmation analysis was not performed.
- P The GC or HPLC confirmation criteria was exceeded. The relative percent difference is greater than 40% between the two analytical results.
- U The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL.
 DOD-QSM 4.2 definition: Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
- i The MRL/MDL or LOQ/LOD is elevated due to a chromatographic interference.
- X See case narrative.
- Q See case narrative. One or more quality control criteria was outside the limits.

Additional Petroleum Hydrocarbon Specific Qualifiers

- F The chromatographic fingerprint of the sample matches the elution pattern of the calibration standard.
- L The chromatographic fingerprint of the sample resembles a petroleum product, but the elution pattern indicates the presence of a greater amount of lighter molecular weight constituents than the calibration standard.
- H The chromatographic fingerprint of the sample resembles a petroleum product, but the elution pattern indicates the presence of a greater amount of heavier molecular weight constituents than the calibration standard.
- O The chromatographic fingerprint of the sample resembles an oil, but does not match the calibration standard.
- Y The chromatographic fingerprint of the sample resembles a petroleum product eluting in approximately the correct carbon range, but the elution pattern does not match the calibration standard.
- Z The chromatographic fingerprint does not resemble a petroleum product.

ALS Group USA Corp. dba ALS Environmental (ALS) - Kelso State Certifications, Accreditations, and Licenses

| Agency | Web Site | Number |
|--------------------------|---|-------------|
| Alaska DEH | http://dec.alaska.gov/eh/lab/cs/csapproval.htm | UST-040 |
| Arizona DHS | http://www.azdhs.gov/lab/license/env.htm | AZ0339 |
| Arkansas - DEQ | http://www.adeq.state.ar.us/techsvs/labcert.htm | 88-0637 |
| California DHS (ELAP) | http://www.cdph.ca.gov/certlic/labs/Pages/ELAP.aspx | 2795 |
| DOD ELAP | http://www.denix.osd.mil/edqw/Accreditation/AccreditedLabs.cfm | L16-58-R4 |
| Florida DOH | http://www.doh.state.fl.us/lab/EnvLabCert/WaterCert.htm | E87412 |
| Hawaii DOH | http://health.hawaii.gov/ | - |
| ISO 17025 | http://www.pjlabs.com/ | L16-57 |
| Louisiana DEQ | http://www.deq.louisiana.gov/page/la-lab-accreditation | 03016 |
| Maine DHS | http://www.maine.gov/dhhs/ | WA01276 |
| Minnesota DOH | http://www.health.state.mn.us/accreditation | 053-999-457 |
| Nevada DEP | http://ndep.nv.gov/bsdw/labservice.htm | WA01276 |
| New Jersey DEP | http://www.nj.gov/dep/enforcement/oqa.html | WA005 |
| New York - DOH | https://www.wadsworth.org/regulatory/elap | 12060 |
| | https://deq.nc.gov/about/divisions/water-resources/water-resources-data/water-sciences-home-page/laboratory-certification-branch/non-field-lab- | |
| North Carolina DEQ | certification | 605 |
| Oklahoma DEQ | http://www.deq.state.ok.us/CSDnew/labcert.htm | 9801 |
| Oregon – DEQ (NELAP) | http://public.health.oregon.gov/LaboratoryServices/EnvironmentalLaboratoryAccreditation/Pages/index.aspx | WA100010 |
| South Carolina DHEC | http://www.scdhec.gov/environment/EnvironmentalLabCertification/ | 61002 |
| Texas CEQ | http://www.tceq.texas.gov/field/qa/env_lab_accreditation.html | T104704427 |
| Washington DOE | http://www.ecy.wa.gov/programs/eap/labs/lab-accreditation.html | C544 |
| Wyoming (EPA Region 8) | https://www.epa.gov/region8-waterops/epa-region-8-certified-drinking-water- | - |
| Kelso Laboratory Website | www.alsglobal.com | NA |

Analyses were performed according to our laboratory's NELAP-approved quality assurance program. A complete listing of specific NELAP-certified analytes, can be found in the certification section at www.ALSGlobal.com or at the accreditation bodies web site.

Please refer to the certification and/or accreditation body's web site if samples are submitted for compliance purposes. The states highlighted above, require the analysis be listed on the state certification if used for compliance purposes and if the method/anlayte is offered by that state.



Case Narrative

ALS Environmental—Kelso Laboratory 1317 South 13th Avenue, Kelso, WA 98626 Phone (360)577-7222 Fax (360)636-1068 www.alsglobal.com



Client:Terraphase Engineering Inc.Service Request: K2410642Project:Upper Granite Creek MinesDate Received: 10/08/2024

Sample Matrix: Soil

CASE NARRATIVE

All analyses were performed consistent with the quality assurance program of ALS Environmental. This report contains analytical results for samples for the Tier II level requested by the client.

Sample Receipt:

Twenty soil samples were received for analysis at ALS Environmental on 10/08/2024. Any discrepancies upon initial sample inspection are annotated on the sample receipt and preservation form included within this report. The samples were stored at minimum in accordance with the analytical method requirements.

Metals:

No significant anomalies were noted with this analysis.

Approved by Moe D. Daw

Date 11/01/2024



Chain of Custody

ALS Environmental—Kelso Laboratory 1317 South 13th Avenue, Kelso, WA 98626 Phone (360)577-7222 Fax (360)636-1068 www.alsglobal.com

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CHAIN OF CUSTODY

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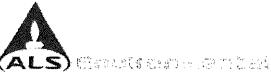
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| F-WRA-0.5-1 | 7 | 10/5 | 0430 | Soil | Z | 1- | \vdash | | | X | | | | | | | | | | | |
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| Time | Date/Time | 10/8/ | 24 1306 | Date | e/Time | 10 | 081 | 24 | <u></u> | 145 | D | ate/ | ime | | | <u> </u> | | Date/Tim | е | Date/Time | |
| 10/8 1306 | | | 7 | | | | 7 | 7 | | | | | | | | | | | , , , , , , , , , , , , , , , , , , , | | |
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| COC Set 6 | of_ _8 |
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| (ALS) (Secure | i Kurai Veresi | | | 13 | 17 Sout | h 13th. | Ave, K | Celso, ' | WA 9 | | | e (360) alsglot | | | 800-6 | 95-722 | 2/F/ | AX (360) 63 | 6-1068 | _ | | Page 1 of 1 | |
|--|---|--------------|----------------|----------------|--|----------|-------------------|-------------|-------------------|------------------|------------------|---|--------------|--------|-------|--------|----------|-------------|------------|-------------------|------------------|----------------|--|
| Project Name Upple Grant Creek M. Project Manager D. AA. 16. | Project N | lumber: O | 031.005.001 | | | Cac | 3 | | 180D | | 8 | 3880 | | | | | | | | | 1063/ | | |
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| | | | AMPLING | Matrix | | | | | -6 | Į6. | 9 | l " | - | ~ | ~ | *† | ~ | 1101 | IIOIICO | | | | |
| CLIENT SAMPLE ID | LABID | | Time State | ļ | | 1 | | | | _ | | | | | _ | | _ | | | 4 | | | |
| .GCS-WRA -0.5-4-03 | <u>عا۱</u> | 10 4 | 1222 | 5021 | 2 | | \Box | × | ኡ | | <u> </u> | | | | | | _ | + pal | | | | | |
| GCG - WFA - 0.5 - 2 | | 1014 | | 50:1 | 2 | | | ¥ | ۲. | × | | | | | | | _ | + 645 | | | | | |
| 1.GCG - WR4 -0.5-1 | 156 | 1614 | 1645 | 1:42 | 2 | | | | | λ | | | | | | | | | | _ | | | |
| GC7-494-05-3 | 19 | 1014 | 1150 | Suil | 2 | | | | | X | | | | | | | | | | | | | |
| .GC7-6-18-0-5-1 | 7.0 | 1014 | ll12 | 50.1 | 2. | | | | | አ | | | | | | | | | | _ | | | |
| T L - 4RA - 0.5-3 | 7700 | 10 4 | 1405 | 50.1 | 2 | | | | | × | | | | | | | | | | | | • | |
| - 71 - WRB - 0.5-4 | | 1014 | 1425 | Se. 1 | 2 | | | | | ¥ | | | | | | | | | | | | | |
| - TL-WPA-0.5-1-05-2 | | 13 4 | 1400 | 5.:1 | 7 | | | + | ¥ | ¥ | | | | | | | | + 649 | | | | | |
| 5H-WKB-0.5-2 | | 10 4 | 1005 | 1:02 | 2 | | | | | X | | | | | | | | | | | | | |
| 0.9H-LRC- 0.5-1 | | 1014 | lois | ان به | 2 | | | | | X | | | | | | | | | | | | | |
| Report Requirements | | oice Ir | nformation | | Çircle which metals are to be analyzed | | | | | | | | | | | | alvzed | | | | | | |
| I. Routine Report: Method Blank, Surrogate, as | P.O.#_ | | eraphyx-bov | , | | | Total | Mets | ale. Q | 1 6 | G . | h R | a Re | s R | Ca | Cd (| ີກ ໃ | Or Ou F | e Ph Ma | Mn Mo Ni K Ag N | la Co Cr Ti Co | V 70 He | |
| required | 1 5111 10 | · MACE ! | -11-18-11-1 | - | | | | | | | _ | | | | | | | | | | | - | |
| II. Report Dup., MS, MSD | *************************************** | | | _ | | | | | | | | 50 | ьа | R6 I | | | | | | Ag Mn Mo Ni K Ag | | - | |
| as required | Turnar | ound | Requireme | nts | pecia | IInst | ructio | ons/C | Jom | men | its: | | | | "in | dicate | Sta | ate Hydr | ocarbon P | rocedure: AK CA W | /I Northwest Oth | er(Circle One) | |
| III. CLP Like Summary (no raw data) | 2 | 4 hr. Day | 48 hr. | 1 | - | | | | | | | | | | | | | | | | | | |
| IV. Data Validation Report | X S | itandard | | | | | | | | | | | | | | | | | | | | | |
| V. EDD | | Conventor | ! Report Date | | | | | | | | | | | | | , | | | | | | | |
| Relinquished By: | | 7777400 | red By: | | Re | ling | uish | ed | Ву: | | T | | F | Rece | ive | d By | - | 1 | Re | linquished By: | R | eceived By: | |
| | <u> </u> | | 1 | | | _ | | 1 | | | \bot | | | | | | | | | | | | |
| ignature | Signature | F | | Sigr | ature | 0 | 74 | | | | S | ignat V/2 | lane Laya | اً ۲ | >. | de | B | en | Signature | | Signature | | |
| rinted Name Millemy | Printed, N | | BiL | Prin | ted N | | | Lá | \mathcal{B}_{i} | he | | rinte | | | | | | | Printed Na | ime | Printed Nan | ne | |
| im tel | Firm / | 5 | | Fim | | _5 | _ | į | | | TF: | Firm 1018124 1445 | | | | | | | Firm Firm | | | | |
| ate/Time | Date/Tim | e/0/0 | 8/24 /30 | 6 Date | e/Time | | \\ / ₂ | 24 | 74 | 144 | | ate/ | Time | ······ | | | | | Date/Time | | Date/Time | | |
| 10/8 1306 | _ | 7 7 | -, , | | | ,- | , | - 1 | · | | | | | | | | | | | | | | |

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|---|------------------------|----------|----------|----------|---|-----------------|------------|---------------------------------------|-----------------------------|-----------|---|
| Tearding | ooler Receipt | and F | rese | | | | s . | ~1 11" | Promp. | 7- | |
| Client levaguese | 01645 | | <u> </u> | Sei | | Request / | (24) | 2646 | | a F | |
| Received: 1018124 Opened: | 018124 | By: _ | Δ | 1_ | Unl | oaded: _ | 1018 | 129 | By: <u></u> | <u> </u> | |
| 1. Samples were received via? USPS | Fed Ex | UPS | D | HL | P | DX. | Court | er) 1 | and Deliv | ered | |
| 2. Samples were received in: (circle) Caol | Box | E | ivelope | | Ot | her | <u> </u> | | | NA . | |
| 3. Were <u>custody seals</u> on coolers? NA | Y (N) I | f yes, h | ow mar | y and | where | 7 | ., | | | | |
| ' If present, were custody seals intact? | YNI | f presen | it, were | they s | igned a | and dated? | ? | | Y | N | |
| | | | | 9.17. | 1 | | | · · · · · · · · · · · · · · · · · · · | | | |
| | | | Outo | f temp | | PM Notifie | a I | ** | | | |
| | ooler #/COC ID / N/ | 1 | indicate | | | if out of t | | Trackii | ng Numbe | NA_ | Filed |
| 19.6 14.6 -1801 1 | 40510 | | | | | | | | | | |
| 10.8 5.7 | | | | | | | | | | • | |
| (0.0 4.4 | | | | | | | | | | | |
| a.u 14.5 | | | <u>.</u> | | 1 | | | | | | |
| 107 115 | | _ | | | + | | | | | | |
| 4. Was a Temperature Blank present in cooler? NA | A (Y) N | If ves n | otate th | e temp | eratur | e in the an | propriate | column ab | ove: | | |
| If no, take the temperature of a representative sa | _ | • | | - | | - | | | | | |
| 5. Were samples received within the method specifi | - | | | | | | J | NA. | $\left(\mathbf{v} \right)$ | N | |
| If no, were they received on ice and same day as | | - | cooler | # abov | ve and | potify the | РМ | NA |) v | N | |
| · · · · · · · · · · · · · · · · · · · | zen Partially Th | | Thaw | | . • | | - 2121 | |) | | |
| | • | | * | | | | | | | | |
| | le Wrap Gel Pack | Wet | Ice 1 | ry Ice | Sle | eves | | | | | |
| 7. Were custody papers properly filled out (ink, signature) | • | | | | | | | NA | | N | |
| 8. Were samples received in good condition (unbro | | | | | | | | NA | > * | N | |
| Were all sample labels complete (ie, analysis, p. Did all sample labels and tags agree with custod | | | * | | | | | NA NA | Y | N N | |
| 11. Were appropriate bottles/containers and volume | | ete indi | cated? | | | | | NA | \sim | N | |
| 12. Were the pH-preserved bottles (see SMO GEN. | | | | 17 Ind | licate i | n the table | e helow | NA | Y | N | |
| 13. Were VOA vials received without headspace? | - | | mute pr | 4. 2,,,, | .,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,, | | | NA | | N | |
| 14. Was C12/Res negative? | maicale in the table | DEIUW, | | | | | | NA NA | Y | N | |
| 15. Were samples received within the method speci | ified time limit? If n | ot note | te the e | mor ha | low an | d notify th | e PM | (NA | Y | N | |
| 16. Were 100ml sterile microbiology bottles filled | | | - / | } | Y Y | no monny a N | IC I IVI | Under | / | Overfille | .d |
| 16. Were fooms sterne microbiology bottles filled t | exactly to the 100m | mark? | _(^N | A | | 14 | | Onder | - C | | <u> </u> |
| Sample ID on Bottle | Sample | ID on | COC | | | | | Identifie | d by: | | |
| | | | | | | | | | | | |
| | | | ··· | | | | | | | | |
| | | | | | | | | | | | *************************************** |
| | | | | | | | | | | | |
| | Bottle Count | Head- | | | | | Volume | Reager | t Lot | | |
| Sample ID | Bottle Type | space | Broke | рН | Re | agent | added | Num | | initials | Time |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| Notes, Discrepancies, Resolutions: | | | | | | | | | | | |

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SOP: SMO-GEN

Reviewed: NP 1/3/2024

G:\SMO\2024 Forms



Cooler Receipt and Preservation Form

| | | <u> </u> | <u> </u> | | | | | e Request <i>K2</i> | | V | | |
|--|-------------------|------------|-------------|---------------|------------|---------------|------------------------|---------------------------------|--------|--|------------|-------------|
| Temp Blank | Sample Temp | IR Gun | Cooler #/C | OC ID / N | IA. | Out indica | of temp ite with ") | PM Notifie (" If out of t | emp | Tracking Nur | nber NA | File |
| A8: 7.8 | 3.8 | 1801 | | | | | | | | | | |
| 11.2 | 5.5 | W_ | | | | | | | | (************************************ | | |
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| | | | , | | | | | | | | | |
| | | | | | | 2722 | la asa | | : | | f · | |
| Sar | mpie ID on Bottie | | | Sample li | D on C | OC | | | ld | entified by: | • | |
| | | | | | | | | | | | | |
| | | | | | | <u></u> | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | ottle Count | Out of | | | g giar | | Volume | Reagent Lot | I I | |
| ······································ | Sample ID | E | ottle Type | Temp | space | Broke | рН | Reagent | added | Number | Initials | Time |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | ······ |
| | | | | | | | | | | | | |
| | | | | | 1 1 | <u> </u> | | | 1 | | <u></u> | |
| | ancies & Resol | utions: \(| <u>ا س</u> | 2) a | * + | TOP | <u>04</u> | <u>coolers</u> | > 0) | a topo | <u> </u> | •••• |
| tes, Discrep | | 2 ^ ^ | blan | le L | <u>ias</u> | <u> </u> | nde | rtle | SUN | gles, r | <u>\ot</u> | |
| Sun | ples. To | JAK - | | | | | | | | | | |
| otes, Discrep Sam India | ples. Te | E S | mpl | <u>ا</u> و () | ten | 4 | | | | | | |
| Sam judi | ples. To | £ 5 | ampl | <u>۔ ر</u> ي | ten | AP. | | | | | | |
| Sam judi | ples. To | ST S | ampl | -0 | ten | AP. | | | | | | |
| Sam judi | des. Te | Se S | ampl | ا وي | ten | 4 | | | | | | |
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G:\SMO\2024 Forms

SOP: SMO-GEN

Reviewed: NP 1/3/2024

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Total Solids

ALS Environmental—Kelso Laboratory 1317 South 13th Avenue, Kelso, WA 98626 Phone (360)577-7222 Fax (360)636-1068 www.alsglobal.com

Analytical Report

Client: Terraphase Engineering Inc.

Date Collected: 10/02/24 - 10/05/24 **Project:** Upper Granite Creek Mines/0031.005.001

Sample Matrix: Soil **Date Received:** 10/8/24

Analysis Method: 160.3 Modified

Units: Percent **Prep Method:** Basis: As Received None

Solids, Total

| Sample Name | Lab Code | Result | MRL | Dil. | Date Analyzed | Q |
|------------------|--------------|--------|-----|------|------------------|---|
| UMM-TLB-0.5-1 | K2410642-001 | 86.4 | - | 1 | 10/10/24 10:19 | |
| UMM-TLB-0.5-4 | K2410642-002 | 91.8 | - | 1 | 10/10/24 10:19 | |
| UMM-TLC-0.5-1 | K2410642-003 | 79.3 | - | 1 | 10/10/24 10:19 | |
| UMM-TLC-0.5-2 | K2410642-004 | 76.8 | - | 1 | 10/10/24 10:19 | |
| UMM-TLA-0.5-6 | K2410642-005 | 91.8 | - | 1 | 10/10/24 10:19 | |
| CEM-WRA-0.5-4-DS | K2410642-006 | 96.8 | - | 1 | 10/10/24 10:19 | |
| CEM-WRB-0.5-1 | K2410642-007 | 96.5 | - | 1 | 10/10/24 10:19 | |
| CEM-WRA-0.5-2 | K2410642-008 | 95.3 | - | 1 | 10/10/24 10:19 | |
| CEM-WRC-0.5-1 | K2410642-009 | 95.1 | - | 1 | 10/10/24 10:19 | |
| GF-WRA-0.5-1 | K2410642-010 | 97.0 | - | 1 | 10/10/24 10:19 | |
| GF-WRD-0.5-6 | K2410642-011 | 95.1 | - | 1 | 10/10/24 10:19 | |
| GF-WRD-0.5-4-DS | K2410642-012 | 97.0 | - | 1 | 10/10/24 10:19 | |
| GF-DR-0.5-1 | K2410642-013 | 97.2 | - | 1 | 10/10/24 10:19 | |
| GC5-WRA-0.5-3 | K2410642-014 | 96.2 | - | 1 | 10/10/24 10:19 | |
| GC5-WRA-0.5-4 | K2410642-015 | 95.8 | - | 1 | 10/10/24 10:19 | |
| GC5-WRA-0.5-4-DS | K2410642-016 | 96.0 | - | 1 | 10/10/24 10:19 | |
| GC6-WRA-0.5-2 | K2410642-017 | 94.4 | - | 1 | 10/10/24 10:19 | |
| GC6-WRA-0.5-1 | K2410642-018 | 93.7 | - | 1 | 10/10/24 10:19 | |
| GC7-WRA-0.5-3 | K2410642-019 | 95.2 | - | 1 | 10/10/24 10:19 | |
| GC7-WRB-0.5-1 | K2410642-020 | 96.1 | - | 1 | 10/10/24 10:19 | |

Service Request: K2410642

QA/QC Report

Service Request: K2410642

Client: Terraphase Engineering Inc.

Project Upper Granite Creek Mines/0031.005.001 **Date Collected:**10/02/24 - 10/04/24

Sample Matrix: Soil Date Received: 10/08/24

Analysis Method: 160.3 Modified Units: Percent

Prep Method: None Basis: As Received

Replicate Sample Summary Inorganic Parameters

| Sample Name: | Lab Code: | MRL | Sample Result | Duplicate Result | Average | RPD | RPD Limit | Date Analyzed |
|---------------|-----------------|-----|------------------|---------------------|---------|-----|--------------|------------------|
| UMM-TLB-0.5-1 | K2410642-001DUP | - | 86.4 | 86.5 | 86.5 | <1 | 20 | 10/10/24 |
| GC7-WRB-0.5-1 | K2410642-020DUP | _ | 96.1 | 96.3 | 96.2 | <1 | 20 | 10/10/24 |

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

Printed 10/11/2024 8:28:22 AM Superset Reference:24-0000711613 rev 00



Metals

ALS Environmental—Kelso Laboratory 1317 South 13th Avenue, Kelso, WA 98626 Phone (360)577-7222 Fax (360)636-1068 www.alsglobal.com

Analytical Report

Client: Terraphase Engineering Inc.

Project: Upper Granite Creek Mines/0031.005.001

Sample Matrix: Soil

Service Request: K2410642 **Date Collected:** 10/2/2024 **Date Received:** 10/8/2024

Date Extracted: 10/16-10/17/2024 **Date Analyzed:** 10/17-10/22/2024

Bioaccessibility Value Analyte: Arsenic Units: Percent (%)

| Sample Name | Lab Code | Result |
|------------------|--------------|--------|
| UMM-TLB-0.5-1 | K2410642-001 | 41.6 |
| UMM-TLA-0.5-6 | K2410642-005 | 24.3 |
| CEM-WRA-0.5-2 | K2410642-008 | 5.6 |
| GF-WRD-0.5-4-DS | K2410642-012 | 9.0 |
| GC5-WRA-0.5-4-DS | K2410642-016 | 4.7 |
| GC6-WRA-0.5-2 | K2410642-017 | 3.9 |

Analytical Report

Client: Terraphase Engineering Inc.

Project: Upper Granite Creek Mines/0031.005.001

Sample Matrix: Soil

Service Request: K2410642

Date Collected: 10/2/2024

Date Received: 10/8/2024

Date Extracted: 10/16-10/17/2024 **Date Analyzed:** 10/17-10/22/2024

Bioaccessibility Value Analyte: Lead Units: Percent (%)

| Sample Name | Lab Code | Result |
|------------------|--------------|--------|
| UMM-TLB-0.5-1 | K2410642-001 | 28.7 |
| UMM-TLA-0.5-6 | K2410642-005 | 6.2 |
| CEM-WRA-0.5-2 | K2410642-008 | 27.9 |
| GF-WRD-0.5-4-DS | K2410642-012 | 34.9 |
| GC5-WRA-0.5-4-DS | K2410642-016 | 37.5 |
| GC6-WRA-0.5-2 | K2410642-017 | 41.7 |

Analytical Report

Client: Terraphase Engineering Inc.

Project:

Service Request: K2410642 **Date Collected:** 10/02/24 16:30 Upper Granite Creek Mines/0031.005.001

Date Received: 10/08/24 14:45 **Sample Matrix:** Soil

Sample Name: UMM-TLB-0.5-1 Basis: Dry

Lab Code: K2410642-001

Total Metals

| | Analysis | | | | | | | Date | |
|--------------|----------|--------|-------|-----|-----|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 6130 | mg/Kg | 11 | 1 | 100 | 10/22/24 12:10 | 10/10/24 | |
| Lead | 6020B | 1710 | mg/Kg | 1.1 | 0.4 | 100 | 10/22/24 12:10 | 10/10/24 | |
| Mercury | 7471B | 387 | mg/Kg | 11 | 1 | 500 | 10/15/24 13:08 | 10/14/24 | |

Printed 10/22/2024 8:04:34 PM Superset Reference:

Analytical Report

Client: Terraphase Engineering Inc.

Project:

Service Request: K2410642 **Date Collected:** 10/02/24 16:30 Upper Granite Creek Mines/0031.005.001

Date Received: 10/08/24 14:45 **Sample Matrix:** Soil

UMM-TLB-0.5-1 **Sample Name:** Basis: Dry

Lab Code: K2410642-001

Total Metals – IVBA Analysis

| | Analysis | | | | | | | Date | |
|--------------|----------|--------|-------|------|------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 4420 | mg/Kg | 4.9 | 0.6 | 50 | 10/22/24 15:53 | 10/17/24 | |
| Lead | 6020B | 840 | mg/Kg | 0.49 | 0.20 | 50 | 10/22/24 15:53 | 10/17/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Project:

Service Request: K2410642 **Date Collected:** 10/02/24 16:30 Upper Granite Creek Mines/0031.005.001

Date Received: 10/08/24 14:45 **Sample Matrix:** Soil

Sample Name: UMM-TLB-0.5-1 Basis: Dry

Lab Code: K2410642-001

IVBA Metals

| | Analysis | | | | | | | Date | |
|--------------|----------|--------|-------|------|------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 1840 | mg/Kg | 2.0 | 0.2 | 20 | 10/17/24 11:29 | 10/16/24 | |
| Lead | 6020B | 241 | mg/Kg | 0.20 | 0.08 | 20 | 10/17/24 11:29 | 10/16/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Service Request: K2410642

Date Collected: 10/02/24 16:45 **Project:** Upper Granite Creek Mines/0031.005.001 **Date Received:** 10/08/24 14:45 **Sample Matrix:** Soil

UMM-TLB-0.5-4 **Sample Name:** Basis: Dry

Lab Code: K2410642-002

Total Metals

| | Analysis | | | | | | | Date | |
|---------------------|----------|--------|-------|-----|-----|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 1540 | mg/Kg | 8.0 | 1.0 | 100 | 10/22/24 12:18 | 10/10/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Project:

Service Request: K2410642 **Date Collected:** 10/02/24 17:00 Upper Granite Creek Mines/0031.005.001

Date Received: 10/08/24 14:45 **Sample Matrix:** Soil

Sample Name: UMM-TLC-0.5-1 Basis: Dry

Lab Code: K2410642-003

Total Metals

| | Analysis | | | | | | | Date | |
|--------------|----------|--------|-------|-----|-----|------|----------------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 5290 | mg/Kg | 9.9 | 1.2 | 100 | 10/22/24 12:19 | 10/10/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Upper Granite Creek Mines/0031.005.001

Date Collected: 10/02/24 17:15

Sample Matrix:

Project:

Lab Code:

Soil

Date Received: 10/08/24 14:45

Service Request: K2410642

Sample Name:

UMM-TLC-0.5-2 K2410642-004

Basis: Dry

Total Metals

| | Analysis | | | | | | | Date | |
|---------------------|----------|--------|-------|-----|-----|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 4980 | mg/Kg | 10 | 1 | 100 | 10/22/24 12:21 | 10/10/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Service Request: K2410642 **Date Collected:** 10/02/24 15:45 **Project:** Upper Granite Creek Mines/0031.005.001

Date Received: 10/08/24 14:45 **Sample Matrix:** Soil

Sample Name: UMM-TLA-0.5-6 Basis: Dry

Lab Code: K2410642-005

Total Metals

| | Analysis | | | | | | | Date | |
|--------------|----------|--------|-------|------|------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 3270 | mg/Kg | 8.1 | 1.0 | 100 | 10/22/24 11:35 | 10/10/24 | |
| Lead | 6020B | 589 | mg/Kg | 0.81 | 0.33 | 100 | 10/22/24 11:35 | 10/10/24 | |
| Mercury | 7471B | 9.23 | mg/Kg | 0.19 | 0.02 | 10 | 10/15/24 10:28 | 10/14/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Project:

Service Request: K2410642 **Date Collected:** 10/02/24 15:45 Upper Granite Creek Mines/0031.005.001

Date Received: 10/08/24 14:45 **Sample Matrix:** Soil

UMM-TLA-0.5-6 **Sample Name:** Basis: Dry

Lab Code: K2410642-005

Total Metals – IVBA Analysis

| | Analysis | | | | | | | Date | |
|--------------|----------|--------|-------|------|------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 5560 | mg/Kg | 4.9 | 0.6 | 50 | 10/22/24 15:46 | 10/17/24 | |
| Lead | 6020B | 1110 | mg/Kg | 0.49 | 0.20 | 50 | 10/22/24 15:46 | 10/17/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Service Request: K2410642 **Date Collected:** 10/02/24 15:45 **Project:** Upper Granite Creek Mines/0031.005.001

Date Received: 10/08/24 14:45 **Sample Matrix:** Soil

Sample Name: UMM-TLA-0.5-6 Basis: Dry

Lab Code: K2410642-005

IVBA Metals

| | Analysis | | | | | | | Date | |
|--------------|----------|--------|-------|------|------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 1350 | mg/Kg | 2.0 | 0.2 | 20 | 10/17/24 11:22 | 10/16/24 | |
| Lead | 6020B | 69.2 | mg/Kg | 0.20 | 0.08 | 20 | 10/17/24 11:22 | 10/16/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Service Request: K2410642 **Date Collected:** 10/02/24 12:30 Upper Granite Creek Mines/0031.005.001

Project: Date Received: 10/08/24 14:45 **Sample Matrix:** Soil

Sample Name: CEM-WRA-0.5-4-DS Basis: Dry

Lab Code: K2410642-006

Total Metals

| | Analysis | | | | | | | Date | |
|---------------------|----------|--------|-------|------|------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 32.6 | mo/Ko | 0.40 | 0.05 | 5 | 10/22/24 12:03 | 10/10/24 | |

Analytical Report

Service Request: K2410642

Client: Terraphase Engineering Inc.

> **Date Collected:** 10/05/24 13:00 Upper Granite Creek Mines/0031.005.001

Project: Date Received: 10/08/24 14:45 **Sample Matrix:** Soil

Sample Name: CEM-WRB-0.5-1 Basis: Dry

Lab Code: K2410642-007

Total Metals

| | Analysis | | | | | | | Date | |
|--------------|----------|--------|-------|-----|-----|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 151 | mg/Kg | 8.6 | 1.0 | 100 | 10/22/24 11:38 | 10/10/24 | |

Printed 10/22/2024 8:04:37 PM Superset Reference:

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Analytical Report

Client: Terraphase Engineering Inc.

Service Request: K2410642 **Date Collected:** 10/05/24 12:05 Upper Granite Creek Mines/0031.005.001

Project: Date Received: 10/08/24 14:45 **Sample Matrix:** Soil

CEM-WRA-0.5-2 **Sample Name:** Basis: Dry

Lab Code: K2410642-008

Total Metals – IVBA Analysis

| | Analysis | | | | | | | Date | |
|--------------|----------|-------------|-------|------|------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 794 | mg/Kg | 5.0 | 0.6 | 50 | 10/22/24 15:55 | 10/17/24 | |
| Lead | 6020B | 78.5 | mg/Kg | 0.50 | 0.20 | 50 | 10/22/24 15:55 | 10/17/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Service Request: K2410642 **Date Collected:** 10/05/24 12:05 **Project:** Upper Granite Creek Mines/0031.005.001

Date Received: 10/08/24 14:45 **Sample Matrix:** Soil

Sample Name: CEM-WRA-0.5-2 Basis: Dry

Lab Code: K2410642-008

IVBA Metals

| | Analysis | | | | | | | Date | |
|--------------|----------|--------|-------|------|------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 44.5 | mg/Kg | 2.0 | 0.2 | 20 | 10/17/24 11:30 | 10/16/24 | |
| Lead | 6020B | 21.9 | mg/Kg | 0.20 | 0.08 | 20 | 10/17/24 11:30 | 10/16/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Upper Granite Creek Mines/0031.005.001

Date Collected: 10/05/24 12:05

Service Request: K2410642

Sample Matrix:

Project:

Soil

Date Received: 10/08/24 14:45

Basis: Dry

CEM-WRA-0.5-2 **Sample Name:**

Lab Code:

K2410642-008

Total Metals

| | Analysis | | | | | | | Date | |
|---------------------|----------|--------|-------|-----|-----|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 299 | mg/Kg | 8.3 | 1.0 | 100 | 10/22/24 11:39 | 10/10/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Project:

Service Request: K2410642 **Date Collected:** 10/05/24 12:40 Upper Granite Creek Mines/0031.005.001

Date Received: 10/08/24 14:45 **Sample Matrix:** Soil

Sample Name: CEM-WRC-0.5-1 Basis: Dry

Lab Code: K2410642-009

Total Metals

| | Analysis | | | | | | | Date | |
|---------------------|----------|--------|-------|-----|-----|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 110 | mg/Kg | 8.0 | 1.0 | 100 | 10/22/24 11:41 | 10/10/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Project:

Upper Granite Creek Mines/0031.005.001 **Date Collected:** 10/05/24 09:30

Service Request: K2410642

Sample Matrix: Soil Date Received: 10/08/24 14:45

Sample Name: GF-WRA-0.5-1 Basis: Dry

Lab Code: K2410642-010

Total Metals

| | Analysis | | | | | | | Date | |
|---------------------|----------|--------|-------|-----|-----|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 332 | mg/Kg | 7.8 | 0.9 | 100 | 10/22/24 11:42 | 10/10/24 | |

Analytical Report

Service Request: K2410642 **Date Collected:** 10/05/24 11:10

Date Received: 10/08/24 14:45

Client: Terraphase Engineering Inc.

Upper Granite Creek Mines/0031.005.001

Sample Matrix: Soil

Project:

Lab Code:

Sample Name:

GF-WRD-0.5-6 Basis: Dry K2410642-011

Total Metals

| | Analysis | | | | | | | Date | |
|---------------------|----------|--------|-------|-----|-----|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 66.6 | mg/Kg | 7.9 | 0.9 | 100 | 10/22/24 11:44 | 10/10/24 | |

Printed 10/22/2024 8:04:37 PM Superset Reference:

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Analytical Report

Client: Terraphase Engineering Inc.

Project:

Service Request: K2410642 **Date Collected:** 10/05/24 11:05 Upper Granite Creek Mines/0031.005.001

Date Received: 10/08/24 14:45 **Sample Matrix:** Soil

Sample Name: GF-WRD-0.5-4-DS Basis: Dry

Lab Code: K2410642-012

Total Metals – IVBA Analysis

| | Analysis | | | | | | | Date | |
|--------------|----------|--------|-------|------|------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 137 | mg/Kg | 4.9 | 0.6 | 50 | 10/22/24 15:56 | 10/17/24 | |
| Lead | 6020B | 25.6 | mg/Kg | 0.49 | 0.19 | 50 | 10/22/24 15:56 | 10/17/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Service Request: K2410642 **Date Collected:** 10/05/24 11:05 Upper Granite Creek Mines/0031.005.001

Project: Date Received: 10/08/24 14:45 **Sample Matrix:** Soil

Sample Name: GF-WRD-0.5-4-DS Basis: Dry

Lab Code: K2410642-012

IVBA Metals

| | Analysis | | | | | | | Date | |
|--------------|----------|--------|-------|------|------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 12.3 | mg/Kg | 2.0 | 0.2 | 20 | 10/17/24 11:32 | 10/16/24 | |
| Lead | 6020B | 8.94 | mg/Kg | 0.20 | 0.08 | 20 | 10/17/24 11:32 | 10/16/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Project:

Service Request: K2410642 **Date Collected:** 10/05/24 11:05 Upper Granite Creek Mines/0031.005.001

Date Received: 10/08/24 14:45 **Sample Matrix:** Soil

Sample Name: GF-WRD-0.5-4-DS Basis: Dry

Lab Code: K2410642-012

Total Metals

| | Analysis | | | | | | | Date | |
|--------------|----------|--------|-------|-----|-----|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 55.2 | mo/Ko | 8.5 | 1.0 | 100 | 10/22/24 11:45 | 10/10/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Upper Granite Creek Mines/0031.005.001

Sample Matrix: Soil

Date Collected: 10/05/24 10:35

Date Received: 10/08/24 14:45

Basis: Dry

Service Request: K2410642

Sample Name:

GF-DR-0.5-1

Lab Code:

Project:

K2410642-013

Total Metals

Analysis Date Analyte Name Method Result Units MRL MDL Dil. **Date Analyzed Extracted** Q 6020B Arsenic 58.3 mg/Kg 8.4 1.0 100 10/22/24 11:49 10/10/24

Printed 10/22/2024 8:04:37 PM Superset Reference:

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Analytical Report

Client: Terraphase Engineering Inc.

Project:

Service Request: K2410642 **Date Collected:** 10/04/24 16:15 Upper Granite Creek Mines/0031.005.001

Date Received: 10/08/24 14:45 **Sample Matrix:** Soil

Sample Name: GC5-WRA-0.5-3 Basis: Dry

Lab Code: K2410642-014

Total Metals

| | Analysis | | | | | | | Date | |
|---------------------|----------|--------|-------|-----|-----|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 421 | mg/Kg | 8.0 | 1.0 | 100 | 10/22/24 11:51 | 10/10/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Service Request: K2410642 **Date Collected:** 10/04/24 15:54 Upper Granite Creek Mines/0031.005.001

Project: Date Received: 10/08/24 14:45 **Sample Matrix:** Soil

Sample Name: GC5-WRA-0.5-4 Basis: Dry

Lab Code: K2410642-015

Total Metals

| | Analysis | | | | | | | Date | |
|---------------------|----------|--------|-------|-----|-----|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 160 | mg/Kg | 7.8 | 0.9 | 100 | 10/22/24 11:52 | 10/10/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Project:

Service Request: K2410642 **Date Collected:** 10/04/24 15:55 Upper Granite Creek Mines/0031.005.001

Date Received: 10/08/24 14:45 **Sample Matrix:** Soil

Sample Name: GC5-WRA-0.5-4-DS Basis: Dry

Lab Code: K2410642-016

Total Metals – IVBA Analysis

| | Analysis | | | | | | | Date | |
|--------------|----------|--------|-------|------|------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 221 | mg/Kg | 5.0 | 0.6 | 50 | 10/22/24 16:01 | 10/17/24 | |
| Lead | 6020B | 70.4 | mg/Kg | 0.50 | 0.20 | 50 | 10/22/24 16:01 | 10/17/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Service Request: K2410642 **Date Collected:** 10/04/24 15:55 **Project:** Upper Granite Creek Mines/0031.005.001

Date Received: 10/08/24 14:45 **Sample Matrix:** Soil

Sample Name: GC5-WRA-0.5-4-DS Basis: Dry

Lab Code: K2410642-016

IVBA Metals

| | Analysis | | | | | | | Date | |
|--------------|----------|--------|-------|------|------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 10.4 | mg/Kg | 1.9 | 0.2 | 20 | 10/17/24 11:37 | 10/16/24 | |
| Lead | 6020B | 26.4 | mg/Kg | 0.19 | 0.08 | 20 | 10/17/24 11:37 | 10/16/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Project:

Service Request: K2410642 **Date Collected:** 10/04/24 15:55 Upper Granite Creek Mines/0031.005.001

Date Received: 10/08/24 14:45 **Sample Matrix:** Soil

Sample Name: GC5-WRA-0.5-4-DS Basis: Dry

Lab Code: K2410642-016

Total Metals

| | Analysis | | | | | | | Date | |
|--------------|----------|--------|-------|-----|-----|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 81.3 | mg/Kg | 7.9 | 0.9 | 100 | 10/22/24 11:54 | 10/10/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Project:

Service Request: K2410642 **Date Collected:** 10/04/24 14:00 Upper Granite Creek Mines/0031.005.001

Date Received: 10/08/24 14:45 **Sample Matrix:** Soil

GC6-WRA-0.5-2 **Sample Name:** Basis: Dry

Lab Code: K2410642-017

Total Metals – IVBA Analysis

| | Analysis | | | | | | | Date | |
|--------------|----------|--------|-------|------|------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 759 | mg/Kg | 4.9 | 0.6 | 50 | 10/22/24 16:02 | 10/17/24 | |
| Lead | 6020B | 360 | mg/Kg | 0.49 | 0.20 | 50 | 10/22/24 16:02 | 10/17/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Project:

Service Request: K2410642 **Date Collected:** 10/04/24 14:00 Upper Granite Creek Mines/0031.005.001

Date Received: 10/08/24 14:45 **Sample Matrix:** Soil

Sample Name: GC6-WRA-0.5-2 Basis: Dry

Lab Code: K2410642-017

IVBA Metals

| | Analysis | | | | | | | Date | |
|--------------|----------|--------|-------|------|------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 29.3 | mg/Kg | 2.0 | 0.2 | 20 | 10/17/24 11:39 | 10/16/24 | |
| Lead | 6020B | 150 | mg/Kg | 0.20 | 0.08 | 20 | 10/17/24 11:39 | 10/16/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Service Request: K2410642 **Date Collected:** 10/04/24 14:00 **Project:** Upper Granite Creek Mines/0031.005.001

Date Received: 10/08/24 14:45 **Sample Matrix:** Soil

GC6-WRA-0.5-2 **Sample Name:** Basis: Dry

Lab Code: K2410642-017

Total Metals

| | Analysis | | | | | | | Date | |
|---------------------|----------|--------|-------|-----|-----|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 504 | mg/Kg | 8.5 | 1.0 | 100 | 10/22/24 11:55 | 10/10/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Upper Granite Creek Mines/0031.005.001

Date Collected: 10/04/24 10:45

Basis: Dry

Service Request: K2410642

Sample Matrix:

Soil

Date Received: 10/08/24 14:45

Sample Name:

GC6-WRA-0.5-1

Lab Code:

Project:

K2410642-018

Total Metals

| | Analysis | | | | | | | Date | |
|---------------------|----------|--------|-------|-----|-----|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 257 | mg/Kg | 8.5 | 1.0 | 100 | 10/22/24 11:57 | 10/10/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Project:

Service Request: K2410642 **Date Collected:** 10/04/24 11:50 Upper Granite Creek Mines/0031.005.001

Date Received: 10/08/24 14:45 **Sample Matrix:** Soil

Sample Name: GC7-WRA-0.5-3 Basis: Dry

Lab Code: K2410642-019

Total Metals

| | Analysis | | | | | | | Date | |
|--------------|----------|--------|-------|------|------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 26.9 | mg/Kg | 8.5 | 1.0 | 100 | 10/22/24 11:58 | 10/10/24 | |
| Arsenic | 6020B | 26.2 | mg/Kg | 0.43 | 0.05 | 5 | 10/22/24 12:04 | 10/10/24 | |

Printed 10/22/2024 8:04:38 PM Superset Reference:

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Analytical Report

Client: Terraphase Engineering Inc.

Upper Granite Creek Mines/0031.005.001

Date Collected: 10/04/24 11:15

Basis: Dry

Service Request: K2410642

Sample Matrix:

Soil

Date Received: 10/08/24 14:45

Sample Name:

GC7-WRB-0.5-1

Lab Code:

Project:

K2410642-020

Total Metals

| | Analysis | | | | | | | Date | |
|---------------------|----------|--------|-------|------|------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 7.43 | mg/Kg | 0.43 | 0.05 | 5 | 10/22/24 12:09 | 10/10/24 | |

Analytical Report

Client: Terraphase Engineering Inc. Service Request: K2410642

Project:Upper Granite Creek Mines/0031.005.001Date Collected: NASample Matrix:SoilDate Received: NA

Sample Name: Method Blank Basis: Dry

Lab Code: KQ2416652-01

Total Metals – IVBA Analysis

| | Analysis | | | | | | | Date | |
|--------------|----------|---------|-------|------|-------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | ND U | mg/Kg | 0.5 | 0.06 | 5 | 10/22/24 15:43 | 10/17/24 | |
| Lead | 6020B | 0.043 J | mg/Kg | 0.05 | 0.020 | 5 | 10/22/24 15:43 | 10/17/24 | |

Analytical Report

Client: Terraphase Engineering Inc. Service Request: K2410642

Project:Upper Granite Creek Mines/0031.005.001Date Collected: NASample Matrix:SoilDate Received: NA

Sample Name: Method Blank Basis: Dry

Lab Code: KQ2416789-01

IVBA Metals

| | Analysis | | | | | | | Date | |
|--------------|----------|--------|-------|------|-------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | ND U | mg/Kg | 0.5 | 0.06 | 5 | 10/17/24 10:57 | 10/16/24 | |
| Lead | 6020B | ND U | mg/Kg | 0.05 | 0.020 | 5 | 10/17/24 10:57 | 10/16/24 | |

Printed 10/22/2024 8:04:36 PM Superset Reference:

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Analytical Report

Client: Terraphase Engineering Inc. Service Request: K2410642

Project:Upper Granite Creek Mines/0031.005.001Date Collected: NASample Matrix:SoilDate Received: NA

Sample Name: Method Blank Basis: Dry

Lab Code: KQ2416391-03

Total Metals

| | Analysis | | | | | | | Date | |
|--------------|----------|--------|-------|------|-------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 0.07 J | mg/Kg | 0.5 | 0.06 | 5 | 10/22/24 11:05 | 10/10/24 | |
| Lead | 6020B | ND U | mg/Kg | 0.05 | 0.020 | 5 | 10/22/24 11:05 | 10/10/24 | |

Analytical Report

Client: Terraphase Engineering Inc. Service Request: K2410642

Project:Upper Granite Creek Mines/0031.005.001Date Collected: NASample Matrix:SoilDate Received: NA

Sample Name: Method Blank Basis: Dry

Lab Code: KQ2416426-03

Total Metals

| | Analysis | | | | | | | Date | |
|---------------------|----------|--------|-------|------|-------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Mercurv | 7471B | ND U | mg/Kg | 0.02 | 0.002 | 1 | 10/15/24 09:02 | 10/14/24 | |

ALS Group USA, Corp.

dba ALS Environmental

QA/QC Report

Client: Terraphase Engineering Inc. Service Request: K2410642

Project Upper Granite Creek Mines/0031.005.001 Date Collected: 10/02/24

Sample Matrix: Soil **Date Received:** 10/08/24

Date Analyzed: 10/22/24

Replicate Sample Summary Total Metals – IVBA Analysis

Sample Name: UMM-TLA-0.5-6 Units: mg/Kg Lab Code: K2410642-005

Basis: Dry

Duplicate Sample **Analysis** Sample KQ2416652-03 Method **Analyte Name MRL MDL** Result Result Average RPD **RPD Limit** Arsenic 6020B 5.0 0.6 5560 6460 6010 15 20 Lead 6020B0.50 0.20 1110 1280 1200 14 20

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

ALS Group USA, Corp.

dba ALS Environmental

QA/QC Report

Client: Terraphase Engineering Inc. **Service Request:** K2410642

Project Upper Granite Creek Mines/0031.005.001 **Date Collected:** 10/02/24

Soil **Sample Matrix:**

Lab Code:

Date Received: 10/08/24

Date Analyzed: 10/17/24

Replicate Sample Summary

IVBA Metals

Sample Name: UMM-TLA-0.5-6 Units: mg/Kg

Basis: Dry

K2410642-005

Duplicate

| | Analysis | | | Sample | Sample KQ2416789-04 | | | |
|--------------|----------|------|------|--------|------------------------|---------|-----|------------------|
| Analyte Name | Method | MRL | MDL | Result | Result | Average | RPD | RPD Limit |
| Arsenic | 6020B | 2.0 | 0.2 | 1350 | 1360 | 1360 | <1 | 20 |
| Lead | 6020B | 0.20 | 0.08 | 69.2 | 72.3 | 70.8 | 4 | 20 |

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

Printed 10/22/2024 8:04:36 PM Superset Reference:

ALS Group USA, Corp.

dba ALS Environmental

QA/QC Report

Client: Terraphase Engineering Inc.

Project

Upper Granite Creek Mines/0031.005.001 **Date Collected:** 10/02/24

Soil **Date Received:** 10/08/24 **Sample Matrix:**

Date Analyzed: 10/22/24

Service Request: K2410642

Replicate Sample Summary

Total Metals

Sample Name: UMM-TLB-0.5-1 Units: mg/Kg Lab Code: K2410642-001

Basis: Dry

| | | | | | Duplicate | | | |
|--------------|-----------|--------|------|--------|--------------|----------|-----|---------------|
| | | | | | Sample | | | |
| | Analysis | | | Sample | KQ2416391-01 | | | |
| Analyte Name | Method | MRL | MDL | Result | Result | Average | RPD | RPD Limit |
| | 112001100 | 171141 | MIDE | resure | Result | mittinge | MD | 111 2 2111111 |
| Arsenic | 6020B | 11 | 1 | 6130 | 7400 | 6770 | 19 | 20 |

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

Printed 10/22/2024 8:04:38 PM Superset Reference:

QA/QC Report

Client: Terraphase Engineering Inc. **Project:**

Upper Granite Creek Mines/0031.005.001

Sample Matrix: Soil

Service Request: Date Collected:

K2410642

10/02/24

Date Received: Date Analyzed: 10/08/24 10/22/24

Date Extracted:

10/17/24

Matrix Spike Summary

Total Metals – IVBA Analysis

Sample Name:

UMM-TLA-0.5-6

Lab Code: K2410642-005

Analysis Method: Prep Method:

6020B

EPA 3050B

Units: Basis: mg/Kg

Dry

Matrix Spike

KQ2416652-04

| Analyte Name | Sample Result | Result | Spike Amount | % Rec | % Rec Limits |
|--------------|---------------|--------|--------------|-------|--------------|
| Arsenic | 5560 | 5980 | 97.0 | 435 # | 75-125 |
| Lead | 1110 | 1250 | 97.0 | 145 # | 75-125 |

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

Matrix Spike and Matrix Spike Duplicate Data is presented for information purposes only. The matrix may or may not be relevant to samples reported in this report. The laboratory evaluates system performance based on the LCS and LCSD control limits.

Printed 10/22/2024 8:04:36 PM Superset Reference:

QA/QC Report

Client: Terraphase Engineering Inc.

Service Request:

K2410642

Project:

Upper Granite Creek Mines/0031.005.001

Date Collected:

10/02/24

Sample Matrix: Soil

1 1

Date Received: Date Analyzed: 10/08/24

Date Extracted:

10/22/24 10/10/24

Matrix Spike Summary

Total Metals

Sample Name: UMM-TLB-0.5-1

Units: Basis:

mg/Kg Dry

Lab Code: Analysis Method: K2410642-001

Prep Method:

6020B

EPA 3050B

Matrix Spike

KQ2416391-02

| Analyte Name | Sample Result | Result | Spike Amount | % Rec | % Rec Limits |
|--------------|---------------|--------|--------------|--------|--------------|
| Arsenic | 6130 | 5760 | 11 | -3268# | 75-125 |
| Lead | 1710 | 1750 | 5.6 | 557 # | 75-125 |

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

Matrix Spike and Matrix Spike Duplicate Data is presented for information purposes only. The matrix may or may not be relevant to samples reported in this report. The laboratory evaluates system performance based on the LCS and LCSD control limits.

Printed 10/22/2024 8:04:38 PM Superset Reference:

QA/QC Report

Client: Terraphase Engineering Inc.

Project: Upper Granite Creek Mines/0031.005.001 Date Analyzed: 10/22/24

Sample Matrix: Soil

Lab Control Sample Summary Total Metals – IVBA Analysis

> Units:mg/Kg Basis:Dry

Service Request: K2410642

Lab Control Sample

KQ2416652-02

| Analyte Name | Analytical Method | Result | Spike Amount | % Rec | % Rec Limits |
|--------------|--------------------------|--------|--------------|-------|--------------|
| Arsenic | 6020B | 108 | 100 | 108 | 80-120 |
| Lead | 6020B | 111 | 100 | 111 | 80-120 |

Printed 10/22/2024 8:04:36 PM Superset Reference:

QA/QC Report

Client: Terraphase Engineering Inc.

Service Request: K2410642 **Project:** Upper Granite Creek Mines/0031.005.001 **Date Analyzed:** 10/17/24

Sample Matrix: Soil

> **Lab Control Sample Summary IVBA Metals**

> > Units:mg/Kg Basis:Dry

Lab Control Sample

KQ2416789-02

| Analyte Name | Analytical Method | Result | Spike Amount | % Rec | % Rec Limits |
|--------------|--------------------------|--------|--------------|-------|--------------|
| Arsenic | 6020B | 92.9 | 100 | 93 | 80-120 |
| Lead | 6020B | 105 | 100 | 105 | 80-120 |

Printed 10/22/2024 8:04:36 PM Superset Reference:

QA/QC Report

Client: Terraphase Engineering Inc.

Service Request: K2410642 **Project:** Upper Granite Creek Mines/0031.005.001 Date Analyzed: 10/22/24

Sample Matrix: Soil

> **Lab Control Sample Summary Total Metals**

> > Units:mg/Kg Basis:Dry

Lab Control Sample

KQ2416391-04

| Analyte Name | Analytical Method | Result | Spike Amount | % Rec | % Rec Limits |
|--------------|--------------------------|--------|--------------|-------|--------------|
| Arsenic | 6020B | 107 | 100 | 107 | 80-120 |
| Lead | 6020B | 113 | 100 | 113 | 80-120 |

Printed 10/22/2024 8:04:38 PM Superset Reference:

QA/QC Report

Client: Terraphase Engineering Inc.

Project: Upper Granite Creek Mines/0031.005.001 Date Analyzed: 10/15/24

Sample Matrix: Soil

Lab Control Sample Summary Total Metals

Units:mg/Kg
Basis:Dry

Service Request: K2410642

Lab Control Sample KQ2416426-04

Analyte NameAnalytical MethodResultSpike Amount% Rec% Rec LimitsMercury7471B0.5200.50010480-120

Printed 10/22/2024 8:04:38 PM Superset Reference:

ALS Group USA, Corp.

dba ALS Environmental QA/QC Report

Client: Terraphase Engineering Inc. Service Request: K2410642

Project:Upper Granite Creek Mines/0031.005.001Date Collected:NALCS Matrix:SoilDate Received:NA

Date Extracted: 10/16/2024 **Date Analyzed:** 10/17/2024

Standard Reference Material (SRM) Summary

Bioaccessible Metals

Sample Name: Standard Reference Material Units: mg/Kg (ppm)

Basis: Dry

Test Notes: Montana II Solids = 97.8%

KQ2416789-03

Lab Code:

Source: NIST 2711a - Montana II Soil

| Analyte | Prep Method | Analysis Method | True Value | Result | Percent Recovery | Control Limits (%) | Result Notes |
|---------|----------------|--------------------|---------------|--------|---------------------|-----------------------|-----------------|
| Lead | EPA 1340 | 6020B | 1300 | 1250 | 96 | 75.2 - 96.2 | |





Don Malkemus Terraphase Engineering Inc. 610 SW Broadway, Suite 405 Portland, OR 97205

Laboratory Results for: Upper Granite Creek Mines

Dear Don.

Enclosed are the results of the sample(s) submitted to our laboratory October 08, 2024 For your reference, these analyses have been assigned our service request number **K2410643**.

Analyses were performed according to our laboratory's NELAP-approved quality assurance program. The test results meet requirements of the current NELAP standards, where applicable, and except as noted in the laboratory case narrative provided. For a specific list of NELAP-accredited analytes, refer to the certifications section at www.alsglobal.com. All results are intended to be considered in their entirety, and ALS Group USA Corp. dba ALS Environmental (ALS) is not responsible for use of less than the complete report. Results apply only to the items submitted to the laboratory for analysis and individual items (samples) analyzed, as listed in the report.

Please contact me if you have any questions. My extension is 3376. You may also contact me via email at Mark.Harris@alsglobal.com.

Respectfully submitted,

noe D. Oak

ALS Group USA, Corp. dba ALS Environmental

Mark Harris

Project Manager



Narrative Documents

ALS Environmental—Kelso Laboratory 1317 South 13th Avenue, Kelso, WA 98626 Phone (360) 577-7222 Fax (360) 425-9096 www.alsglobal.com



Client: Terraphase Engineering Inc. Service Request: K2410643

Project: Upper Granite Creek Mines Date Received: 10/08/2024

Sample Matrix: Soil

CASE NARRATIVE

All analyses were performed consistent with the quality assurance program of ALS Environmental. This report contains analytical results for samples for the Tier II level requested by the client.

Sample Receipt:

Fourteen soil samples were received for analysis at ALS Environmental on 10/08/2024. Any discrepancies upon initial sample inspection are annotated on the sample receipt and preservation form included within this report. The samples were stored at minimum in accordance with the analytical method requirements.

Metals:

Method 6020B, 10/22/2024: The Relative Percent Difference (RPD) for the replicate analysis of Silver in sample TL-WRA-0.5-3 was outside the normal ALS control limits. The variability in the results was attributed to the heterogeneous character of the sample. Standard mixing techniques were used, but were not sufficient for complete homogenization of this sample.

Method 6020B, 10/22/2024: Antimony recoveries are generally low for soil and sediment samples when digested using EPA Method 3050B. Despite anticipated low recoveries, the method is still generally prescribed because of its versatility for general metals analysis. Antimony results (in conjunction with the matrix spike recovery) from this procedure should only be used as indicators to estimate concentrations. The matrix spike recovery of Antimony for sample TL-WRA-0.5-3 was below the ALS control criterion. Since low recoveries resulted from a method defect and were possibly magnified by certain matrix components, no corrective action was appropriate. Alternative procedures that specifically target Antimony are available but were not specified for this project. The associated QA/QC results (e.g. control sample, calibration standards, etc.) indicated the analysis was in control.

Method 6020B, 10/22/2024: The matrix spike recovery of Lead for sample TL-WRA-0.5-3 was outside control criteria. Recovery in the Laboratory Control Sample (LCS) was acceptable, which indicated the analytical batch was in control. No further corrective action was appropriate.

| | 1 (OE V. () Our | | | |
|-------------|-------------------|--------|------------|--|
| Approved by | | Date _ | 10/23/2024 | |

× -00000



| CLIENT ID: CS-SD-1 | | Lab | Lab ID: K2410643-006 | | | | | |
|---|---|-------------|--|--|--|---|--|--|
| Analyte | Results | Flag | MDL | MRL | Units | Method | | |
| Antimony | 0.26 | | 0.05 | 0.13 | mg/Kg | 6020B | | |
| Arsenic | 5.8 | | 0.2 | 1.3 | mg/Kg | 6020B | | |
| Cadmium | 0.234 | | 0.019 | 0.053 | mg/Kg | 6020B | | |
| Chromium | 7.81 | | 0.16 | 0.53 | mg/Kg | 6020B | | |
| Lead | 4.12 | | 0.05 | 0.13 | mg/Kg | 6020B | | |
| Mercury | 0.031 | J | 0.005 | 0.053 | mg/Kg | 7471B | | |
| Silver | 0.282 | | 0.011 | 0.053 | mg/Kg | 6020B | | |
| Solids, Total | 34.2 | | | | Percent | 160.3 Modified | | |
| Zinc | 45.0 | | 0.5 | 1.3 | mg/Kg | 6020B | | |
| CLIENT ID: CS-SD-2 | | Lab | ID: K2410 | 643-007 | | | | |
| Analyte | Results | Flag | MDL | MRL | Units | Method | | |
| Antimony | 0.038 | J | 0.022 | 0.054 | mg/Kg | 6020B | | |
| Arsenic | 4.52 | | 0.07 | 0.54 | mg/Kg | 6020B | | |
| Cadmium | 0.038 | | 0.008 | 0.022 | mg/Kg | 6020B | | |
| Chromium | 2.49 | | 0.07 | 0.22 | mg/Kg | 6020B | | |
| Lead | 0.927 | | 0.022 | 0.054 | mg/Kg | 6020B | | |
| Silver | 0.043 | | 0.004 | 0.022 | mg/Kg | 6020B | | |
| Solids, Total | 76.9 | | | | Percent | 160.3 Modified | | |
| Zinc | 16.9 | | 0.22 | 0.54 | mg/Kg | 6020B | | |
| | | | | | 0 0 | | | |
| CLIENT ID: CS-SD-3 | | | ID: K2410 | | | | | |
| | Results | Lab Flag | MDL | MRL | Units | Method | | |
| CLIENT ID: CS-SD-3 Analyte Antimony | Results 0.069 | | MDL 0.025 | MRL 0.063 | Units mg/Kg | 6020B | | |
| CLIENT ID: CS-SD-3 Analyte Antimony Arsenic | Results 0.069 11.7 | | MDL 0.025 0.08 | MRL 0.063 0.63 | Units mg/Kg mg/Kg | 6020B 6020B | | |
| CLIENT ID: CS-SD-3 Analyte Antimony Arsenic Cadmium | Results 0.069 11.7 0.062 | | MDL 0.025 0.08 0.009 | MRL 0.063 0.63 0.025 | Units mg/Kg mg/Kg mg/Kg | 6020B 6020B 6020B | | |
| CLIENT ID: CS-SD-3 Analyte Antimony Arsenic Cadmium Chromium | Results 0.069 11.7 0.062 4.90 | | MDL 0.025 0.08 0.009 0.08 | MRL 0.063 0.63 0.025 0.25 | Units mg/Kg mg/Kg mg/Kg mg/Kg | 6020B 6020B 6020B 6020B | | |
| CLIENT ID: CS-SD-3 Analyte Antimony Arsenic Cadmium Chromium Lead | Results 0.069 11.7 0.062 4.90 1.53 | | MDL 0.025 0.08 0.009 0.08 0.025 | MRL 0.063 0.63 0.025 0.25 0.063 | Units mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg | 6020B 6020B 6020B 6020B 6020B | | |
| Analyte Antimony Arsenic Cadmium Chromium Lead Mercury | Results 0.069 11.7 0.062 4.90 1.53 0.923 | | MDL 0.025 0.08 0.009 0.08 0.025 0.003 | MRL 0.063 0.63 0.025 0.25 0.063 0.027 | Units mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg | 6020B 6020B 6020B 6020B 6020B 7471B | | |
| Analyte Antimony Arsenic Cadmium Chromium Lead Mercury Silver | Results 0.069 11.7 0.062 4.90 1.53 0.923 0.112 | | MDL 0.025 0.08 0.009 0.08 0.025 | MRL 0.063 0.63 0.025 0.25 0.063 | Units mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg | 6020B 6020B 6020B 6020B 6020B 7471B 6020B | | |
| Analyte Antimony Arsenic Cadmium Chromium Lead Mercury Silver Solids, Total | Results 0.069 11.7 0.062 4.90 1.53 0.923 0.112 69.1 | | MDL 0.025 0.08 0.009 0.08 0.025 0.003 0.005 | MRL 0.063 0.63 0.025 0.25 0.063 0.027 0.025 | Units mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg | 6020B 6020B 6020B 6020B 6020B 7471B 6020B 160.3 Modified | | |
| Analyte Antimony Arsenic Cadmium Chromium Lead Mercury Silver | Results 0.069 11.7 0.062 4.90 1.53 0.923 0.112 | | MDL 0.025 0.08 0.009 0.08 0.025 0.003 | MRL 0.063 0.63 0.025 0.25 0.063 0.027 | Units mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg | 6020B 6020B 6020B 6020B 6020B 7471B 6020B | | |
| Analyte Antimony Arsenic Cadmium Chromium Lead Mercury Silver Solids, Total | Results 0.069 11.7 0.062 4.90 1.53 0.923 0.112 69.1 | Flag | MDL 0.025 0.08 0.009 0.08 0.025 0.003 0.005 | MRL 0.063 0.63 0.025 0.25 0.063 0.027 0.025 | Units mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg | 6020B 6020B 6020B 6020B 6020B 7471B 6020B 160.3 Modified | | |
| Analyte Antimony Arsenic Cadmium Chromium Lead Mercury Silver Solids, Total Zinc CLIENT ID: CS-SD-4 Analyte | Results 0.069 11.7 0.062 4.90 1.53 0.923 0.112 69.1 29.7 | Flag | MDL 0.025 0.08 0.009 0.08 0.025 0.003 0.005 0.25 0 ID: K2410 MDL | MRL 0.063 0.63 0.025 0.25 0.063 0.027 0.025 0.63 0.63 | Units mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg | 6020B 6020B 6020B 6020B 6020B 7471B 6020B 160.3 Modified 6020B | | |
| Analyte Antimony Arsenic Cadmium Chromium Lead Mercury Silver Solids, Total Zinc CLIENT ID: CS-SD-4 Analyte Antimony | Results 0.069 11.7 0.062 4.90 1.53 0.923 0.112 69.1 29.7 Results 0.892 | Flag | MDL 0.025 0.08 0.009 0.08 0.025 0.003 0.005 0.25 0 ID: K2410 MDL 0.023 | MRL 0.063 0.63 0.025 0.25 0.063 0.027 0.025 0.63 0643-009 MRL 0.058 | Units mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg | 6020B 6020B 6020B 6020B 6020B 7471B 6020B 160.3 Modified 6020B | | |
| Analyte Antimony Arsenic Cadmium Chromium Lead Mercury Silver Solids, Total Zinc CLIENT ID: CS-SD-4 Analyte Antimony Arsenic | Results 0.069 11.7 0.062 4.90 1.53 0.923 0.112 69.1 29.7 Results 0.892 32.7 | Flag | MDL 0.025 0.08 0.009 0.08 0.025 0.003 0.005 0.25 DID: K2410 MDL 0.023 0.07 | MRL 0.063 0.63 0.025 0.25 0.063 0.027 0.025 0.63 0.63 0.63 0.63 0.63 | Units mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg Mg/Kg Percent mg/Kg Units mg/Kg | 6020B 6020B 6020B 6020B 6020B 7471B 6020B 160.3 Modified 6020B Method 6020B | | |
| Analyte Antimony Arsenic Cadmium Chromium Lead Mercury Silver Solids, Total Zinc CLIENT ID: CS-SD-4 Analyte Antimony Arsenic Cadmium | Results 0.069 11.7 0.062 4.90 1.53 0.923 0.112 69.1 29.7 Results 0.892 32.7 1.09 | Flag | MDL 0.025 0.08 0.009 0.08 0.025 0.003 0.005 0.25 DID: K2410 MDL 0.023 0.07 0.008 | MRL 0.063 0.63 0.025 0.25 0.063 0.027 0.025 0.63 0643-009 MRL 0.058 0.58 0.023 | Units mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg Percent mg/Kg Units mg/Kg mg/Kg | 6020B 6020B 6020B 6020B 6020B 7471B 6020B 160.3 Modified 6020B Method 6020B 6020B | | |
| Analyte Antimony Arsenic Cadmium Chromium Lead Mercury Silver Solids, Total Zinc CLIENT ID: CS-SD-4 Analyte Antimony Arsenic | Results 0.069 11.7 0.062 4.90 1.53 0.923 0.112 69.1 29.7 Results 0.892 32.7 1.09 9.05 | Flag | MDL 0.025 0.08 0.009 0.08 0.025 0.003 0.005 0.25 DID: K2410 MDL 0.023 0.07 | MRL 0.063 0.63 0.025 0.025 0.063 0.027 0.025 0.63 0.63 0.63 0.58 0.58 0.023 0.23 | Units mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg Mg/Kg Percent mg/Kg Units mg/Kg | 6020B 6020B 6020B 6020B 6020B 7471B 6020B 160.3 Modified 6020B Method 6020B 6020B 6020B | | |
| Analyte Antimony Arsenic Cadmium Chromium Lead Mercury Silver Solids, Total Zinc CLIENT ID: CS-SD-4 Analyte Antimony Arsenic Cadmium Chromium Lead | Results 0.069 11.7 0.062 4.90 1.53 0.923 0.112 69.1 29.7 Results 0.892 32.7 1.09 9.05 25.6 | Flag | MDL 0.025 0.08 0.009 0.08 0.025 0.003 0.005 0.25 MDL 0.023 0.07 0.008 0.07 0.023 | MRL 0.063 0.63 0.025 0.25 0.063 0.027 0.025 0.63 0.63 0.058 0.058 0.023 0.058 | Units mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg Percent mg/Kg Units mg/Kg mg/Kg mg/Kg | 6020B 6020B 6020B 6020B 6020B 7471B 6020B 160.3 Modified 6020B Method 6020B 6020B 6020B 6020B 6020B | | |
| Analyte Antimony Arsenic Cadmium Chromium Lead Mercury Silver Solids, Total Zinc CLIENT ID: CS-SD-4 Analyte Antimony Arsenic Cadmium Chromium Chromium | Results 0.069 11.7 0.062 4.90 1.53 0.923 0.112 69.1 29.7 Results 0.892 32.7 1.09 9.05 | Flag | MDL 0.025 0.08 0.009 0.08 0.025 0.003 0.005 0.25 MDL 0.023 0.07 0.008 0.07 | MRL 0.063 0.63 0.025 0.025 0.063 0.027 0.025 0.63 0.63 0.63 0.58 0.58 0.023 0.23 | Units mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg Percent mg/Kg Units mg/Kg mg/Kg mg/Kg | 6020B 6020B 6020B 6020B 6020B 7471B 6020B 160.3 Modified 6020B Method 6020B 6020B 6020B | | |



| CLIENT ID: CS-SD-4 | | Lab | ID: K2410 | 643-009 | | |
|------------------------|---------|------|-----------|----------|---------|----------------|
| Analyte | Results | Flag | MDL | MRL | Units | Method |
| Solids, Total | 64.9 | | | | Percent | 160.3 Modified |
| Zinc | 47.2 | | 0.23 | 0.58 | mg/Kg | 6020B |
| CLIENT ID: CS-SD-5 | | Lab | ID: K2410 | 643-010 | | |
| Analyte | Results | Flag | MDL | MRL | Units | Method |
| Antimony | 0.146 | | 0.020 | 0.051 | mg/Kg | 6020B |
| Arsenic | 14.1 | | 0.06 | 0.51 | mg/Kg | 6020B |
| Cadmium | 0.169 | | 0.007 | 0.020 | mg/Kg | 6020B |
| Chromium | 5.03 | | 0.06 | 0.20 | mg/Kg | 6020B |
| Lead | 2.79 | | 0.020 | 0.051 | mg/Kg | 6020B |
| Mercury | 0.056 | | 0.002 | 0.025 | mg/Kg | 7471B |
| Silver | 0.582 | | 0.004 | 0.020 | mg/Kg | 6020B |
| Solids, Total | 71.1 | | | | Percent | 160.3 Modified |
| Zinc | 32.7 | | 0.20 | 0.51 | mg/Kg | 6020B |
| CLIENT ID: CS-SD-6 | | Lab | ID: K2410 | 643-011 | | |
| Analyte | Results | Flag | MDL | MRL | Units | Method |
| Antimony | 0.147 | | 0.018 | 0.045 | mg/Kg | 6020B |
| Arsenic | 16.6 | | 0.05 | 0.45 | mg/Kg | 6020B |
| Cadmium | 0.146 | | 0.006 | 0.018 | mg/Kg | 6020B |
| Chromium | 4.76 | | 0.05 | 0.18 | mg/Kg | 6020B |
| Lead | 2.74 | | 0.018 | 0.045 | mg/Kg | 6020B |
| Mercury | 0.033 | | 0.002 | 0.021 | mg/Kg | 7471B |
| Silver | 0.200 | | 0.004 | 0.018 | mg/Kg | 6020B |
| Solids, Total | 82.1 | | | | Percent | 160.3 Modified |
| Zinc | 37.1 | | 0.18 | 0.45 | mg/Kg | 6020B |
| LIENT ID: CS-SD-7 | | Lab | ID: K2410 | 643-012 | | |
| Analyte | Results | Flag | MDL | MRL | Units | Method |
| Antimony | 0.355 | | 0.019 | 0.048 | mg/Kg | 6020B |
| Arsenic | 24.2 | | 0.06 | 0.48 | mg/Kg | 6020B |
| Cadmium | 0.538 | | 0.007 | 0.019 | mg/Kg | 6020B |
| Chromium | 10.6 | | 0.06 | 0.19 | mg/Kg | 6020B |
| Lead | 12.1 | | 0.019 | 0.048 | mg/Kg | 6020B |
| Mercury | 0.097 | | 0.002 | 0.023 | mg/Kg | 7471B |
| Silver | 1.10 | | 0.004 | 0.019 | mg/Kg | 6020B |
| Solids, Total | 80.2 | | | | Percent | 160.3 Modified |
| Zinc | 168 | | 0.19 | 0.48 | mg/Kg | 6020B |
| CLIENT ID: CS-SD-7-DUP | | Lab | ID: K2410 | 0643-013 | | |
| Analyte | Results | Flag | MDL | MRL | Units | Method |
| Antimony | 0.334 | | 0.022 | 0.054 | mg/Kg | 6020B |



| CLIENT ID: CS-SD-7-DUP | | Lab | ID: K2410 | 643-013 |)13 | | | |
|-----------------------------|---------|------|-----------|---------|---------|----------------|--|--|
| Analyte | Results | Flag | MDL | MRL | Units | Method | | |
| Arsenic | 24.3 | | 0.06 | 0.54 | mg/Kg | 6020B | | |
| Cadmium | 0.446 | | 0.008 | 0.022 | mg/Kg | 6020B | | |
| Chromium | 9.10 | | 0.06 | 0.22 | mg/Kg | 6020B | | |
| Lead | 12.8 | | 0.022 | 0.054 | mg/Kg | 6020B | | |
| Mercury | 0.099 | | 0.002 | 0.024 | mg/Kg | 7471B | | |
| Silver | 1.62 | | 0.004 | 0.022 | mg/Kg | 6020B | | |
| Solids, Total | 73.2 | | | | Percent | 160.3 Modified | | |
| Zinc | 102 | | 0.22 | 0.54 | mg/Kg | 6020B | | |
| CLIENT ID: CS-SD-8 | | Lab | ID: K2410 | 643-014 | | | | |
| Analyte | Results | Flag | MDL | MRL | Units | Method | | |
| Antimony | 0.406 | | 0.023 | 0.058 | mg/Kg | 6020B | | |
| Arsenic | 35.2 | | 0.07 | 0.58 | mg/Kg | 6020B | | |
| Cadmium | 0.316 | | 0.008 | 0.023 | mg/Kg | 6020B | | |
| Chromium | 9.13 | | 0.07 | 0.23 | mg/Kg | 6020B | | |
| Lead | 10.7 | | 0.023 | 0.058 | mg/Kg | 6020B | | |
| Mercury | 0.096 | | 0.003 | 0.026 | mg/Kg | 7471B | | |
| Silver | 1.26 | | 0.005 | 0.023 | mg/Kg | 6020B | | |
| Solids, Total | 69.0 | | | | Percent | 160.3 Modified | | |
| Zinc | 103 | | 0.23 | 0.58 | mg/Kg | 6020B | | |
| CLIENT ID: TL-WRA-0.5-3 | | Lab | ID: K2410 | 643-001 | | | | |
| Analyte | Results | Flag | MDL | MRL | Units | Method | | |
| Arsenic | 454 | | 0.05 | 0.42 | mg/Kg | 6020B | | |
| Solids, Total | 95.0 | | | | Percent | 160.3 Modified | | |
| LIENT ID: TL-WRB-0.5-4 | | Lab | ID: K2410 | 643-002 | | | | |
| Analyte | Results | Flag | MDL | MRL | Units | Method | | |
| Arsenic | 194 | | 0.05 | 0.42 | mg/Kg | 6020B | | |
| Solids, Total | 95.5 | | | | Percent | 160.3 Modified | | |
| LIENT ID: TL-WRA-0.5-1-DS-2 | | Lab | ID: K2410 | 643-003 | | | | |
| Analyte | Results | Flag | MDL | MRL | Units | Method | | |
| Arsenic | 550 | | 0.6 | 4.9 | mg/Kg | 6020B | | |
| Arsenic | 14.4 | | 0.2 | 1.9 | mg/Kg | 6020B | | |
| Arsenic | 267 | | 0.05 | 0.44 | mg/Kg | 6020B | | |
| Lead | 218 | | 0.19 | 0.49 | mg/Kg | 6020B | | |
| Lead | 83.3 | | 0.08 | 0.19 | mg/Kg | 6020B | | |
| Solids, Total | 93.4 | | | | Percent | 160.3 Modified | | |
| CLIENT ID: SH-WRB-0.5-2 | | Lab | ID: K2410 | 643-004 | | | | |
| Analyte | Results | Flag | MDL | MRL | Units | Method | | |
| Arsenic | 80.8 | | 0.05 | 0.39 | mg/Kg | 6020B | | |



| CLIENT ID: SH-WRB-0.5-2 | | Lab | ID: K2410 | 643-004 | | |
|-------------------------|---------|------|-----------|---------|---------|----------------|
| Analyte | Results | Flag | MDL | MRL | Units | Method |
| Solids, Total | 94.1 | | | | Percent | 160.3 Modified |
| CLIENT ID: SH-WRC-0.5-1 | | Lab | ID: K2410 | 643-005 | | |
| Analyte | Results | Flag | MDL | MRL | Units | Method |
| | | | | | | |
| Arsenic | 14.4 | | 0.05 | 0.44 | mg/Kg | 6020B |



Sample Receipt Information

ALS Environmental—Kelso Laboratory 1317 South 13th Avenue, Kelso, WA 98626 Phone (360) 577-7222 Fax (360) 425-9096 www.alsglobal.com Client: Terraphase Engineering Inc. Service Request: K2410643

Project: Upper Granite Creek Mines/0031.005.001

SAMPLE CROSS-REFERENCE

| SAMPLE # | CLIENT SAMPLE ID | <u>DATE</u> | <u>TIME</u> |
|--------------|-------------------|-------------|-------------|
| K2410643-001 | TL-WRA-0.5-3 | 10/4/2024 | 1405 |
| K2410643-002 | TL-WRB-0.5-4 | 10/4/2024 | 1425 |
| K2410643-003 | TL-WRA-0.5-1-DS-2 | 10/4/2024 | 1400 |
| K2410643-004 | SH-WRB-0.5-2 | 10/4/2024 | 1005 |
| K2410643-005 | SH-WRC-0.5-1 | 10/4/2024 | 1015 |
| K2410643-006 | CS-SD-1 | 10/5/2024 | 1006 |
| K2410643-007 | CS-SD-2 | 10/3/2024 | 1505 |
| K2410643-008 | CS-SD-3 | 10/3/2024 | 0900 |
| K2410643-009 | CS-SD-4 | 10/3/2024 | 1424 |
| K2410643-010 | CS-SD-5 | 10/4/2024 | 0930 |
| K2410643-011 | CS-SD-6 | 10/4/2024 | 1521 |
| K2410643-012 | CS-SD-7 | 10/4/2024 | 1335 |
| K2410643-013 | CS-SD-7-DUP | 10/4/2024 | 1340 |
| K2410643-014 | CS-SD-8 | 10/5/2024 | 1030 |

140510

CHAIN OF CUSTODY

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| SR# |
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| COC Set 6 of 8 |
| COC# |

1317 South 13th Ave, Keisa, WA 98626 Phone (360) 577-7222 / 800-695-7222 / FAX (360) 636-1068

| (ALS) tissues | | | | | | | | 101001 | | | | | obal.co | | | | 2116 | ~~ (300) u | XX-1000 | | | | | Page 1 d |
|---|-------------|---------------------------------------|---------------------|----------|------------|--------------|------------------|--------------|--------------|------------------|------------------|----------------------|----------------------|------|------|------|---------|------------|----------------|-----------|---------|----------------|---------------|------------|
| Project Name Upper Granit Creek Min | Project N | | 31.005.001 | | <u> </u> | 9 | 707 | | 80D | | | 0666 | | | | | | | | 7 | | | | - |
| roject Manager Dan Millemy | S | | | | 1 | | 7 | <u> </u> | <u> </u> | | | 8 | igspace | | | | _ | | | | | | _ | |
| Company Terinihari Engin | eer'n Inc | | | | ERS | | | (E | ĺ | | | Calc | | | ļ | | | | | j | | | 200 | |
| Address, City, State Glo Sty Orange | | 105 | | | CONTAINERS | | | d Total) | ļ " | | | | | | | ĺ | | | | | | 7 | 1001/2 | |
| hone # (503) 943-0394 | email) | on, my Ken | and Okligha | k-Com | | | | (Sieved | Extract | يرا | 9 | ardu | | | ĺ | 1 |] | | | | 7 | γ_{I_O} | w 47 | |
| ampler Signature | | Printed Name | | | 9 | 늘 | 우 | VBA (| MA MA | leta i | Sprin | HH | | | - 1 | 1 | ļ | | | | 1/ | J | | |
| M | Don | Malkem | | _ | NUMBER | 7470A / Hg T | 74718 / Hg | 3020B / IVBA | 5020B / IVBA | 5020B / Metals T | Grind / GrindSub | SM 2340 B / Hardness | | | _ | Ā | ۵ | Re | narks | | * | | 63/3 | |
| CLIENT SAMPLE ID | LABID | Date T | /PLING ime State | Matrix | | | | | - | | | | | | | | | | | | | | • | |
| .GCS - WRA -0.5-4-03 | · | | S22 | 50:1 | 2 | | | × | * | | <u> </u> | | | | | | | + pal | | _ | | | , | |
| GCG - WHA - 0.5 - 2 | | 10/4 14 | | Seil | 2 | <u> </u> | | × | N. | * | | | | _ | _ | | | + 647 | | | | | | |
| 1.GCG - WH -0.5-1 | | <u> </u> | ६५९ | soil | 2 | | | | | 7 | <u> </u> | | | | | | \perp | | | _ | | | | |
| 1.GC7 - WHA - 0.5-3 | | | 1150 | suil | 2 | | | | <u> </u> | × | <u> </u> | | | |] | | | | | | | | | |
| i.GC7 - WRB -0.5-1 | | | MZ | Soil | 2. | | | | | ٦ | <u> </u> | | | | _ | | | | | _ | | | | |
| i. T L - VRA - 0.5 - 3 | \ | · · · · · · · · · · · · · · · · · · · | 1415 | 50.1 | 2 | <u></u> | | | <u> </u> | × | <u> </u> | <u> </u> | | | | | | | | _ | | | | • |
| : 9L-6123-05-4 | 7 | lely | ।५२५ | Sail | 2 | | | | | 1 | _ | | | | | | | | | _ | | | | |
| : TL-WPA-0.5-1-05-2 | 3 | 1014 | 1400 | 5.11 | 2 | | | * | 7 | 7 | <u> </u> | | | | | | | + 649 | | | | | | |
| SH-WKB-05-3 | Ч | 1.4 | 1005 | 1:02 | 2 | | | | | x | _ | | | |] | | _ | | | | | | | |
| 0.8H-WR(- 0.5-1 | 9 | 1014 | lois | 1:02 | 2 | | | | <u> </u> | × | L. | | | | | | | | | <u> </u> | | | | |
| Report Requirements | | oice Inf | ormation | Ī | | | | | | | | | | | | C | ircle v | which meta | is are to be a | nalvzed | | | | |
| I. Routine Report: Method Blank, Surrogate, as | P.O.# | · madei | MANIX-GOV | √ | | | Total | Met | ais: A | AI 6 | s G | Sb E | 3a B | э В | Са | Cd (| Co (| Cr Cu I | e Pb Mg | Mn Mo | Ni K Ag | Na Se | Sr Ti Sn V | / Zn Ho |
| required | 511110 | <u> </u> | | | | 0 | | | | | | | | | | | | | | | | | Se Sr Ti Sn | |
| II. Report Dup., MS, MSD as required | | | | _ | pecia | | | | | | | 30 | - Da | DÇ. | | | | | | | | | thwest Other | |
| III. CLP Like Summary (no raw data) | 2 | ound Ro | equireme 48 hr. | nts | pecia | 111121 | IUCLI | Ulian | CON | II I ICI | ns. | | | | Link | ncau | 3 316 | ate riyul | ocarbon r | rocedure. | AN CA | VVI NOI | triwest Other | (Circle On |
| IV. Data Validation Report | X s | itandard | | | | | | | | | | | | | | - | | | | | | | | |
| V. EDD | | | <u></u> | | | | | | | | | | | | | Ţ, | | | | | | | | |
| Relinquished By: | | Requested Re Receive | | | Re | ling | uish | ned | By: | | 7 | | \overline{a} | Rece | eive | d By | - | | R | elinquisi | ned By: | 1 | Rec | eived By: |
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| ignature | Signature | 01 | | | ature | 2 | 1 | <u> </u> | | | 5 | igna | ture LOO ed Na | ا نه | 2 | lo | BL. | n | Signature | | | | Signature | |
| | | | | | ted N | | | فه | Bi | دركم | <u>J</u> | 419 | ed Na | me | , | | | | Printed N | ame | | | Printed Name | |
| im TEI | | <u> </u> | | Firm | 40 | _S | | | | | | 10) jun | 812 | 24 | _1 | 44 | 5 | | Firm | | | | Firm | |
|)ate/Time | Date/Tim | e/0/08 | 124 130 | Date | /Time | e/0/ | × ₆ / | 24 | | 194 | | Date/ | Time | | | | | | Date/Tim | 3 | | | Date/Time | |
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140510

CHAIN OF CUSTODY

| 01, 002, 003 | SR# |
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| | COC Set 🛕 of 🛕 |
| | COC# |

1317 South 13th Ave, Kelso, WA 98626 Phone (360) 577-7222 / 800-695-7222 / FAX (360) 636-1068

| (ALS) Employe | | | | | | | | | | www.a | alsglo | bal.co | m | | | | | , | | | | | | F | Page 1 of | 1 |
|--|--|------------------------|----------|--------------|------------|------------|---------------------|---------------------|-----------------|------------------|----------------------|-------------------|----------|-----------------|----------|---------------|----------------|-----------|--------|----------|---------|--------|--------------|---------------------------------------|--------------|---|
| Project Name (reck Mine) | Project N | umber: 0031-0+5.001 | | | 6 | } | | 180D | | C | 2000 | | | | | | | | |] | | | 7 | | | |
| Project Manager Don Mal Kumvi | | | |] | | i i | | <u> </u> | | 5 | <u> </u> | <u> </u> | T | —-г | | | | | | | | | 122. | | | |
| Company Termphile Gyineering | Inc. | | | CONTAINERS | | | Total) | l | | | Calc | | | ı | | l | | | | ļ | | | 2 | | | |
| Address, City, State Glo SW Brailwy | Suite 40 | | | Į Į | | | | <u>ت</u> | | | | | | | | | | | | | | | 10 | ı | | |
| Phone # (5%) 448 0384 | email | ··Malkinis Gleccalposs | ·COM | 8 | | | (Siev | Extra | Ŀ \$ | gng | -tardn | | | | İ | | | | | | _ | 1/10 | 00 | | | |
| Sampler Signature | | Printed Name | | # # H | 큠 | ₽ | ₹ | ₹ | Meta | Srind | 186 | | | 1 | 1 | Ì | | | | | (I) | JU" | | | | |
| 111 | Don | , MIKMU | | NUMBER | 7470A / Hg | 7471B / Hg | 020B / IVBA (Sieved | 020B / IVBA Extract | 020B / Metals T | Prind / GrindSub | 3M 2340 B / Hardness | | | | | l | C | Remarl | ko | | Ψ | | 0630 | | | |
| | | SAMPLING | Matrix | | × | - 4 | 8 | 8 | Ж. | Ö | ίδ | - | 73 | | 7 | <u> </u> | Г | Ceman | 7.5 | | | | | | | |
| CLIENT SAMPLE ID | LABID | Date Time State | ! | <u> </u> | | | | | | | | | | | | | | | | | | | | | | |
| 1. (5-50-1 | <u>6</u> | 10/5 1006 | Soil | 2 | | X | \dashv | | X | | | | | | _ | _ | | | | | | | | | | |
| 2. CS - SO-2 | | 1013 1505 | Soil | 2 | | × | | _ | 7 | | | | _ | _ | ļ | _ | | | | | | | | | | |
| 3. CS - SO -3 | <u> </u> | 10 3 0900 | 1518 | 13 | | × | | | X | | | | | } | _ | \dashv | | | · | | | | | | | |
| 4. C3-50 - 4 | 9 | 1013 1424 | ١٠٠٨ | 2 | \vdash | শ | | | X | | | \sqcup | | | \dashv | _ | | | | | | | | | | |
| 5. Cs -50 - 5 | 10 | 1014 0130 | Seil | 2 | - | X | | | x | | | | | _ | | _ | | | | | | | | | | |
| 6. C S-SD-6 | | 104 1521 | 1305 | 5 | 1 | x | | _ | x | | | | | | _ | | | | | | | | | | | |
| 7. Cs - S D - 7 | 12 | 10 4 1335 | 51:1 | 12 | | X | | | X | | | | | _ | _ | _ | | | | | | | | | | |
| 8. CS - SD - 7 - DUP | 13 | 10 4 1340 | 5021 | 2 | 1 | X | - | | X | | | | _ | _ | - | | | | | | | | | | | |
| 9. 5 - 50 - 8 | 14 | 10/5 1030 | Seil | 12 | | _ | | \dashv | X | | | \longrightarrow | | _ | _ | | | | | | | | | | | |
| 10. | · In | oice Information | | <u> </u> | لبا | | | | | L | | | 1 | L | | | | | | <u> </u> | | | | | | 7 |
| Report Requirements 1. Routine Report: Method | P.O.#_ | Oice miorination | | | | | | | | | _ | | | | | | | etals are | | | | | | | | ĺ |
| Blank, Surrogate, as required | Bill To | ep Q'timpuse. | 34M | | | Total | Meta | is: A | 1 6 | 9(S | 9 B | a Be | 8 | Ca (| <u>ල</u> | co ((| ည္ င | Fe (P | gM (g | Mn Mo | Ni K | Ag) Na | Se Sr Tl Sr | 1 N (5) (| tg) | ĺ |
| 1. Report Dup., MS, MSD | | and the second | <u> </u> | | Di | ssolv | ed M | etais: | A! | As | Sb | Ва | Ве | B Ca | Cd | Co | Cr | Cu Fe | Pb M | g Mn M | 10 Ni K | K Ag N | a Se Sr Ti | Sn V Zn | Hg | |
| as required | Turna | round Requireme | ents S | Specia | l Inst | uctio | ons/C | Comr | men | ts: | | | | *Inc | licate | e Sta | ate Hy | /drocarl | on Pr | ocedure | : AK C | A WI | Northwest Ot | her | (Circle One) |] |
| III. CLP Like Summary (no raw data) | | 24 hr48 hr. | | | | | | | | | | | | | | | | | | | | | | | | |
| IV. Data Validation Report | 】 | 5 Day Standard | 1 | | | | | | | | | | | | | | | | | | | | | | | |
| V. EDD | | Requested Report Date | | | | | | | | | | | | | , | | | | | | | | | | | |
| Relinquished By: | | Received By: | | Re | linq | ıish | ed l | Зу: | | Τ. | | F | Repe | | | / : | | T | Rel | inquisl | hed By | y: | Į ,F | Received | By: | ㅓ |
| | | A | | -6 | | _ | } | | | 1/2 | \subseteq | K | <u> </u> | R | ئے | <u> </u> | | <u> </u> | | | | | <u> </u> | | | _ |
| Signature | Signature | A.X | Sign | ature | 7 | 4 | ~ | | | Ž | ignat V <i>Ci</i> | ture OSV | 6 | 201 | -00 | B | e i | Signa | ature | | | | Signature | | | |
| Printed Name A (GMY) | Printed N | lame la Bill | | ed Na | | 1 | aBî | ch | <u> </u> | 4 | rinte | o Na | | }- - | | | عب البياد ا | Print | ed Nar | ne | | * | Printed Na | me | | 1 |
| Firm TEI | Firm | .5 | Firm | AL | 2 | , | | | | Æ | ım - | 181 | 21 | 11 | 4 | 15 | , | Firm | | | | | Firm | · · · · · · · · · · · · · · · · · · · | <u> </u> | 1 |
| Date/Time 1 | Date/Tim | e10]08 24 130 | Date | /Time | 10/0 | 8/2 | 24 | 149 | 15 | | | Time | | | | | | Date | /Time | | | | Date/Time | | | |

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| Toomy | Cooler Receipt a | nd Preser | vation F | orm | | | |
|---|---------------------------|--------------------|---------------|----------------------------------|-------------------|-----------|---|
| Client Client | 1016/100 | | | Request K24 | | a F | <u> </u> |
| Received: 1018124 Opened: | 1018124 | Ву: | Uni | loaded: / O | 8129By:_ | | |
| 1. Samples were received via? USPS | Fed Ex UP | S Di | HL I | PDX (E6 | urier Hand Del | ivered | |
| 2. Samples were received in: (circle) | ler Box | Envelope | O | (her | | NA. | |
| 3. Were <u>custody seals</u> on coolers? | A Y (N) If | es, how man | y and where | ? | | - | |
| If present, were custody seals intact? | Y N If | oresent, were | they signed | and dated? | Y | N | |
| | Cooler#/COC ID / NA | Out of indicate | | PM Notified If out of temp | Tracking Numb | er NA | Filed |
| 9.6 4.6 -1801 | 140510 | | | | | | |
| 168 5.7 | · | | | | | | |
| (e.0 44 | | | | | | | |
| 9.4 4.5 | | | | | | | |
| 18.3 4.5 | | | | | | | |
| 4. Was a Temperature Blank present in cooler? N | A (Y) N If | yes, notate the | temperatur | e in the appropri | ate column above: | | |
| If no, take the temperature of a representative | sample bottle contained | within the co | oler, notate | in the column "S | ample Temp": |) | |
| 5. Were samples received within the method speci | fied temperature ranges | ? | | | NA (Y | N | |
| If no, were they received on ice and same day a | s collected? If not, nota | ite the cooler | # above and | notify the PM. | (NA) Y | N | |
| If applicable, tissue samples were received: Fr | ozen Partially Than | ved Thawe | d | | | | |
| 6. Packing material: Inserts Baggies Bubl | ole Wrap Gel Packs | Wet Ice D | ry Ice Sle | eves | | | |
| 7. Were custody papers properly filled out (ink, s | igned, etc.)? | | | | NA CY | N | |
| 8. Were samples received in good condition (unb | • | | | | NA SX. | N | |
| 9. Were all sample labels complete (ie, analysis, | • | | | | NA Y | , N | |
| 10. Did all sample labels and tags agree with custo11. Were appropriate bottles/containers and volum | | . idied0 | | | NA Y NA Y | , N N | |
| 12. Were the pH-preserved bottles (see SMO GEN | | | D Indicate | in the table helm | | N N | |
| 13. Were VOA vials received without headspace? | | | i maicale i | in the table betor | NA Y | N | |
| 14. Was C12/Res negative? | matcase in the table be | etow. | | | | N | |
| 15. Were samples received within the method spe- | nified time limit? If not | matata tha ar | ear halanı or | nd notify the DM | NA Y | N | |
| 16. Were 100ml sterile microbiology bottles filled | · | | } | N | | Overfille | A |
| 16. Were foom sterne microbiology bottles fined | exactly to the 100mi m | iark? (N | 4 J | IN | Ondermied | Overifine | u |
| Sample ID on Bottle | Sample II | on COC | | | Identified by: | · | |
| | | | | | | | |
| | | <u></u> | | | | | |
| | <u>L</u> | | | | | | |
| | | <u> </u> | | | | , | _,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,, |
| Sample ID | | ead- pace Broke | pH Re | Volun eagent adde | | initiais | Time |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| Notes, Discrepancies, Resolutions: | _ | | 1 | | | ! | |
| G:\SMO\2024 Forms | SC | DP: SMO-G | EN | | Reviewed: | NP 1/3 | /2024 |

174 of 283



Cooler Receipt and Preservation Form

| Temp Blank | Sample Temp | IR Gun | Cooler #/C | OC ID / | NA . | Out Indica | of tem ate with | Х. | PM Notifie If out of t | | Tracking Nur | nber NA | File |
|-------------------------------|-------------------------|------------|--------------|-------------|---------|---------------|--------------------|-----|------------------------------|-----------------|--------------|----------|------|
| 12.2 | 3. \$ 5.5 | 1801 | | | | | | | | | | | |
| | | | | | | | | | | | | 7 | |
| San | nple ID on Bottle | | | Sample | ID on C | :oc | | 210 | | id ld | entified by: | | |
| 1941 | | | | | | | | | | | | | |
| | Sample ID | | ottle Count | Out of Temp | Head- | Broke | рН | | Reagent | Volume added | Reagent Lot | Initials | Time |
| | | | | | | | | _ | | | | | |
| | | | | | | | | | | | | | |
| stes, Discrep Sum India | pancies & Resolution Te | utions: 10 | blan blan | as a Ne (| it is | HOP 3 L | of nd | er | coolers · He | sylv Sylv | n topo | Not | |
| | | | | | | | | | | | | | |
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G:\SMO\2024 Forms

SOP: SMO-GEN

Reviewed: NP 1/3/2024

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Miscellaneous Forms

ALS Environmental—Kelso Laboratory 1317 South 13th Avenue, Kelso, WA 98626 Phone (360) 577-7222 Fax (360) 425-9096 www.alsglobal.com

Inorganic Data Qualifiers

- * The result is an outlier. See case narrative.
- # The control limit criteria is not applicable.
- B The analyte was found in the associated method blank at a level that is significant relative to the sample result as defined by the DOD or NELAC standards.
- F. The result is an estimate amount because the value exceeded the instrument calibration range.
- I The result is an estimated value
- U The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL.
 DOD-QSM 4.2 definition: Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
- i The MRL/MDL or LOQ/LOD is elevated due to a matrix interference.
- X See case narrative.
- Q See case narrative. One or more quality control criteria was outside the limits.
- H The holding time for this test is immediately following sample collection. The samples were analyzed as soon as possible after receipt by the laboratory.

Metals Data Qualifiers

- # The control limit criteria is not applicable.
- J The result is an estimated value.
- E The percent difference for the serial dilution was greater than 10%, indicating a possible matrix interference in the sample.
- M The duplicate injection precision was not met.
- N The Matrix Spike sample recovery is not within control limits. See case narrative.
- S The reported value was determined by the Method of Standard Additions (MSA).
- U The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL. DOD-QSM 4.2 definition: Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
- W The post-digestion spike for furnace AA analysis is out of control limits, while sample absorbance is less than 50% of spike absorbance.
- i The MRL/MDL or LOQ/LOD is elevated due to a matrix interference.
- X See case narrative.
- + The correlation coefficient for the MSA is less than 0.995.
- Q See case narrative. One or more quality control criteria was outside the limits.

Organic Data Qualifiers

- * The result is an outlier. See case narrative.
- # The control limit criteria is not applicable. See case narrative.
- A A tentatively identified compound, a suspected aldol-condensation product.
- B The analyte was found in the associated method blank at a level that is significant relative to the sample result as defined by the DOD or NELAC standards.
- C The analyte was qualitatively confirmed using GC/MS techniques, pattern recognition, or by comparing to historical data.
- D The reported result is from a dilution.
- E The result is an estimated value over the calibration range.
- J The result is an estimated value between the MDL and the MRL.
- $N \quad \text{ The result is presumptive. The analyte was tentatively identified, but \ a confirmation analysis was not performed.} \\$
- P The GC or HPLC confirmation criteria was exceeded. The relative percent difference is greater than 40% between the two analytical results.
- U The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL.
 DOD-QSM 4.2 definition: Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
- i The MRL/MDL or LOQ/LOD is elevated due to a chromatographic interference.
- X See case narrative.
- Q See case narrative. One or more quality control criteria was outside the limits.

Additional Petroleum Hydrocarbon Specific Qualifiers

- L The chromatographic fingerprint of the sample resembles a petroleum product, but the elution pattern indicates the presence of a greater amount of lighter molecular weight constituents than the calibration standard.
- H The chromatographic fingerprint of the sample resembles a petroleum product, but the elution pattern indicates the presence of a greater amount of heavier molecular weight constituents than the calibration standard.
- O The chromatographic fingerprint of the sample resembles an oil, but does not match the calibration standard.
- Y The chromatographic fingerprint of the sample resembles a petroleum product eluting in approximately the correct carbon range, but the elution pattern does not match the calibration standard.
- Z The chromatographic fingerprint does not resemble a petroleum product.

ALS Group USA Corp. dba ALS Environmental (ALS) - Kelso State Certifications, Accreditations, and Licenses

| Agency | Web Site | Number |
|--------------------------|---|-------------|
| Alaska DEH | http://dec.alaska.gov/eh/lab/cs/csapproval.htm | UST-040 |
| Arizona DHS | http://www.azdhs.gov/lab/license/env.htm | AZ0339 |
| Arkansas - DEQ | http://www.adeq.state.ar.us/techsvs/labcert.htm | 88-0637 |
| California DHS (ELAP) | http://www.cdph.ca.gov/certlic/labs/Pages/ELAP.aspx | 2795 |
| DOD ELAP | http://www.denix.osd.mil/edqw/Accreditation/AccreditedLabs.cfm | L16-58-R4 |
| Florida DOH | http://www.doh.state.fl.us/lab/EnvLabCert/WaterCert.htm | E87412 |
| Hawaii DOH | http://health.hawaii.gov/ | - |
| ISO 17025 | http://www.pjlabs.com/ | L16-57 |
| Louisiana DEQ | http://www.deq.louisiana.gov/page/la-lab-accreditation | 03016 |
| Maine DHS | http://www.maine.gov/dhhs/ | WA01276 |
| Minnesota DOH | http://www.health.state.mn.us/accreditation | 053-999-457 |
| Nevada DEP | http://ndep.nv.gov/bsdw/labservice.htm | WA01276 |
| New Jersey DEP | http://www.nj.gov/dep/enforcement/oqa.html | WA005 |
| New York - DOH | https://www.wadsworth.org/regulatory/elap | 12060 |
| | https://deq.nc.gov/about/divisions/water-resources/water-resources-data/water-sciences-home-page/laboratory-certification-branch/non-field-lab- | |
| North Carolina DEQ | certification | 605 |
| Oklahoma DEQ | http://www.deq.state.ok.us/CSDnew/labcert.htm | 9801 |
| Oregon – DEQ (NELAP) | http://public.health.oregon.gov/LaboratoryServices/EnvironmentalLaboratoryAccreditation/Pages/index.aspx | WA100010 |
| South Carolina DHEC | http://www.scdhec.gov/environment/EnvironmentalLabCertification/ | 61002 |
| Texas CEQ | http://www.tceq.texas.gov/field/qa/env_lab_accreditation.html | T104704427 |
| Washington DOE | http://www.ecy.wa.gov/programs/eap/labs/lab-accreditation.html | C544 |
| Wyoming (EPA Region 8) | https://www.epa.gov/region8-waterops/epa-region-8-certified-drinking-water- | - |
| Kelso Laboratory Website | www.alsglobal.com | NA |

Analyses were performed according to our laboratory's NELAP-approved quality assurance program. A complete listing of specific NELAP-certified analytes, can be found in the certification section at www.ALSGlobal.com or at the accreditation bodies web site.

Please refer to the certification and/or accreditation body's web site if samples are submitted for compliance purposes. The states highlighted above, require the analysis be listed on the state certification if used for compliance purposes and if the method/anlayte is offered by that state.

Acronyms

ASTM American Society for Testing and Materials

A2LA American Association for Laboratory Accreditation

CARB California Air Resources Board

CAS Number Chemical Abstract Service registry Number

CFC Chlorofluorocarbon
CFU Colony-Forming Unit

DEC Department of Environmental Conservation

DEQ Department of Environmental Quality

DHS Department of Health Services

DOE Department of Ecology
DOH Department of Health

EPA U. S. Environmental Protection Agency

ELAP Environmental Laboratory Accreditation Program

GC Gas Chromatography

GC/MS Gas Chromatography/Mass Spectrometry

LOD Limit of Detection
LOQ Limit of Quantitation

LUFT Leaking Underground Fuel Tank

M Modified

MCL Maximum Contaminant Level is the highest permissible concentration of a substance

allowed in drinking water as established by the USEPA.

MDL Method Detection Limit
MPN Most Probable Number
MRL Method Reporting Limit

NA Not Applicable
NC Not Calculated

NCASI National Council of the Paper Industry for Air and Stream Improvement

ND Not Detected

NIOSH National Institute for Occupational Safety and Health

PQL Practical Quantitation Limit

RCRA Resource Conservation and Recovery Act

SIM Selected Ion Monitoring

TPH Total Petroleum Hydrocarbons

tr Trace level is the concentration of an analyte that is less than the PQL but greater than or

equal to the MDL.

Analyst Summary report

Client: Terraphase Engineering Inc.

Project: Upper Granite Creek Mines/0031.005.001

Date Collected: 10/4/24

Date Received: 10/8/24

Service Request: K2410643

Sample Name: TL-WRA-0.5-3 **Lab Code:** K2410643-001

Sample Matrix: Soil

Analysis Method

Extracted/Digested By Analyzed By

160.3 Modified ZBIBI

6020B KLAWSON JCHAN

Sample Name: TL-WRB-0.5-4 Date Collected: 10/4/24

Lab Code: K2410643-002 **Date Received:** 10/8/24

Sample Matrix: Soil

Analysis Method Extracted/Digested By Analyzed By

160.3 Modified ZBIBI

6020B KLAWSON JCHAN

Sample Name: TL-WRA-0.5-1-DS-2 Date Collected: 10/4/24

Lab Code: K2410643-003 **Date Received:** 10/8/24

Sample Matrix: Soil

Analysis Method Extracted/Digested By Analyzed By

160.3 Modified ZBIBI

6020B KLAWSON JCHAN
6020B MSOLADEY JCHAN

Sample Name: SH-WRB-0.5-2 Date Collected: 10/4/24

Lab Code: K2410643-004 Date Received: 10/8/24 Sample Matrix: Soil

Analysis Method Extracted/Digested By Analyzed By

160.3 Modified ZBIBI

6020B KLAWSON JCHAN

Analyst Summary report

Service Request: K2410643

Client: Terraphase Engineering Inc.

Project: Upper Granite Creek Mines/0031.005.001

 Sample Name:
 SH-WRC-0.5-1
 Date Collected:
 10/4/24

 Lab Code:
 K2410643-005
 Date Received:
 10/8/24

Sample Matrix: Soil

Analysis Method Extracted/Digested By Analyzed By

160.3 Modified ZBIBI

6020B KLAWSON JCHAN

Sample Name: CS-SD-1 Date Collected: 10/5/24

Lab Code: K2410643-006 **Date Received:** 10/8/24

Sample Matrix: Soil

Analysis Method Extracted/Digested By Analyzed By

160.3 Modified ZBIBI

6020B KLAWSON JCHAN 7471B KLINN KLINN

Sample Name: CS-SD-2 Date Collected: 10/3/24

Lab Code: K2410643-007 **Date Received:** 10/8/24

Sample Matrix: Soil

Analysis Method Extracted/Digested By Analyzed By

160.3 Modified ZBIBI

6020B KLAWSON JCHAN 7471B KLINN KLINN

Sample Name: CS-SD-3 Date Collected: 10/3/24

Lab Code: K2410643-008 **Date Received:** 10/8/24

Sample Matrix: Soil

Analysis Method Extracted/Digested By Analyzed By

160.3 Modified ZBIBI

6020B KLAWSON JCHAN 7471B KLINN KLINN

Printed 10/23/2024 5:16:32 PM Superset Reference:24-0000711615 rev 00

Analyst Summary report

Service Request: K2410643

Analyzed By

Client: Terraphase Engineering Inc.

Project: Upper Granite Creek Mines/0031.005.001

Sample Name: CS-SD-4 Date Collected: 10/3/24

Lab Code: K2410643-009 **Date Received:** 10/8/24

Sample Matrix: Soil

Analysis Method

Analysis Method Extracted/Digested By Analyzed By

160.3 Modified ZBIBI

6020B KLAWSON JCHAN 7471B KLINN KLINN

Sample Name: CS-SD-5 Date Collected: 10/4/24

Lab Code: K2410643-010 **Date Received:** 10/8/24

Sample Matrix: Soil

Analysis Method Extracted/Digested By Analyzed By

160.3 Modified ZBIBI

6020B KLAWSON JCHAN 7471B KLINN KLINN

Sample Name: CS-SD-6 Date Collected: 10/4/24

Lab Code:K2410643-011Date Received:10/8/24Sample Matrix:Soil

Extracted/Digested By

160.3 Modified ZBIBI

6020B KLAWSON JCHAN 7471B KLINN KLINN

Sample Name: CS-SD-7 Date Collected: 10/4/24

Lab Code: K2410643-012 **Date Received:** 10/8/24

Sample Matrix: Soil

Analysis Method Extracted/Digested By Analyzed By

160.3 Modified ZBIBI

6020B KLAWSON JCHAN 7471B KLINN KLINN

Printed 10/23/2024 5:16:33 PM Superset Reference:24-0000711615 rev 00

Analyst Summary report

Client: Terraphase Engineering Inc. Service Request: K2410643

Project: Upper Granite Creek Mines/0031.005.001

 Sample Name:
 CS-SD-7-DUP
 Date Collected:
 10/4/24

 Lab Code:
 K2410643-013
 Date Received:
 10/8/24

Sample Matrix: Soil

Analysis Method Extracted/Digested By Analyzed By

160.3 Modified ZBIBI

6020B KLAWSON JCHAN 7471B KLINN KLINN

Sample Name: CS-SD-8 Date Collected: 10/5/24

Lab Code: K2410643-014 Date Received: 10/8/24 Sample Matrix: Soil

Analysis Method Extracted/Digested By Analyzed By

160.3 Modified ZBIBI

6020B KLAWSON JCHAN 7471B KLINN KLINN



Sample Results

ALS Environmental—Kelso Laboratory 1317 South 13th Avenue, Kelso, WA 98626 Phone (360) 577-7222 Fax (360) 425-9096 www.alsglobal.com



Metals

ALS Environmental—Kelso Laboratory 1317 South 13th Avenue, Kelso, WA 98626 Phone (360) 577-7222 Fax (360) 425-9096 www.alsglobal.com

Analytical Report

Client: Terraphase Engineering Inc.

Upper Granite Creek Mines/0031.005.001

Date Collected: 10/04/24 14:05

Service Request: K2410643

Sample Matrix:

Project:

Soil

Date Received: 10/08/24 11:45

Sample Name: TL-WRA-0.5-3 Basis: Dry

Lab Code: K2410643-001

Total Metals

| | Analysis | | | | | | | Date | |
|---------------------|----------|--------|-------|------|------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 454 | mg/Kg | 0.42 | 0.05 | 5 | 10/22/24 13:49 | 10/14/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Project:

Service Request: K2410643 **Date Collected:** 10/04/24 14:25 Upper Granite Creek Mines/0031.005.001

Date Received: 10/08/24 11:45 **Sample Matrix:** Soil

Sample Name: TL-WRB-0.5-4 Basis: Dry

Lab Code: K2410643-002

Total Metals

| | Analysis | | | | | | | Date | |
|---------------------|----------|--------|-------|------|------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 194 | mg/Kg | 0.42 | 0.05 | 5 | 10/22/24 13:58 | 10/14/24 | |

Analytical Report

Terraphase Engineering Inc. **Client:**

Project:

Service Request: K2410643 **Date Collected:** 10/04/24 14:00 Upper Granite Creek Mines/0031.005.001

Date Received: 10/08/24 11:45 **Sample Matrix:** Soil

TL-WRA-0.5-1-DS-2 **Sample Name:** Basis: Dry

Lab Code: K2410643-003

Total Metals – IVBA Analysis

| | Analysis | | | | | | | Date | |
|--------------|----------|--------|-------|------|------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 550 | mg/Kg | 4.9 | 0.6 | 50 | 10/22/24 16:11 | 10/17/24 | |
| Lead | 6020B | 218 | mg/Kg | 0.49 | 0.19 | 50 | 10/22/24 16:11 | 10/17/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Project:

Service Request: K2410643 **Date Collected:** 10/04/24 14:00 Upper Granite Creek Mines/0031.005.001

Date Received: 10/08/24 11:45 **Sample Matrix:** Soil

Sample Name: TL-WRA-0.5-1-DS-2 Basis: Dry

Lab Code: K2410643-003

IVBA Metals

| | Analysis | | | | | | | Date | |
|--------------|----------|--------|-------|------|------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 14.4 | mg/Kg | 1.9 | 0.2 | 20 | 10/17/24 11:50 | 10/16/24 | |
| Lead | 6020B | 83.3 | mg/Kg | 0.19 | 0.08 | 20 | 10/17/24 11:50 | 10/16/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Project:

Service Request: K2410643 **Date Collected:** 10/04/24 14:00 Upper Granite Creek Mines/0031.005.001

Date Received: 10/08/24 11:45 **Sample Matrix:** Soil

TL-WRA-0.5-1-DS-2 **Sample Name:** Basis: Dry

Lab Code: K2410643-003

| | Analysis | | | | | | | Date | |
|---------------------|----------|--------|-------|------|------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 267 | mg/Kg | 0.44 | 0.05 | 5 | 10/22/24 14:00 | 10/14/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Upper Granite Creek Mines/0031.005.001

Service Request: K2410643 **Date Collected:** 10/04/24 10:05

Sample Matrix: Soil

opper Grame Creek Willies, 0031.003.00

Date Received: 10/08/24 11:45

Sample Name:

SH-WRB-0.5-2

Lab Code:

Project:

K2410643-004

Basis: Dry

| | Analysis | | | | | | | Date | |
|---------------------|----------|--------|-------|------|------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 80.8 | mg/Kg | 0.39 | 0.05 | 5 | 10/22/24 14:02 | 10/14/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Upper Granite Creek Mines/0031.005.001

Sample Matrix:

Soil

SH-WRC-0.5-1

Sample Name: Lab Code:

Project:

K2410643-005

Service Request: K2410643

Date Collected: 10/04/24 10:15

Date Received: 10/08/24 11:45

Basis: Dry

| | Analysis | | | | | | | Date | |
|---------------------|----------|--------|-------|------|------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 14.4 | mg/Kg | 0.44 | 0.05 | 5 | 10/22/24 14:08 | 10/14/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Service Request: K2410643 **Date Collected:** 10/05/24 10:06 **Project:** Upper Granite Creek Mines/0031.005.001

Date Received: 10/08/24 11:45 **Sample Matrix:** Soil

Sample Name: CS-SD-1 Basis: Dry

Lab Code: K2410643-006

| | Analysis | | | | | | | Date | |
|--------------|----------|---------|-------|-------|-------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Antimony | 6020B | 0.26 | mg/Kg | 0.13 | 0.05 | 5 | 10/22/24 14:10 | 10/14/24 | |
| Arsenic | 6020B | 5.8 | mg/Kg | 1.3 | 0.2 | 5 | 10/22/24 14:10 | 10/14/24 | |
| Cadmium | 6020B | 0.234 | mg/Kg | 0.053 | 0.019 | 5 | 10/22/24 14:10 | 10/14/24 | |
| Chromium | 6020B | 7.81 | mg/Kg | 0.53 | 0.16 | 5 | 10/22/24 14:10 | 10/14/24 | |
| Lead | 6020B | 4.12 | mg/Kg | 0.13 | 0.05 | 5 | 10/22/24 14:10 | 10/14/24 | |
| Mercury | 7471B | 0.031 J | mg/Kg | 0.053 | 0.005 | 1 | 10/15/24 12:21 | 10/14/24 | |
| Silver | 6020B | 0.282 | mg/Kg | 0.053 | 0.011 | 5 | 10/22/24 14:10 | 10/14/24 | |
| Zinc | 6020B | 45.0 | mg/Kg | 1.3 | 0.5 | 5 | 10/22/24 14:10 | 10/14/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Service Request: K2410643 **Date Collected:** 10/03/24 15:05 Upper Granite Creek Mines/0031.005.001

Date Received: 10/08/24 11:45 **Sample Matrix:** Soil

Sample Name: CS-SD-2 Basis: Dry

Lab Code: K2410643-007

Project:

| | Analysis | | | | | | | Date | |
|--------------|----------|---------|-------|-------|-------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Antimony | 6020B | 0.038 J | mg/Kg | 0.054 | 0.022 | 5 | 10/22/24 14:12 | 10/14/24 | |
| Arsenic | 6020B | 4.52 | mg/Kg | 0.54 | 0.07 | 5 | 10/22/24 14:12 | 10/14/24 | |
| Cadmium | 6020B | 0.038 | mg/Kg | 0.022 | 0.008 | 5 | 10/22/24 14:12 | 10/14/24 | |
| Chromium | 6020B | 2.49 | mg/Kg | 0.22 | 0.07 | 5 | 10/22/24 14:12 | 10/14/24 | |
| Lead | 6020B | 0.927 | mg/Kg | 0.054 | 0.022 | 5 | 10/22/24 14:12 | 10/14/24 | |
| Mercury | 7471B | ND U | mg/Kg | 0.024 | 0.002 | 1 | 10/15/24 12:22 | 10/14/24 | |
| Silver | 6020B | 0.043 | mg/Kg | 0.022 | 0.004 | 5 | 10/22/24 14:12 | 10/14/24 | |
| Zinc | 6020B | 16.9 | mg/Kg | 0.54 | 0.22 | 5 | 10/22/24 14:12 | 10/14/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Service Request: K2410643 **Date Collected:** 10/03/24 09:00 **Project:** Upper Granite Creek Mines/0031.005.001

Date Received: 10/08/24 11:45 **Sample Matrix:** Soil

Sample Name: CS-SD-3 Basis: Dry

Lab Code: K2410643-008

| | Analysis | | | | | | | Date | |
|--------------|----------|--------|-------|-------|-------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Antimony | 6020B | 0.069 | mg/Kg | 0.063 | 0.025 | 5 | 10/22/24 14:14 | 10/14/24 | |
| Arsenic | 6020B | 11.7 | mg/Kg | 0.63 | 0.08 | 5 | 10/22/24 14:14 | 10/14/24 | |
| Cadmium | 6020B | 0.062 | mg/Kg | 0.025 | 0.009 | 5 | 10/22/24 14:14 | 10/14/24 | |
| Chromium | 6020B | 4.90 | mg/Kg | 0.25 | 0.08 | 5 | 10/22/24 14:14 | 10/14/24 | |
| Lead | 6020B | 1.53 | mg/Kg | 0.063 | 0.025 | 5 | 10/22/24 14:14 | 10/14/24 | |
| Mercury | 7471B | 0.923 | mg/Kg | 0.027 | 0.003 | 1 | 10/15/24 12:24 | 10/14/24 | |
| Silver | 6020B | 0.112 | mg/Kg | 0.025 | 0.005 | 5 | 10/22/24 14:14 | 10/14/24 | |
| Zinc | 6020B | 29.7 | mg/Kg | 0.63 | 0.25 | 5 | 10/22/24 14:14 | 10/14/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Service Request: K2410643 **Date Collected:** 10/03/24 14:24 **Project:** Upper Granite Creek Mines/0031.005.001

Date Received: 10/08/24 11:45 **Sample Matrix:** Soil

Sample Name: CS-SD-4 Basis: Dry

Lab Code: K2410643-009

| | Analysis | | | | | | | Date | |
|--------------|----------|---------|-------|-------|-------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Antimony | 6020B | 0.892 | mg/Kg | 0.058 | 0.023 | 5 | 10/22/24 14:16 | 10/14/24 | |
| Arsenic | 6020B | 32.7 | mg/Kg | 0.58 | 0.07 | 5 | 10/22/24 14:16 | 10/14/24 | |
| Cadmium | 6020B | 1.09 | mg/Kg | 0.023 | 0.008 | 5 | 10/22/24 14:16 | 10/14/24 | |
| Chromium | 6020B | 9.05 | mg/Kg | 0.23 | 0.07 | 5 | 10/22/24 14:16 | 10/14/24 | |
| Lead | 6020B | 25.6 | mg/Kg | 0.058 | 0.023 | 5 | 10/22/24 14:16 | 10/14/24 | |
| Mercury | 7471B | 0.011 J | mg/Kg | 0.029 | 0.003 | 1 | 10/15/24 12:26 | 10/14/24 | |
| Silver | 6020B | 0.961 | mg/Kg | 0.023 | 0.005 | 5 | 10/22/24 14:16 | 10/14/24 | |
| Zinc | 6020B | 47.2 | mg/Kg | 0.58 | 0.23 | 5 | 10/22/24 14:16 | 10/14/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Service Request: K2410643 **Date Collected:** 10/04/24 09:30 **Project:** Upper Granite Creek Mines/0031.005.001

Date Received: 10/08/24 11:45 **Sample Matrix:** Soil

Sample Name: CS-SD-5 Basis: Dry

Lab Code: K2410643-010

| | Analysis | | | | | | | Date | |
|--------------|----------|--------|-------|-------|-------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Antimony | 6020B | 0.146 | mg/Kg | 0.051 | 0.020 | 5 | 10/22/24 14:18 | 10/14/24 | |
| Arsenic | 6020B | 14.1 | mg/Kg | 0.51 | 0.06 | 5 | 10/22/24 14:18 | 10/14/24 | |
| Cadmium | 6020B | 0.169 | mg/Kg | 0.020 | 0.007 | 5 | 10/22/24 14:18 | 10/14/24 | |
| Chromium | 6020B | 5.03 | mg/Kg | 0.20 | 0.06 | 5 | 10/22/24 14:18 | 10/14/24 | |
| Lead | 6020B | 2.79 | mg/Kg | 0.051 | 0.020 | 5 | 10/22/24 14:18 | 10/14/24 | |
| Mercury | 7471B | 0.056 | mg/Kg | 0.025 | 0.002 | 1 | 10/15/24 12:27 | 10/14/24 | |
| Silver | 6020B | 0.582 | mg/Kg | 0.020 | 0.004 | 5 | 10/22/24 14:18 | 10/14/24 | |
| Zinc | 6020B | 32.7 | mg/Kg | 0.51 | 0.20 | 5 | 10/22/24 14:18 | 10/14/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Service Request: K2410643 **Date Collected:** 10/04/24 15:21 **Project:** Upper Granite Creek Mines/0031.005.001

Date Received: 10/08/24 11:45 **Sample Matrix:** Soil

Sample Name: CS-SD-6 Basis: Dry

Lab Code: K2410643-011

| | Analysis | | | | | | | Date | |
|--------------|----------|--------|-------|-------|-------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Antimony | 6020B | 0.147 | mg/Kg | 0.045 | 0.018 | 5 | 10/22/24 14:20 | 10/14/24 | |
| Arsenic | 6020B | 16.6 | mg/Kg | 0.45 | 0.05 | 5 | 10/22/24 14:20 | 10/14/24 | |
| Cadmium | 6020B | 0.146 | mg/Kg | 0.018 | 0.006 | 5 | 10/22/24 14:20 | 10/14/24 | |
| Chromium | 6020B | 4.76 | mg/Kg | 0.18 | 0.05 | 5 | 10/22/24 14:20 | 10/14/24 | |
| Lead | 6020B | 2.74 | mg/Kg | 0.045 | 0.018 | 5 | 10/22/24 14:20 | 10/14/24 | |
| Mercury | 7471B | 0.033 | mg/Kg | 0.021 | 0.002 | 1 | 10/15/24 12:29 | 10/14/24 | |
| Silver | 6020B | 0.200 | mg/Kg | 0.018 | 0.004 | 5 | 10/22/24 14:20 | 10/14/24 | |
| Zinc | 6020B | 37.1 | mg/Kg | 0.45 | 0.18 | 5 | 10/22/24 14:20 | 10/14/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Service Request: K2410643 **Date Collected:** 10/04/24 13:35 **Project:** Upper Granite Creek Mines/0031.005.001

Date Received: 10/08/24 11:45 **Sample Matrix:** Soil

Sample Name: CS-SD-7 Basis: Dry

Lab Code: K2410643-012

| | Analysis | | | | | | | Date | |
|--------------|----------|--------|-------|-------|-------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Antimony | 6020B | 0.355 | mg/Kg | 0.048 | 0.019 | 5 | 10/22/24 14:21 | 10/14/24 | |
| Arsenic | 6020B | 24.2 | mg/Kg | 0.48 | 0.06 | 5 | 10/22/24 14:21 | 10/14/24 | |
| Cadmium | 6020B | 0.538 | mg/Kg | 0.019 | 0.007 | 5 | 10/22/24 14:21 | 10/14/24 | |
| Chromium | 6020B | 10.6 | mg/Kg | 0.19 | 0.06 | 5 | 10/22/24 14:21 | 10/14/24 | |
| Lead | 6020B | 12.1 | mg/Kg | 0.048 | 0.019 | 5 | 10/22/24 14:21 | 10/14/24 | |
| Mercury | 7471B | 0.097 | mg/Kg | 0.023 | 0.002 | 1 | 10/15/24 12:30 | 10/14/24 | |
| Silver | 6020B | 1.10 | mg/Kg | 0.019 | 0.004 | 5 | 10/22/24 14:21 | 10/14/24 | |
| Zinc | 6020B | 168 | mg/Kg | 0.48 | 0.19 | 5 | 10/22/24 14:21 | 10/14/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Service Request: K2410643 **Date Collected:** 10/04/24 13:40 **Project:** Upper Granite Creek Mines/0031.005.001

Date Received: 10/08/24 11:45 **Sample Matrix:** Soil

Sample Name: CS-SD-7-DUP Basis: Dry

Lab Code: K2410643-013

| | Analysis | | | | | | | Date | |
|--------------|----------|--------|-------|-------|-------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Antimony | 6020B | 0.334 | mg/Kg | 0.054 | 0.022 | 5 | 10/22/24 14:23 | 10/14/24 | |
| Arsenic | 6020B | 24.3 | mg/Kg | 0.54 | 0.06 | 5 | 10/22/24 14:23 | 10/14/24 | |
| Cadmium | 6020B | 0.446 | mg/Kg | 0.022 | 0.008 | 5 | 10/22/24 14:23 | 10/14/24 | |
| Chromium | 6020B | 9.10 | mg/Kg | 0.22 | 0.06 | 5 | 10/22/24 14:23 | 10/14/24 | |
| Lead | 6020B | 12.8 | mg/Kg | 0.054 | 0.022 | 5 | 10/22/24 14:23 | 10/14/24 | |
| Mercury | 7471B | 0.099 | mg/Kg | 0.024 | 0.002 | 1 | 10/15/24 12:35 | 10/14/24 | |
| Silver | 6020B | 1.62 | mg/Kg | 0.022 | 0.004 | 5 | 10/22/24 14:23 | 10/14/24 | |
| Zinc | 6020B | 102 | mg/Kg | 0.54 | 0.22 | 5 | 10/22/24 14:23 | 10/14/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Service Request: K2410643 **Date Collected:** 10/05/24 10:30 **Project:** Upper Granite Creek Mines/0031.005.001

Date Received: 10/08/24 11:45 **Sample Matrix:** Soil

Sample Name: CS-SD-8 Basis: Dry

Lab Code: K2410643-014

| | Analysis | | | | | | | Date | |
|--------------|----------|--------|-------|-------|-------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Antimony | 6020B | 0.406 | mg/Kg | 0.058 | 0.023 | 5 | 10/22/24 14:25 | 10/14/24 | |
| Arsenic | 6020B | 35.2 | mg/Kg | 0.58 | 0.07 | 5 | 10/22/24 14:25 | 10/14/24 | |
| Cadmium | 6020B | 0.316 | mg/Kg | 0.023 | 0.008 | 5 | 10/22/24 14:25 | 10/14/24 | |
| Chromium | 6020B | 9.13 | mg/Kg | 0.23 | 0.07 | 5 | 10/22/24 14:25 | 10/14/24 | |
| Lead | 6020B | 10.7 | mg/Kg | 0.058 | 0.023 | 5 | 10/22/24 14:25 | 10/14/24 | |
| Mercury | 7471B | 0.096 | mg/Kg | 0.026 | 0.003 | 1 | 10/15/24 12:37 | 10/14/24 | |
| Silver | 6020B | 1.26 | mg/Kg | 0.023 | 0.005 | 5 | 10/22/24 14:25 | 10/14/24 | |
| Zinc | 6020B | 103 | mg/Kg | 0.58 | 0.23 | 5 | 10/22/24 14:25 | 10/14/24 | |



General Chemistry

ALS Environmental—Kelso Laboratory 1317 South 13th Avenue, Kelso, WA 98626 Phone (360) 577-7222 Fax (360) 425-9096 www.alsglobal.com

Analytical Report

Client: Terraphase Engineering Inc.

Project:

Service Request: K2410643 **Date Collected:** 10/04/24 14:05 Upper Granite Creek Mines/0031.005.001

Sample Matrix: Soil **Date Received:** 10/08/24 11:45

TL-WRA-0.5-3 **Sample Name:** Basis: As Received

Lab Code: K2410643-001

Inorganic Parameters

Analyte Name Analysis Method Result MRL Dil. **Date Analyzed** Q Units 95.0 Solids, Total 160.3 Modified Percent 10/10/24 15:28

Analytical Report

Client: Terraphase Engineering Inc.

Project:

Service Request: K2410643 **Date Collected:** 10/04/24 14:25 Upper Granite Creek Mines/0031.005.001

Sample Matrix: Soil **Date Received:** 10/08/24 11:45

TL-WRB-0.5-4 **Sample Name:** Basis: As Received

Lab Code: K2410643-002

Inorganic Parameters

Analyte Name Analysis Method Result MRL Dil. **Date Analyzed** Q Units 95.5 Solids, Total 160.3 Modified Percent 10/10/24 15:28

Analytical Report

Terraphase Engineering Inc. **Client:**

K2410643-003

Service Request: K2410643 **Date Collected:** 10/04/24 14:00 Upper Granite Creek Mines/0031.005.001

Sample Matrix: Soil

Project:

Lab Code:

Date Received: 10/08/24 11:45

TL-WRA-0.5-1-DS-2 **Sample Name:**

Basis: As Received

| Analyte Name | Analysis Method | Result | Units | MRL | Dil. | Date Analyzed | Q |
|---------------------|------------------------|--------|---------|-----|------|----------------|----------|
| Solids Total | 160 3 Modified | 93.4 | Percent | _ | 1 | 10/10/24 15:28 | <u>.</u> |

Analytical Report

Client: Terraphase Engineering Inc.

Project:

Upper Granite Creek Mines/0031.005.001 **Date Collected:** 10/04/24 10:05

Sample Matrix: Soil Date Received: 10/08/24 11:45

Sample Name: SH-WRB-0.5-2 Basis: As Received

Lab Code: K2410643-004

Inorganic Parameters

Analyte NameAnalysis MethodResultUnitsMRLDil.Date AnalyzedQSolids, Total160.3 Modified94.1Percent-110/10/24 15:28

Service Request: K2410643

Analytical Report

Client: Terraphase Engineering Inc.

> **Date Collected:** 10/04/24 10:15 Upper Granite Creek Mines/0031.005.001

Soil **Date Received:** 10/08/24 11:45

Sample Matrix:

Project:

SH-WRC-0.5-1 **Sample Name:** Basis: As Received

Lab Code: K2410643-005

Inorganic Parameters

Analyte Name Analysis Method Result MRL Dil. **Date Analyzed** Q Units 92.3 Solids, Total 160.3 Modified Percent 10/10/24 15:28

Service Request: K2410643

Analytical Report

Client: Terraphase Engineering Inc.

Service Request: K2410643 **Date Collected:** 10/05/24 10:06 Upper Granite Creek Mines/0031.005.001

Date Received: 10/08/24 11:45 **Sample Matrix:** Soil

Sample Name: CS-SD-1 Basis: As Received

Lab Code: K2410643-006

Project:

| Analyte Name | Analysis Method | Result | Units | MRL | Dil. | Date Analyzed | Q |
|---------------|-----------------|--------|---------|-----|------|----------------|---|
| Solids, Total | 160.3 Modified | 34.2 | Percent | - | 1 | 10/10/24 15:28 | |

Analytical Report

Client: Terraphase Engineering Inc.

Project:

Service Request: K2410643 **Date Collected:** 10/03/24 15:05 Upper Granite Creek Mines/0031.005.001

Date Received: 10/08/24 11:45 **Sample Matrix:** Soil

CS-SD-2 **Sample Name:** Basis: As Received

Lab Code: K2410643-007

| Analyte Name | Analysis Method | Result | Units | MRL | Dil. | Date Analyzed | Q |
|---------------|------------------------|--------|---------|-----|------|----------------|---|
| Solids, Total | 160.3 Modified | 76.9 | Percent | - | 1 | 10/10/24 15:28 | |

Analytical Report

Client: Terraphase Engineering Inc.

Upper Granite Creek Mines/0031.005.001

Date Collected: 10/03/24 09:00 **Date Received:** 10/08/24 11:45

Sample Matrix:

Soil

Basis: As Received

Service Request: K2410643

Sample Name:

Project:

CS-SD-3

Lab Code: K2410643-008

| Analyte Name | Analysis Method | Result | Units | MRL | Dil. | Date Analyzed | Q |
|---------------|-----------------|--------|---------|-----|------|----------------|---|
| Solids, Total | 160.3 Modified | 69.1 | Percent | - | 1 | 10/10/24 15:28 | |

Analytical Report

Client: Terraphase Engineering Inc.

Terraphase Engineering Inc. Service Request: K2410643

Project: Upper Granite Creek Mines/0031.005.001 Date Collected: 10/03/24 14:24

Sample Matrix: Soil Date Received: 10/08/24 11:45

Sample Name: CS-SD-4 Basis: As Received

Lab Code: K2410643-009

| Analyte Name | Analysis Method | Result | Units | MRL | Dil. | Date Analyzed | Q |
|---------------|-----------------|--------|---------|-----|------|----------------|---|
| Solids, Total | 160.3 Modified | 64.9 | Percent | - | 1 | 10/10/24 15:28 | |

Analytical Report

Client: Terraphase Engineering Inc.

Project:

Upper Granite Creek Mines/0031.005.001 **Date Collected:** 10/04/24 09:30

Sample Matrix: Soil Date Received: 10/08/24 11:45

Sample Name: CS-SD-5 Basis: As Received

Lab Code: K2410643-010

Inorganic Parameters

| Analyte Name | Analysis Method | Result | Units | MRL | Dil. | Date Analyzed | Q |
|---------------|------------------------|--------|---------|-----|------|----------------|---|
| Solids, Total | 160.3 Modified | 71.1 | Percent | - | 1 | 10/10/24 15:28 | |

Service Request: K2410643

Analytical Report

Client: Terraphase Engineering Inc.

Upper Granite Creek Mines/0031.005.001

Date Collected: 10/04/24 15:21

Service Request: K2410643

Sample Matrix:

Soil

Date Received: 10/08/24 11:45

Sample Name:

Lab Code:

Project:

CS-SD-6

K2410643-011

Basis: As Received

| Analyte Name | Analysis Method | Result | Units | MRL | Dil. | Date Analyzed | Q |
|---------------|------------------------|--------|---------|-----|------|----------------|---|
| Solids, Total | 160.3 Modified | 82.1 | Percent | - | 1 | 10/10/24 15:28 | |

Analytical Report

Client: Terraphase Engineering Inc.

Upper Granite Creek Mines/0031.005.001

Service Request: K2410643

Date Collected: 10/04/24 13:35

Sample Matrix:

Soil

Date Received: 10/08/24 11:45

Sample Name:

Project:

CS-SD-7

Lab Code: K2410643-012 Basis: As Received

| Analyte Name | Analysis Method | Result | Units | MRL | Dil. | Date Analyzed | Q |
|---------------|-----------------|--------|---------|-----|------|----------------|---|
| Solids, Total | 160.3 Modified | 80.2 | Percent | - | 1 | 10/10/24 15:28 | |

Analytical Report

Client: Terraphase Engineering Inc.

Upper Granite Creek Mines/0031.005.001

Service Request: K2410643 **Date Collected:** 10/04/24 13:40

Sample Matrix:

Soil

Date Received: 10/08/24 11:45

Basis: As Received

Sample Name:

Project:

CS-SD-7-DUP

Lab Code:

K2410643-013

Inorganic Parameters

Analyte Name Analysis Method Result Units MRL Dil. **Date Analyzed** Q 73.2 Solids, Total 160.3 Modified Percent 10/10/24 15:28

Analytical Report

Client: Terraphase Engineering Inc.

Project:

Service Request: K2410643 **Date Collected:** 10/05/24 10:30 Upper Granite Creek Mines/0031.005.001

Date Received: 10/08/24 11:45 **Sample Matrix:** Soil

CS-SD-8 **Sample Name:** Basis: As Received

Lab Code: K2410643-014

| Analyte Name | Analysis Method | Result | Units | MRL | Dil. | Date Analyzed | Q |
|---------------|------------------------|--------|---------|-----|------|----------------|---|
| Solids, Total | 160.3 Modified | 69.0 | Percent | = | 1 | 10/10/24 15:28 | |



QC Summary Forms

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Metals

ALS Environmental—Kelso Laboratory 1317 South 13th Avenue, Kelso, WA 98626 Phone (360) 577-7222 Fax (360) 425-9096 www.alsglobal.com

Analytical Report

Client: Terraphase Engineering Inc. Service Request: K2410643

Project:Upper Granite Creek Mines/0031.005.001Date Collected: NASample Matrix:SoilDate Received: NA

Sample Name: Method Blank Basis: Dry

Lab Code: KQ2416426-03

| | Analysis | | | | | | | Date | |
|--------------|----------|--------|-------|------|-------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Mercury | 7471B | ND U | mg/Kg | 0.02 | 0.002 | 1 | 10/15/24 09:02 | 10/14/24 | |

Analytical Report

Client: Terraphase Engineering Inc. Service Request: K2410643

Project:Upper Granite Creek Mines/0031.005.001Date Collected: NASample Matrix:SoilDate Received: NA

Sample Name: Method Blank Basis: Dry

Lab Code: KQ2416427-03

| | Analysis | | | | | | | Date | |
|--------------|----------|---------|-------|-------|-------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Antimony | 6020B | ND U | mg/Kg | 0.05 | 0.020 | 5 | 10/22/24 14:55 | 10/14/24 | |
| Arsenic | 6020B | ND U | mg/Kg | 0.5 | 0.06 | 5 | 10/22/24 14:55 | 10/14/24 | |
| Cadmium | 6020B | ND U | mg/Kg | 0.020 | 0.007 | 5 | 10/22/24 14:55 | 10/14/24 | |
| Chromium | 6020B | 0.06 J | mg/Kg | 0.20 | 0.06 | 5 | 10/22/24 14:55 | 10/14/24 | |
| Lead | 6020B | 0.036 J | mg/Kg | 0.05 | 0.020 | 5 | 10/22/24 14:55 | 10/14/24 | |
| Silver | 6020B | ND U | mg/Kg | 0.020 | 0.004 | 5 | 10/22/24 14:55 | 10/14/24 | |
| Zinc | 6020B | 0.27 J | mg/Kg | 0.5 | 0.20 | 5 | 10/22/24 14:55 | 10/14/24 | |

Analytical Report

Client: Terraphase Engineering Inc. Service Request: K2410643

Project:Upper Granite Creek Mines/0031.005.001Date Collected: NASample Matrix:SoilDate Received: NA

Sample Name: Method Blank Basis: Dry

Lab Code: KQ2416652-01

Total Metals – IVBA Analysis

| | Analysis | | | | | | | Date | |
|---------------------|----------|---------|-------|------|-------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | ND U | mg/Kg | 0.5 | 0.06 | 5 | 10/22/24 15:43 | 10/17/24 | |
| Lead | 6020B | 0.043 J | mg/Kg | 0.05 | 0.020 | 5 | 10/22/24 15:43 | 10/17/24 | |

Analytical Report

Client: Terraphase Engineering Inc. Service Request: K2410643

Project:Upper Granite Creek Mines/0031.005.001Date Collected: NASample Matrix:SoilDate Received: NA

Sample Name: Method Blank Basis: Dry

Lab Code: KQ2416789-01

IVBA Metals

| | Analysis | | | | | | | Date | |
|--------------|----------|--------|-------|------|-------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | ND U | mg/Kg | 0.5 | 0.06 | 5 | 10/17/24 10:57 | 10/16/24 | |
| Lead | 6020B | ND U | mg/Kg | 0.05 | 0.020 | 5 | 10/17/24 10:57 | 10/16/24 | |

QA/QC Report

Client: Terraphase Engineering Inc.

Upper Granite Creek Mines/0031.005.001

Sample Matrix: Soil

Project:

Service Request: Date Collected:

K2410643

Date Received:

10/04/24 10/08/24

Date Analyzed:

10/22/24

Date Extracted:

10/14/24

Matrix Spike Summary

Total Metals

TL-WRA-0.5-3 Sample Name: Lab Code: K2410643-001

Units: Basis: mg/Kg Dry

Analysis Method: Prep Method:

6020B **EPA 3050B**

Matrix Spike

KQ2416427-02

| Analyte Name | Sample Result | Result | Spike Amount | % Rec | % Rec Limits |
|--------------|---------------|--------|--------------|-------|--------------|
| Antimony | 1.54 | 23.7 | 85.7 | 26 N | 75-125 |
| Arsenic | 454 | 510 | 85.7 | 65 # | 75-125 |
| Cadmium | 12.3 | 20.7 | 8.57 | 97 | 75-125 |
| Chromium | 2.38 | 38.0 | 34.3 | 104 | 75-125 |
| Lead | 183 | 244 | 85.7 | 71 N | 75-125 |
| Silver | 2.80 | 11.4 | 8.57 | 101 | 75-125 |
| Zinc | 517 | 610 | 85.7 | 108 # | 75-125 |

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

Matrix Spike and Matrix Spike Duplicate Data is presented for information purposes only. The matrix may or may not be relevant to samples reported in this report. The laboratory evaluates system performance based on the LCS and LCSD control limits.

Printed 10/23/2024 5:16:36 PM

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QA/QC Report

Client: Terraphase Engineering Inc. **Service Request:** K2410643

Project Upper Granite Creek Mines/0031.005.001 **Date Collected:** 10/04/24 **Date Received:** 10/08/24

Soil **Sample Matrix:**

Date Analyzed: 10/22/24

Replicate Sample Summary

Total Metals

Duplicate

Sample Name: TL-WRA-0.5-3 Units: mg/Kg Lab Code: K2410643-001

Basis: Dry

| Analyte Name | Analysis Method | MRL | MDL | Sample Result | Sample KQ2416427-01 Result | Average | RPD | RPD Limit |
|--------------|--------------------|-------|-------|------------------|----------------------------------|---------|------|-----------|
| Antimony | 6020B | 0.043 | 0.017 | 1.54 | 1.76 | 1.65 | 13 | 20 |
| Arsenic | 6020B | 0.43 | 0.05 | 454 | 453 | 454 | <1 | 20 |
| Cadmium | 6020B | 0.017 | 0.006 | 12.3 | 12.1 | 12.2 | 2 | 20 |
| Chromium | 6020B | 0.17 | 0.05 | 2.38 | 2.33 | 2.36 | 2 | 20 |
| Lead | 6020B | 0.043 | 0.017 | 183 | 177 | 180 | 4 | 20 |
| Silver | 6020B | 0.017 | 0.003 | 2.80 | 3.57 | 3.19 | 24 * | 20 |
| Zinc | 6020B | 0.43 | 0.17 | 517 | 510 | 514 | 1 | 20 |

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

QA/QC Report

Client: Terraphase Engineering Inc.

Project: Upper Granite Creek Mines/0031.005.001 Date Analyzed: 10/15/24

Sample Matrix: Soil

Lab Control Sample Summary Total Metals

Units:mg/Kg
Basis:Dry

Service Request: K2410643

Lab Control Sample KQ2416426-04

Analyte NameAnalytical MethodResultSpike Amount% Rec% Rec LimitsMercury7471B0.5200.50010480-120

QA/QC Report

Client: Terraphase Engineering Inc.

Service Request: K2410643 **Project:** Upper Granite Creek Mines/0031.005.001 Date Analyzed: 10/22/24

Sample Matrix: Soil

Lab Control Sample Summary Total Metals

Units:mg/Kg Basis:Dry

Lab Control Sample

KQ2416427-04

| Analyte Name | Analytical Method | Result | Spike Amount | % Rec | % Rec Limits |
|--------------|--------------------------|--------|--------------|-------|--------------|
| Antimony | 6020B | 99.4 | 100 | 99 | 80-120 |
| Arsenic | 6020B | 105 | 100 | 105 | 80-120 |
| Cadmium | 6020B | 10.3 | 10.0 | 103 | 80-120 |
| Chromium | 6020B | 42.3 | 40.0 | 106 | 80-120 |
| Lead | 6020B | 108 | 100 | 108 | 80-120 |
| Silver | 6020B | 10.5 | 10.0 | 105 | 80-120 |
| Zinc | 6020B | 105 | 100 | 105 | 80-120 |

QA/QC Report

Client: Terraphase Engineering Inc.

Project: Upper Granite Creek Mines/0031.005.001 Date Analyzed: 10/22/24

Sample Matrix: Soil

Lab Control Sample Summary Total Metals – IVBA Analysis

Units:mg/Kg
Basis:Dry

Service Request: K2410643

Lab Control Sample

KQ2416652-02

| Analyte Name | Analytical Method | Result | Spike Amount | % Rec | % Rec Limits |
|--------------|--------------------------|--------|--------------|-------|--------------|
| Arsenic | 6020B | 108 | 100 | 108 | 80-120 |
| Lead | 6020B | 111 | 100 | 111 | 80-120 |

QA/QC Report

Client: Terraphase Engineering Inc.

Project: Upper Granite Creek Mines/0031.005.001 Date Analyzed: 10/17/24

Sample Matrix: Soil

Lab Control Sample Summary
IVBA Metals

Units:mg/Kg
Basis:Dry

Service Request: K2410643

Lab Control Sample

KQ2416789-02

| Analyte Name | Analytical Method | Result | Spike Amount | % Rec | % Rec Limits |
|--------------|--------------------------|--------|--------------|-------|--------------|
| Arsenic | 6020B | 92.9 | 100 | 93 | 80-120 |
| Lead | 6020B | 105 | 100 | 105 | 80-120 |



General Chemistry

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ALS Group USA, Corp.

dba ALS Environmental

QA/QC Report

Client: Terraphase Engineering Inc.

Service Request: K2410643

Project Upper Granite Creek Mines/0031.005.001

Date Collected: 10/04/24

Sample Matrix: Soil

Lab Code:

Date Received: 10/08/24 **Date Analyzed:** 10/10/24

Replicate Sample Summary

Inorganic Parameters

Sample Name: TL-WRA-0.5-3

Units: Percent

Ba

Basis: As Received

K2410643-001 **Duplicate**

Sample

K2410643-

. 00

Sample

001DUP

Analyte NameAnalysis MethodMRLResultResultAverageRPDRPD LimitSolids, Total160.3 Modified-95.094.694.8<1</td>20

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

ALS Group USA, Corp.

dba ALS Environmental

QA/QC Report

Client: Terraphase Engineering Inc. Service Request: K2410643

Project Upper Granite Creek Mines/0031.005.001 **Date Collected:** 10/05/24

Sample Matrix:

Date Received: 10/08/24

Soil

Date Analyzed: 10/10/24

Replicate Sample Summary

Inorganic Parameters

Sample Name:

CS-SD-8

Units: Percent

Lab Code:

K2410643-014

Basis: As Received

Duplicate

Sample

K2410643-

Sample

014DUP

Analyte Name Analysis Method

Result **MRL**

Result

RPD RPD Limit Average

Solids, Total

160.3 Modified

69.0

69.5

69.3

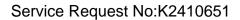
Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

Printed 10/23/2024 5:16:39 PM

Superset Reference:24-0000711615 rev 00





Don Malkemus Terraphase Engineering Inc. 610 SW Broadway, Suite 405 Portland, OR 97205

Laboratory Results for: Upper Granite Creek Mines

Dear Don.

Enclosed are the results of the sample(s) submitted to our laboratory October 08, 2024 For your reference, these analyses have been assigned our service request number **K2410651**.

Analyses were performed according to our laboratory's NELAP-approved quality assurance program. The test results meet requirements of the current NELAP standards, where applicable, and except as noted in the laboratory case narrative provided. For a specific list of NELAP-accredited analytes, refer to the certifications section at www.alsglobal.com. All results are intended to be considered in their entirety, and ALS Group USA Corp. dba ALS Environmental (ALS) is not responsible for use of less than the complete report. Results apply only to the items submitted to the laboratory for analysis and individual items (samples) analyzed, as listed in the report.

Please contact me if you have any questions. My extension is 3376. You may also contact me via email at Mark.Harris@alsglobal.com.

Respectfully submitted,

noe D. Oar

ALS Group USA, Corp. dba ALS Environmental

Mark Harris

Project Manager



Narrative Documents

ALS Environmental—Kelso Laboratory 1317 South 13th Avenue, Kelso, WA 98626 Phone (360) 577-7222 Fax (360) 425-9096 www.alsglobal.com



Client:Terraphase Engineering Inc.Service Request: K2410651Project:Upper Granite Creek MinesDate Received: 10/08/2024

Sample Matrix: Water

CASE NARRATIVE

All analyses were performed consistent with the quality assurance program of ALS Environmental. This report contains analytical results for samples for the Tier II level requested by the client.

Sample Receipt:

Twelve water samples were received for analysis at ALS Environmental on 10/08/2024. Any discrepancies upon initial sample inspection are annotated on the sample receipt and preservation form included within this report. The samples were stored at minimum in accordance with the analytical method requirements.

Metals:

No significant anomalies were noted with this analysis.

Approved by Moe D. Dark

Date 10/22/2024



SAMPLE DETECTION SUMMARY

This form includes only detections above the reporting levels. For a full listing of sample results, continue to the Sample Results section of this Report.

| CLIENT ID: CS-SW-1 | | Lab ID: K2410651-004 | | | | | | | | |
|--|----------------------|----------------------|-----------|---------|-------|-----------|--|--|--|--|
| Analyte | Results | Flag | MDL | MRL | Units | Method | | | | |
| Antimony | 0.036 | J | 0.020 | 0.050 | ug/L | 6020B | | | | |
| Arsenic | 0.36 | J | 0.09 | 0.50 | ug/L | 6020B | | | | |
| Calcium | 5590 | | 6 | 20 | ug/L | 6020B | | | | |
| Chromium | 0.11 | J | 0.03 | 0.20 | ug/L | 6020B | | | | |
| Hardness, Total as CaCO3 | 18.1 | | 0.023 | 0.09 | mg/L | SM 2340 B | | | | |
| Lead | 0.013 | J | 0.006 | 0.020 | ug/L | 6020B | | | | |
| Magnesium | 996 | | 2 | 10 | ug/L | 6020B | | | | |
| CLIENT ID: CS-SW-2 | | Lab | ID: K2410 | 651-005 | | | | | | |
| Analyte | Results | Flag | MDL | MRL | Units | Method | | | | |
| Antimony | 0.025 | J | 0.020 | 0.050 | ug/L | 6020B | | | | |
| Arsenic | 0.67 | | 0.09 | 0.50 | ug/L | 6020B | | | | |
| Calcium | 6070 | | 6 | 20 | ug/L | 6020B | | | | |
| Chromium | 0.11 | J | 0.03 | 0.20 | ug/L | 6020B | | | | |
| Hardness, Total as CaCO3 | 19.7 | | 0.023 | 0.09 | mg/L | SM 2340 B | | | | |
| Lead | 0.012 | J | 0.006 | 0.020 | ug/L | 6020B | | | | |
| Magnesium | 1110 | | 2 | 10 | ug/L | 6020B | | | | |
| LIENT ID: CS-SW-2-Dup | Lab ID: K2410651-006 | | | | | | | | | |
| Analyte | Results | Flag | MDL | MRL | Units | Method | | | | |
| Antimony | 0.031 | J | 0.020 | 0.050 | ug/L | 6020B | | | | |
| Arsenic | 0.61 | | 0.09 | 0.50 | ug/L | 6020B | | | | |
| Calcium | 5920 | | 6 | 20 | ug/L | 6020B | | | | |
| Chromium | 0.11 | J | 0.03 | 0.20 | ug/L | 6020B | | | | |
| Hardness, Total as CaCO3 | 19.3 | | 0.023 | 0.09 | mg/L | SM 2340 B | | | | |
| Lead | 0.007 | J | 0.006 | 0.020 | ug/L | 6020B | | | | |
| Magnesium | 1090 | | 2 | 10 | ug/L | 6020B | | | | |
| LIENT ID: CS-SW-3 | | Lab | ID: K2410 | 651-007 | | | | | | |
| Analyte | Results | Flag | MDL | MRL | Units | Method | | | | |
| Antimony | 0.038 | J | 0.020 | 0.050 | ug/L | 6020B | | | | |
| Arsenic | 0.87 | | 0.09 | 0.50 | ug/L | 6020B | | | | |
| Calcium | 6490 | | 6 | 20 | ug/L | 6020B | | | | |
| Chromium | 0.12 | J | 0.03 | 0.20 | ug/L | 6020B | | | | |
| Hardness, Total as CaCO3 | 21.0 | | 0.023 | 0.09 | mg/L | SM 2340 B | | | | |
| Lead | 0.012 | J | 0.006 | 0.020 | ug/L | 6020B | | | | |
| Magnesium | 1170 | | 2 | 10 | ug/L | 6020B | | | | |
| LIENT ID: CS-SW-4 | | Lab | ID: K2410 | 651-008 | | | | | | |
| Analyte | Results | Flag | MDL | MRL | Units | Method | | | | |
| ······································ | | | | | | | | | | |

0.09

0.50

ug/L

6020B

0.92

Arsenic



SAMPLE DETECTION SUMMARY

| CLIENT ID: CS-SW-4 | | Lak | ID: K2410 | 651-008 | | |
|--------------------------|---------|------|-----------|---------|-------|-----------|
| Analyte | Results | Flag | MDL | MRL | Units | Method |
| Calcium | 8410 | | 6 | 20 | ug/L | 6020B |
| Chromium | 0.14 | J | 0.03 | 0.20 | ug/L | 6020B |
| Hardness, Total as CaCO3 | 27.5 | | 0.023 | 0.09 | mg/L | SM 2340 B |
| Magnesium | 1590 | | 2 | 10 | ug/L | 6020B |
| LIENT ID: CS-SW-5 | | Lak | ID: K2410 | 651-009 | | |
| Analyte | Results | Flag | MDL | MRL | Units | Method |
| Antimony | 0.098 | | 0.020 | 0.050 | ug/L | 6020B |
| Arsenic | 1.78 | | 0.09 | 0.50 | ug/L | 6020B |
| Cadmium | 0.010 | J | 0.008 | 0.020 | ug/L | 6020B |
| Calcium | 9550 | | 6 | 20 | ug/L | 6020B |
| Chromium | 0.11 | J | 0.03 | 0.20 | ug/L | 6020B |
| Hardness, Total as CaCO3 | 31.8 | | 0.023 | 0.09 | mg/L | SM 2340 B |
| Lead | 0.018 | J | 0.006 | 0.020 | ug/L | 6020B |
| Magnesium | 1930 | | 2 | 10 | ug/L | 6020B |
| Zinc | 1.8 | J | 0.5 | 2.0 | ug/L | 6020B |
| LIENT ID: CS-SW-6 | | Lak | ID: K2410 | 651-010 | | |
| Analyte | Results | Flag | MDL | MRL | Units | Method |
| Antimony | 0.076 | | 0.020 | 0.050 | ug/L | 6020B |
| Arsenic | 2.04 | | 0.09 | 0.50 | ug/L | 6020B |
| Calcium | 9710 | | 6 | 20 | ug/L | 6020B |
| Chromium | 0.11 | J | 0.03 | 0.20 | ug/L | 6020B |
| Hardness, Total as CaCO3 | 32.3 | | 0.023 | 0.09 | mg/L | SM 2340 B |
| Lead | 0.013 | J | 0.006 | 0.020 | ug/L | 6020B |
| Magnesium | 1960 | | 2 | 10 | ug/L | 6020B |
| Zinc | 0.7 | J | 0.5 | 2.0 | ug/L | 6020B |
| LIENT ID: CS-SW-7 | | Lat | ID: K2410 | 651-011 | | |
| Analyte | Results | Flag | MDL | MRL | Units | Method |
| Antimony | 0.104 | | 0.020 | 0.050 | ug/L | 6020B |
| Arsenic | 1.99 | | 0.09 | 0.50 | ug/L | 6020B |
| Cadmium | 0.019 | J | 0.008 | 0.020 | ug/L | 6020B |
| Calcium | 10900 | | 6 | 20 | ug/L | 6020B |
| Chromium | 0.09 | J | 0.03 | 0.20 | ug/L | 6020B |
| Hardness, Total as CaCO3 | 36.3 | | 0.023 | 0.09 | mg/L | SM 2340 B |
| Lead | 0.022 | | 0.006 | 0.020 | ug/L | 6020B |
| Magnesium | 2200 | | 2 | 10 | ug/L | 6020B |
| Magneolam | | | | | | |

0.5

2.0

ug/L

6020B

8.0

Zinc



SAMPLE DETECTION SUMMARY

This form includes only detections above the reporting levels. For a full listing of sample results, continue to the Sample Results section of this Report.

| | Lab | ID: K2410 | 651-012 | | | | | | |
|---------|---|----------------|---|---|------------------------------------|--|--|--|--|
| Results | Flag | MDL | MRL | Units | Method | | | | |
| 0.108 | | 0.020 | 0.050 | ug/L | 6020B | | | | |
| 2.21 | | 0.09 | 0.50 | ug/L | 6020B | | | | |
| 0.020 | J | 0.008 | 0.020 | ug/L | 6020B | | | | |
| 10900 | | 6 | 20 | ug/L | 6020B | | | | |
| 0.11 | J | 0.03 | 0.20 | ug/L | 6020B | | | | |
| 36.7 | | 0.023 | 0.09 | mg/L | SM 2340 B | | | | |
| 0.084 | | 0.006 | 0.020 | ug/L | 6020B | | | | |
| 2310 | | 2 | 10 | ug/L | 6020B | | | | |
| 0.8 | J | 0.5 | 2.0 | ug/L | 6020B | | | | |
| | Lab ID: K2410651-001 | | | | | | | | |
| Results | Flag | MDL | MRL | Units | Method | | | | |
| 0.64 | | 0.09 | 0.50 | ug/L | 6020B | | | | |
| | Lab | ID: K2410 | 651-002 | | | | | | |
| Results | Flag | MDL | MRL | Units | Method | | | | |
| 3.12 | | 0.09 | 0.50 | ug/L | 6020B | | | | |
| | Lab | ID: K2410 | 651-003 | | | | | | |
| Results | Flag | MDL | MRL | Units | Method | | | | |
| 0.11 | J | 0.09 | 0.50 | ug/L | 6020B | | | | |
| | 0.108 2.21 0.020 10900 0.11 36.7 0.084 2310 0.8 Results 0.64 Results 3.12 | Results Flag | Results Flag MDL 0.108 0.020 2.21 0.09 0.020 J 0.008 10900 6 0.11 J 0.03 36.7 0.023 0.084 0.006 2310 2 0.8 J 0.5 Lab ID: K2410 | 0.108 0.020 0.050 2.21 0.09 0.50 0.020 J 0.008 0.020 10900 6 20 0.11 J 0.03 0.20 36.7 0.023 0.09 0.084 0.006 0.020 2310 2 10 0.8 J 0.5 2.0 Lab ID: K2410651-001 Results Flag MDL MRL 3.12 0.09 0.50 Lab ID: K2410651-003 Results Flag MDL MRL MRL MRL MRL MRL | Results Flag MDL MRL Units | | | | |



Sample Receipt Information

ALS Environmental—Kelso Laboratory 1317 South 13th Avenue, Kelso, WA 98626 Phone (360) 577-7222 Fax (360) 425-9096 www.alsglobal.com Client: Terraphase Engineering Inc. Service Request:K2410651

Project: Upper Granite Creek Mines/0031.005.001

SAMPLE CROSS-REFERENCE

| CLIENT SAMPLE ID | <u>DATE</u> | <u>TIME</u> |
|------------------|--|--|
| EB-2024 1003 | 10/5/2024 | 0830 |
| EB-2024 1004 | 10/4/2024 | 0800 |
| EB-2024 1005 | 10/5/2024 | 0830 |
| CS-SW-1 | 10/5/2024 | 1004 |
| CS-SW-2 | 10/3/2024 | 1700 |
| CS-SW-2-Dup | 10/3/2024 | 1701 |
| CS-SW-3 | 10/3/2024 | 1600 |
| CS-SW-4 | 10/3/2024 | 1419 |
| CS-SW-5 | 10/4/2024 | 0925 |
| CS-SW-6 | 10/4/2024 | 1523 |
| CS-SW-7 | 10/4/2024 | 1334 |
| CS-SW-8 | 10/5/2024 | 1035 |
| | EB-2024 1003 EB-2024 1004 EB-2024 1005 CS-SW-1 CS-SW-2 CS-SW-2-Dup CS-SW-3 CS-SW-4 CS-SW-5 CS-SW-6 CS-SW-7 | EB-2024 1003 10/5/2024 EB-2024 1004 10/4/2024 EB-2024 1005 10/5/2024 CS-SW-1 10/5/2024 CS-SW-2 10/3/2024 CS-SW-2-Dup 10/3/2024 CS-SW-3 10/3/2024 CS-SW-4 10/3/2024 CS-SW-5 10/4/2024 CS-SW-6 10/4/2024 CS-SW-7 10/4/2024 |

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Page 1 of 1

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| M | Don | Malk | | | NUMBER | 7470A1Hg | 7471B / Hg | 50208 / IVBA (Sieved | 60208 / IVBA Extract | 5020B / Metals | Grind / G | SM 2340 B / Hardness | <u> </u> | | | <u>v</u> | | Re | marks | | | | | | | | | |
| CLIENT SAMPLE ID | LABID | | MPLING Fime State | Matrix | | | | | · | | | | | | | | | | | | | | | | | | | |
| EB-2029 1003 | | 10/5 | 0830 | H20 | 1 | | | | | X | | | | | | | | | | | | | | | | | | |
| EB-20241004 | | 1014 | 0800 | H20 | 1 | | | | | × | | | | | | | | | | | | | | | • | | | |
| EB-2024 1005 | | tal5 | 0830 | H20 | 1 | | | | | X | | | | | | | | | | | | | | | | | | |
| UMM-628-05-4 | | 10(5 | 1335 | 50.11 | 7. | | | | | | | | | | | | | 1- pJ. | | | | | | | | | | |
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| leport Requirements | | ice Inf | ormation | | | | | | | | | | | | | Ω | ircle | which met | als are to b | e analy | zed | | | | | | | |
| Routine Report: Method Blank, Surrogate, as required | P.O.#_ Bill To: | ape to | inhise con | | | | | | | - | _ | | | | | | | | | | | | | | TI Sn | | - | |
| II. Report Dup., MS, MSD | | | | _ | ···· | | | | | | | Sb | Ва | Be | | | | | | | | | | | Sr TI S | | n Hg | |
| as required III. CLP Like Summary (no raw data) | 24 5 [| hr. Day | equiremer 48 hr. | nts | pecia | i instr | uctio | ins/C | Jomr | neni | s; | | | | rinc | dicat | e St | ate Hyd | rocarboi | n Proc | edure: / | AK CA | Wi | Northw | est Othe | € [| _(Circle | One) |
| IV. Data Validation Report | Sta | andard | | | | | | | | | | | | | | | | | | | | | | | | | | |
| V. EDD | | Requested Re | eport Date | | | | | | | | | | | | | | | | | | | | | | | | | |
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| on Malkemo | Printed Na | me La | Bih | | ed Na | | <i></i> | cit | 3; J | c | | Signature Naw Redesce Printed Name A18 | | | | | 3 | Printed | Name |) | | | Prin | ted Name | 9 | | | |
| TEI | Firm AL | | | Firm | AL | | | | | | | | 2/c | (12) | 4 | ١٢ | 14 | 5 | Firm | | | | | Firm | | | | |
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Page 1 of 1

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| M | 100 | n Malkinus | <u> </u> | NUMBER | 7470A / Hg T | 7471B / Hg | 80208 / IVBA | 8020B / IVBA Extraci | 5020B / Metals | Grind / GrindSub | SM 2340 B / Hardness | | | L | ع | Re | emarks | _ | | | | | | | | |
| CLIENT SAMPLE ID | LABID | SAMPLING Date Time State | Matrix | | | | | | | | | | | | | | | | | | | | | | | |
| C5-5W-1 | | 10/5 1035 1004 | | I | χ | | | | X | | X | | | | | | | · | | | | | | | | |
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| CS-5W-Z-100P | | 1013 1701 | HLO | 1 | X | | | | X | | X | | | | | | | | | | | | | | | |
| <u>C5-Sw-3</u> | | 10/3 1600 | 420 | 1 | 1 | | | | * | | λ | | | | | | | | | | | | | | | |
| C5-5W-4 | | 10/3 1419 | H20 | 1 | X | | | | 4 | _ | لد | | _ | | | | | | | | | | | | | |
| C5-5W-5 | | 10/4 0925 | H20 | 1 | k | | | | * | | 논 | | | | | | | | | | | | | | • | |
| C5-5W-6 | | 10/4 1523 | H20 | 1 | x | | | | X | | <u>\ </u> | | _ | | | | | | | | | | | | | |
| C5-SW-7 | | 1014 1334 | HLO | 1 | x | | | | X | | x | | | | | | | | | | | | | | | |
| C5-5W-8 | | 1015 1035 | HŁO | <u> </u> | × | | | _ | <u>X</u> | \dashv | × | | ╀- | <u> </u> | | | | | | | | | | | | |
| | | <u> </u> | | <u> </u> | | | | | | | | | | <u> </u> | | | | | | | | | | ······································ | | |
| Report Requirements | P.O.# | oice Information | | | | | | | | | | | | 9 | <u>Circle v</u> | which me | tais are to l | be analy | zed | | | | | | | |
| _ I. Routine Report: Method Blank, Surrogate, as required | Bill To | ap@temphil. Com | | | | | | | _ | , - | | | | - | | | | | | _ | - | | TI Sn V | | • | |
| II. Report Dup., MS, MSD | | | _ | | | | | | | | Sb | ва ве | | | | | | | | | | | ir TI Sn | | | |
| as required III. CLP Like Summary | Turnar | ound Requireme | nts | pecia | inst | ructio | ons/C | Jomr | nent | s: | | | -11 | ldica | te Sta | ate Hyc | irocarbo | n Pro | cedure: / | AK CA | VVI I | Northwe | st Other | ((| Circle C |)ne) |
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| _ IV. Data Validation Report | -X-s | tandard | | | | | | | | | | | | | | | | | | | | | | | | |
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| Relinquished By: | | Received By: | | Re | ling | uish | ed | Ву: | | | 1 | Re | ceive | d B | y: | | | Reli | nquishe | d By: | | | Rec | eived | Ву: | |
| nature | Signature | , | Sign | ature | | 7 | | | | 810 | anat Vi | UTE OM 1 | 00 | el o | ſs. | PIA | Signati | иге | | | | Signa | ture | <u>.</u> | | |
| Don Mikemy | Printed N. | ame , | Print | ed Na | ame | Late | } ., | ~ | | Pri | inte | d Name | | | | - | Printed | Nam | e | | | Printe | d Name | | | |
| TEI | Firm AL | S. | Firm | | | <u> </u> | | | - | Eir | m | 8124 | 1 1 | 4 | 5 | ************************************** | Firm | · · · · · · · · · · · · · · · · · · · | • | | | Firm | · | | - | |
| e/Time | Date/Time | 10/08/14 1300 | Date | /Time | 77 | /08 | 124 | 1] | 444 | ∱Da | ite/T | ime | | | | | Date/T | ime | | | | Date/ | Time | | | |
| 10/8 306 | | • | | | • | , | 7 | , - | | | | | | | | | | | | | | | | | - | |

| | Sample ID | | Bottle Count Bottle Type | Head- space | Broke | Нф | Reagent | Volume added | Reagent Numb | | nitiais | Time |
|--------------------|---|------------------|---|----------------|---------------|-----------------------------|-------------------|-----------------|-----------------|---------------------------|--------------|----------------|
| Sa | mple ID on Bott | ile . | Sample | e ID on | COC | - | | | Identified | by: | | |
| Were 100m | l sterile microbiolo | gy bottles fille | d exactly to the 100m | nl mark? | (N | A | Y N | | Underfi | lled O | verfille | i |
| | *** | the method sp | ecified time limit? If | not, nota | te the er | xor belo | ow and notify | the PM | (NA) | Y | N | |
| | es negative? | | | | | | | | NA | Y | N | |
| - | - | | ? Indicate in the tabl | | hi | A151651 | | | (NA) | Y | N | |
| | | | mes received for the t N SOP) received at th | | | 19 Indi | rate in the tah | le helow | NA NA | Y | N N | |
| ` | ole labels and tags | | - • " | | nns do | | | | NA NA | Y | N | |
| Were all sar | nple labels comple | te (ie, analysis | , preservation, etc.)? | | | | | | NA | 5 | N | |
| | es received in good | | - | | | | | | NA | ₹. | N | |
| - | iterial: <i>Inserts</i> ly papers properly | | - | is we | <u>IÇE</u> YL | ry ice | Sleeves | | NA | (v) | N | |
| - | - | _ | bble Wrap Gel Pack | | - | | C/ | | | | | |
| | sue samples were | - | rozen Partially Ti | | Thaw | | , min nonly u | O # 171. | |) | • | |
| • | | • | as collected? If not, r | • | conier | # ahove | and notify th | e PM | NA | \ Y | N | |
| | _ | - | ified temperature ran | | iii die et | MICI, IN | Julic III IIIC CO | ignin isa | NA | $\left(\mathbf{v}\right)$ | N | |
| - | erature Blank prese | | NA (Y N sample bottle contain | | | _ | rature in the a | | | ve: | | |
| 6.3 | 4.5 | 4 | | 16 | | _ 4 | | | | | | |
| <u>.Ц</u> | 4.5 | | | | | | | | | | | |
| 0.0 | 4.4 | | | | | | - | | | | | |
| ·S | 5.7 | | | | | | | | | | * | - |
| 4_ | 7.0 | 1601 | 140510 | | | | | | | | | |
| np Blank | Sample Temp | IR Gun | Cooler #/COC ID / N | A | indicate | with X | " If out of | temp | Trackin | g Number | NA_ | Filed |
| | <u> </u> | | * | | | ftemp | Notifi | 23.00 | * | | | |
| | | | | | | ् <i>र</i> ार ४.२.५५,७३, | | | | | | T |
| f present, w | ere custody seals in | ntact? | Y N | If preser | it, were | they sig | aned and dated | 1? | | Y | N | |
| Vere <u>custod</u> | y seals on coolers? | ? | NA Y (N) | If yes, h | ow man | y and w | here? | | · | | | |
| Samples we | ere received in: (cir | cle) 🕜 | oler Box | E | nvelope | | Other | | | | NA | |
| Samples we | re received via? | USPS | Fed Ex | UPS | D. | HL | PDX | Cour | rier) H | and Delive | ered | |
| eived: <u>10</u> | 18124 | Opened: _ | 1018124 | By: _ | Δ | K_ | _Unioaded: _ | 1015 | 1129 | By: <u></u> | 4 | |
| nt | iera, | nes | <u>e</u> | | | Sen | rice Request | K24 <u>/ (</u> | 0651 | | 1 | > |
| | <u> </u> | ~1 | Cooler Receipt | t and F | orese | rvatio | n Form | _ | ~ > | | | 7 |
| | | | | | | | | | | | PM// | Ol Emm |

| Sample ID | Bottle Count Bottle Type | Head- space | Broke | рН | Reagent | Volume added | Reagent Lot Number | initials | Time | |
|-----------|-----------------------------|----------------|-------|----|---------|-----------------|---------------------------------------|----------|-------------|---|
| | | | | | | | | | | |
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G:\SMO\2024 Forms

1.

SOP: SMO-GEN

Reviewed: NP 1/3/2024



Cooler Receipt and Preservation Form

| ent | Terra | kna | <u> </u> | | | | _Servi | ce F | Request K2 | 4 | <u> </u> | | |
|---------------|-------------------|---------------------------------------|-------------|------------------|-------------|--|--|-------------|------------------------------|----------|---------------------------------------|--------------------------------|-------------|
| Temp Blank | Sample Temp | IR Gun | Cooler #/C | OC ID / | NA | Out indica | of temp | x• | PM Notifie if out of t | d emp | Tracking Nur | nber NA | Filed |
| Hr. 7.8 | 3.8 | 1801 | | | | | | | | | | | |
| 12.2 | 5.5 | V | | · | | | | | | | · · · · · · · · · · · · · · · · · · · | NAME AND ADDRESS OF THE PARTY. | |
| | | | | | | | | | | | | (| |
| San | npie ID on Bottle | | | Sample | ID on C | OC | | | | <u> </u> | dentified by: | | |
| | | | | | | | | | | | | | |
| | | | ottle Count | | Head- | | | | | Volume | Reagent Lot | | |
| 10. | Sample ID | B | ottle Type | Temp | space | Broke | рН | | Reagent | added | Number | Initials | Time |
| | | | | | | | | | | | | | |
| otes, Discrep | ancies & Resol | utions: _\(| د س | <u> </u> 25 a | <u></u> | TOP | 0F | (| Coolers | >o | n topo | £ | |
| Saw | ples. Te | mp_ | blan | RI | <u> </u> | <u> </u> | nd | er | - He | SUN | uples, 1 | \ot_ | |
| india | certire, | & S | gun | <u>()</u> | ten | MP. | | | | | | | |
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| G:\SMO' | \2024 Forms | | | | SOP. | SMO- | GEN | | | | Reviewe | d- ND 1/3 | 1/2024 |

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Miscellaneous Forms

ALS Environmental—Kelso Laboratory 1317 South 13th Avenue, Kelso, WA 98626 Phone (360) 577-7222 Fax (360) 425-9096 www.alsglobal.com

Inorganic Data Qualifiers

- * The result is an outlier. See case narrative.
- # The control limit criteria is not applicable.
- B The analyte was found in the associated method blank at a level that is significant relative to the sample result as defined by the DOD or NELAC standards.
- E The result is an estimate amount because the value exceeded the instrument calibration range.
- I The result is an estimated value
- U The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL.
 DOD-QSM 4.2 definition: Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
- i The MRL/MDL or LOQ/LOD is elevated due to a matrix interference.
- X See case narrative.
- Q See case narrative. One or more quality control criteria was outside the limits.
- H The holding time for this test is immediately following sample collection. The samples were analyzed as soon as possible after receipt by the laboratory.

Metals Data Qualifiers

- # The control limit criteria is not applicable.
- J The result is an estimated value.
- E The percent difference for the serial dilution was greater than 10%, indicating a possible matrix interference in the sample.
- M The duplicate injection precision was not met.
- N The Matrix Spike sample recovery is not within control limits. See case narrative.
- S The reported value was determined by the Method of Standard Additions (MSA).
- U The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL. DOD-QSM 4.2 definition: Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
- W The post-digestion spike for furnace AA analysis is out of control limits, while sample absorbance is less than 50% of spike absorbance.
- i The MRL/MDL or LOQ/LOD is elevated due to a matrix interference.
- X See case narrative.
- + The correlation coefficient for the MSA is less than 0.995.
- Q See case narrative. One or more quality control criteria was outside the limits.

Organic Data Qualifiers

- * The result is an outlier. See case narrative.
- # The control limit criteria is not applicable. See case narrative.
- A A tentatively identified compound, a suspected aldol-condensation product.
- B The analyte was found in the associated method blank at a level that is significant relative to the sample result as defined by the DOD or NELAC standards.
- C The analyte was qualitatively confirmed using GC/MS techniques, pattern recognition, or by comparing to historical data.
- D The reported result is from a dilution.
- E The result is an estimated value over the calibration range.
- J The result is an estimated value between the MDL and the MRL.
- N The result is presumptive. The analyte was tentatively identified, but a confirmation analysis was not performed.
- P The GC or HPLC confirmation criteria was exceeded. The relative percent difference is greater than 40% between the two analytical results.
- U The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL.
 DOD-QSM 4.2 definition: Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
- i The MRL/MDL or LOQ/LOD is elevated due to a chromatographic interference.
- X See case narrative.
- Q See case narrative. One or more quality control criteria was outside the limits.

Additional Petroleum Hydrocarbon Specific Qualifiers

- F The chromatographic fingerprint of the sample matches the elution pattern of the calibration standard.
- L The chromatographic fingerprint of the sample resembles a petroleum product, but the elution pattern indicates the presence of a greater amount of lighter molecular weight constituents than the calibration standard.
- H The chromatographic fingerprint of the sample resembles a petroleum product, but the elution pattern indicates the presence of a greater amount of heavier molecular weight constituents than the calibration standard.
- O The chromatographic fingerprint of the sample resembles an oil, but does not match the calibration standard.
- Y The chromatographic fingerprint of the sample resembles a petroleum product eluting in approximately the correct carbon range, but the elution pattern does not match the calibration standard.
- Z The chromatographic fingerprint does not resemble a petroleum product.

ALS Group USA Corp. dba ALS Environmental (ALS) - Kelso State Certifications, Accreditations, and Licenses

| Agency | Web Site | Number |
|--------------------------|---|-------------|
| Alaska DEH | http://dec.alaska.gov/eh/lab/cs/csapproval.htm | UST-040 |
| Arizona DHS | http://www.azdhs.gov/lab/license/env.htm | AZ0339 |
| Arkansas - DEQ | http://www.adeq.state.ar.us/techsvs/labcert.htm | 88-0637 |
| California DHS (ELAP) | http://www.cdph.ca.gov/certlic/labs/Pages/ELAP.aspx | 2795 |
| DOD ELAP | http://www.denix.osd.mil/edqw/Accreditation/AccreditedLabs.cfm | L16-58-R4 |
| Florida DOH | http://www.doh.state.fl.us/lab/EnvLabCert/WaterCert.htm | E87412 |
| Hawaii DOH | http://health.hawaii.gov/ | - |
| ISO 17025 | http://www.pjlabs.com/ | L16-57 |
| Louisiana DEQ | http://www.deq.louisiana.gov/page/la-lab-accreditation | 03016 |
| Maine DHS | http://www.maine.gov/dhhs/ | WA01276 |
| Minnesota DOH | http://www.health.state.mn.us/accreditation | 053-999-457 |
| Nevada DEP | http://ndep.nv.gov/bsdw/labservice.htm | WA01276 |
| New Jersey DEP | http://www.nj.gov/dep/enforcement/oqa.html | WA005 |
| New York - DOH | https://www.wadsworth.org/regulatory/elap | 12060 |
| | https://deq.nc.gov/about/divisions/water-resources/water-resources-data/water-sciences-home-page/laboratory-certification-branch/non-field-lab- | |
| North Carolina DEQ | certification | 605 |
| Oklahoma DEQ | http://www.deq.state.ok.us/CSDnew/labcert.htm | 9801 |
| Oregon – DEQ (NELAP) | http://public.health.oregon.gov/LaboratoryServices/EnvironmentalLaboratoryAccreditation/Pages/index.aspx | WA100010 |
| South Carolina DHEC | http://www.scdhec.gov/environment/EnvironmentalLabCertification/ | 61002 |
| Texas CEQ | http://www.tceq.texas.gov/field/qa/env_lab_accreditation.html | T104704427 |
| Washington DOE | http://www.ecy.wa.gov/programs/eap/labs/lab-accreditation.html | C544 |
| Wyoming (EPA Region 8) | https://www.epa.gov/region8-waterops/epa-region-8-certified-drinking-water- | - |
| Kelso Laboratory Website | www.alsglobal.com | NA |

Analyses were performed according to our laboratory's NELAP-approved quality assurance program. A complete listing of specific NELAP-certified analytes, can be found in the certification section at www.ALSGlobal.com or at the accreditation bodies web site.

Please refer to the certification and/or accreditation body's web site if samples are submitted for compliance purposes. The states highlighted above, require the analysis be listed on the state certification if used for compliance purposes and if the method/anlayte is offered by that state.

Acronyms

ASTM American Society for Testing and Materials

A2LA American Association for Laboratory Accreditation

CARB California Air Resources Board

CAS Number Chemical Abstract Service registry Number

CFC Chlorofluorocarbon
CFU Colony-Forming Unit

DEC Department of Environmental Conservation

DEQ Department of Environmental Quality

DHS Department of Health Services

DOE Department of Ecology
DOH Department of Health

EPA U. S. Environmental Protection Agency

ELAP Environmental Laboratory Accreditation Program

GC Gas Chromatography

GC/MS Gas Chromatography/Mass Spectrometry

LOD Limit of Detection
LOQ Limit of Quantitation

LUFT Leaking Underground Fuel Tank

M Modified

MCL Maximum Contaminant Level is the highest permissible concentration of a substance

allowed in drinking water as established by the USEPA.

MDL Method Detection Limit
MPN Most Probable Number
MRL Method Reporting Limit

NA Not Applicable
NC Not Calculated

NCASI National Council of the Paper Industry for Air and Stream Improvement

ND Not Detected

NIOSH National Institute for Occupational Safety and Health

PQL Practical Quantitation Limit

RCRA Resource Conservation and Recovery Act

SIM Selected Ion Monitoring

TPH Total Petroleum Hydrocarbons

tr Trace level is the concentration of an analyte that is less than the PQL but greater than or

equal to the MDL.

Analyst Summary report

Client: Terraphase Engineering Inc.

Project: Upper Granite Creek Mines/0031.005.001 Service Request: K2410651

Sample Name: EB-2024 1003 Lab Code: K2410651-001

Sample Matrix: Water **Date Collected:** 10/5/24 Date Received: 10/8/24

Analyzed By Extracted/Digested By Analysis Method 6020B **MCHATTICK ABOYER**

Sample Name: EB-2024 1004 **Date Collected:** 10/4/24

Lab Code: K2410651-002 Date Received: 10/8/24

Sample Matrix: Water

Analyzed By Extracted/Digested By Analysis Method

6020B **MCHATTICK ABOYER**

Sample Name: EB-2024 1005 **Date Collected:** 10/5/24

Lab Code: K2410651-003 Date Received: 10/8/24

Sample Matrix: Water

Analysis Method Extracted/Digested By Analyzed By

6020B **MCHATTICK ABOYER**

Sample Name: CS-SW-1 **Date Collected:** 10/5/24

Lab Code: K2410651-004 Date Received: 10/8/24 Sample Matrix: Water

Analyzed By Analysis Method Extracted/Digested By

6020B **MCHATTICK ABOYER** 7470A **KLINN KLINN**

Analyst Summary report

Client: Terraphase Engineering Inc.

Project: Upper Granite Creek Mines/0031.005.001 Service Request: K2410651

Sample Name: CS-SW-2

Lab Code: K2410651-005

Sample Matrix: Water **Date Collected:** 10/3/24

Date Received: 10/8/24

Analysis Method

6020B 7470A

Analyzed By Extracted/Digested By MCHATTICK ABOYER KLINN KLINN

Sample Name: CS-SW-2-Dup Lab Code: K2410651-006

Sample Matrix: Water **Date Collected:** 10/3/24 **Date Received:** 10/8/24

Analysis Method

6020B 7470A **Extracted/Digested By MCHATTICK**

ABOYER KLINN

Sample Name: CS-SW-3

Lab Code: K2410651-007 Water

KLINN

Sample Matrix:

Date Collected: 10/3/24 Date Received: 10/8/24

Analysis Method

6020B

7470A

Extracted/Digested By MCHATTICK KLINN

Analyzed By ABOYER KLINN

Analyzed By

CS-SW-4 **Sample Name:**

K2410651-008

Sample Matrix: Water **Date Collected:** 10/3/24 Date Received: 10/8/24

Analysis Method

6020B 7470A

Lab Code:

Extracted/Digested By

MCHATTICK **ABOYER KLINN KLINN**

Analyzed By

Analyst Summary report

Client: Terraphase Engineering Inc.

Project: Upper Granite Creek Mines/0031.005.001

Date Collected: 10/4/24

Date Received: 10/8/24

Service Request: K2410651

Sample Name: CS-SW-5

Lab Code: K2410651-009

Sample Matrix: Water

Analysis Method

Extracted/Digested By Analyzed By

6020B MCHATTICK ABOYER 7470A KLINN KLINN

Sample Name: CS-SW-6 Date Collected: 10/4/24

Lab Code: K2410651-010 **Date Received:** 10/8/24

Sample Matrix: Water

Analysis Method Extracted/Digested By Analyzed By

6020B MCHATTICK ABOYER 7470A KLINN KLINN

Sample Name: CS-SW-7 Date Collected: 10/4/24

Lab Code: K2410651-011 **Date Received:** 10/8/24

Sample Matrix: Water

Analysis Method Extracted/Digested By Analyzed By

6020B MCHATTICK ABOYER 7470A KLINN KLINN

Sample Name: CS-SW-8 Date Collected: 10/5/24

Lab Code: K2410651-012 **Date Received:** 10/8/24

Sample Matrix: Water

Analysis Method Extracted/Digested By Analyzed By

6020B MCHATTICK ABOYER 7470A KLINN KLINN



Sample Results

ALS Environmental—Kelso Laboratory 1317 South 13th Avenue, Kelso, WA 98626 Phone (360) 577-7222 Fax (360) 425-9096 www.alsglobal.com



Metals

ALS Environmental—Kelso Laboratory 1317 South 13th Avenue, Kelso, WA 98626 Phone (360) 577-7222 Fax (360) 425-9096 www.alsglobal.com

Analytical Report

Client: Terraphase Engineering Inc.

Upper Granite Creek Mines/0031.005.001

Service Request: K2410651

Date Collected: 10/05/24 08:30

Sample Matrix: Water

Date Received: 10/08/24 14:45

Sample Name:

EB-2024 1003

Basis: NA

Lab Code:

Project:

K2410651-001

| | Analysis | | | | | | | Date | |
|--------------|----------|--------|-------|------|------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 0.64 | ug/L | 0.50 | 0.09 | 1 | 10/21/24 16:32 | 10/18/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Upper Granite Creek Mines/0031.005.001

Service Request: K2410651 **Date Collected:** 10/04/24 08:00

Date Received: 10/08/24 14:45 Water

Sample Name: EB-2024 1004 Basis: NA

Lab Code: K2410651-002

Project:

Sample Matrix:

| | Analysis | | | | | | | Date | |
|--------------|----------|--------|-------|------|------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 3.12 | 11g/L | 0.50 | 0.09 | 1 | 10/21/24 16:34 | 10/18/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Project:

Sample Matrix:

Upper Granite Creek Mines/0031.005.001

Date Collected: 10/05/24 08:30

Service Request: K2410651

Water **Date Received:** 10/08/24 14:45

Sample Name: EB-2024 1005 Basis: NA

Lab Code: K2410651-003

| | Analysis | | | | | | | Date | |
|--------------|----------|--------|-------|------|------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Arsenic | 6020B | 0.11 J | ug/L | 0.50 | 0.09 | 1 | 10/21/24 16:36 | 10/18/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Service Request: K2410651 **Date Collected:** 10/05/24 10:04

Project: Upper Granite Creek Mines/0031.005.001 **Sample Matrix:** Water

Date Received: 10/08/24 14:45

CS-SW-1 **Sample Name:** Basis: NA

Lab Code: K2410651-004

Hardness by ICP-AES Calculation 20th Ed.

Analysis

| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Q |
|--------------------------|-----------|--------|-------|------|-------|------|----------------------|---|
| Hardness, Total as CaCO3 | SM 2340 B | 18.1 | mg/L | 0.09 | 0.023 | 1 | 10/21/24 16:39 | |

Analytical Report

Client: Terraphase Engineering Inc.

Service Request: K2410651 **Date Collected:** 10/05/24 10:04 **Project:** Upper Granite Creek Mines/0031.005.001

Date Received: 10/08/24 14:45 **Sample Matrix:** Water

Sample Name: CS-SW-1 Basis: NA

Lab Code: K2410651-004

| | Analysis | | | | | | | Date | |
|--------------|----------|---------|-------|-------|-------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Antimony | 6020B | 0.036 J | ug/L | 0.050 | 0.020 | 1 | 10/21/24 16:39 | 10/18/24 | |
| Arsenic | 6020B | 0.36 J | ug/L | 0.50 | 0.09 | 1 | 10/21/24 16:39 | 10/18/24 | |
| Cadmium | 6020B | ND U | ug/L | 0.020 | 0.008 | 1 | 10/21/24 16:39 | 10/18/24 | |
| Calcium | 6020B | 5590 | ug/L | 20 | 6 | 1 | 10/21/24 16:39 | 10/18/24 | |
| Chromium | 6020B | 0.11 J | ug/L | 0.20 | 0.03 | 1 | 10/21/24 16:39 | 10/18/24 | |
| Lead | 6020B | 0.013 J | ug/L | 0.020 | 0.006 | 1 | 10/21/24 16:39 | 10/18/24 | |
| Magnesium | 6020B | 996 | ug/L | 10 | 2 | 1 | 10/21/24 16:39 | 10/18/24 | |
| Mercury | 7470A | ND U | ug/L | 0.20 | 0.02 | 1 | 10/15/24 09:17 | 10/14/24 | |
| Silver | 6020B | ND U | ug/L | 0.020 | 0.009 | 1 | 10/21/24 16:39 | 10/18/24 | |
| Zinc | 6020B | ND U | ug/L | 2.0 | 0.5 | 1 | 10/21/24 16:39 | 10/18/24 | |

Analytical Report

Client: Terraphase Engineering Inc. **Service Request:** K2410651

Project: Upper Granite Creek Mines/0031.005.001

K2410651-005

Date Collected: 10/03/24 17:00

Sample Matrix: Water **Date Received:** 10/08/24 14:45

Basis: NA

CS-SW-2 **Sample Name:** Lab Code:

Hardness by ICP-AES Calculation 20th Ed.

Analysis

| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Q |
|--------------------------|-----------|--------|-------|------|-------|------|----------------------|---|
| Hardness, Total as CaCO3 | SM 2340 B | 19.7 | mg/L | 0.09 | 0.023 | 1 | 10/21/24 16:53 | |

Analytical Report

Client: Terraphase Engineering Inc.

Project: Upper Granite Creek Mines/0031.005.001 Date Collected: 10/03/24 17:00

Sample Matrix: Water Date Received: 10/08/24 14:45

Sample Name: CS-SW-2 Basis: NA

Lab Code: K2410651-005

Total Metals

| | Analysis | | | | | | | Date | |
|--------------|----------|---------|-------|-------|-------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Antimony | 6020B | 0.025 J | ug/L | 0.050 | 0.020 | 1 | 10/21/24 16:53 | 10/18/24 | |
| Arsenic | 6020B | 0.67 | ug/L | 0.50 | 0.09 | 1 | 10/21/24 16:53 | 10/18/24 | |
| Cadmium | 6020B | ND U | ug/L | 0.020 | 0.008 | 1 | 10/21/24 16:53 | 10/18/24 | |
| Calcium | 6020B | 6070 | ug/L | 20 | 6 | 1 | 10/21/24 16:53 | 10/18/24 | |
| Chromium | 6020B | 0.11 J | ug/L | 0.20 | 0.03 | 1 | 10/21/24 16:53 | 10/18/24 | |
| Lead | 6020B | 0.012 J | ug/L | 0.020 | 0.006 | 1 | 10/21/24 16:53 | 10/18/24 | |
| Magnesium | 6020B | 1110 | ug/L | 10 | 2 | 1 | 10/21/24 16:53 | 10/18/24 | |
| Mercury | 7470A | ND U | ug/L | 0.20 | 0.02 | 1 | 10/15/24 09:22 | 10/14/24 | |
| Silver | 6020B | ND U | ug/L | 0.020 | 0.009 | 1 | 10/21/24 16:53 | 10/18/24 | |
| Zinc | 6020B | ND U | ug/L | 2.0 | 0.5 | 1 | 10/21/24 16:53 | 10/18/24 | |

Service Request: K2410651

Analytical Report

Client: Terraphase Engineering Inc.

Water

per Granite Creek Mines/0031.005.001 Service Request: K2410651

Date Collected: 10/03/24 17:01

Project: Upper Granite Creek Mines/0031.005.001

Date Received: 10/08/24 14:45

Sample Matrix:

Sample Name:

CS-SW-2-Dup Basis: NA

Lab Code: K2410651-006

Hardness by ICP-AES Calculation 20th Ed.

Analysis

| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Q |
|--------------------------|-----------|--------|-------|------|-------|------|----------------|---|
| Hardness, Total as CaCO3 | SM 2340 B | 19.3 | mg/L | 0.09 | 0.023 | 1 | 10/21/24 16:55 | |

Analytical Report

Client: Terraphase Engineering Inc.

Service Request: K2410651 Upper Granite Creek Mines/0031.005.001 **Date Collected:** 10/03/24 17:01 **Project:**

Date Received: 10/08/24 14:45 **Sample Matrix:** Water

Sample Name: CS-SW-2-Dup Basis: NA

Lab Code: K2410651-006

| | Analysis | | | | | | | Date | |
|--------------|----------|---------|-------|-------|-------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Antimony | 6020B | 0.031 J | ug/L | 0.050 | 0.020 | 1 | 10/21/24 16:55 | 10/18/24 | |
| Arsenic | 6020B | 0.61 | ug/L | 0.50 | 0.09 | 1 | 10/21/24 16:55 | 10/18/24 | |
| Cadmium | 6020B | ND U | ug/L | 0.020 | 0.008 | 1 | 10/21/24 16:55 | 10/18/24 | |
| Calcium | 6020B | 5920 | ug/L | 20 | 6 | 1 | 10/21/24 16:55 | 10/18/24 | |
| Chromium | 6020B | 0.11 J | ug/L | 0.20 | 0.03 | 1 | 10/21/24 16:55 | 10/18/24 | |
| Lead | 6020B | 0.007 J | ug/L | 0.020 | 0.006 | 1 | 10/21/24 16:55 | 10/18/24 | |
| Magnesium | 6020B | 1090 | ug/L | 10 | 2 | 1 | 10/21/24 16:55 | 10/18/24 | |
| Mercury | 7470A | ND U | ug/L | 0.20 | 0.02 | 1 | 10/15/24 09:23 | 10/14/24 | |
| Silver | 6020B | ND U | ug/L | 0.020 | 0.009 | 1 | 10/21/24 16:55 | 10/18/24 | |
| Zinc | 6020B | ND U | ug/L | 2.0 | 0.5 | 1 | 10/21/24 16:55 | 10/18/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Service Request: K2410651 **Date Collected:** 10/03/24 16:00 Upper Granite Creek Mines/0031.005.001

Sample Matrix: Date Received: 10/08/24 14:45 Water

CS-SW-3 **Sample Name:** Basis: NA

Lab Code: K2410651-007

Project:

Hardness by ICP-AES Calculation 20th Ed.

Analysis

| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Q |
|--------------------------|-----------|--------|-------|------|-------|------|----------------------|---|
| Hardness, Total as CaCO3 | SM 2340 B | 21.0 | mg/L | 0.09 | 0.023 | 1 | 10/21/24 16:57 | |

Analytical Report

Client: Terraphase Engineering Inc.

Service Request: K2410651 **Date Collected:** 10/03/24 16:00 **Project:** Upper Granite Creek Mines/0031.005.001

Date Received: 10/08/24 14:45 **Sample Matrix:** Water

Sample Name: CS-SW-3 Basis: NA

Lab Code: K2410651-007

Total Metals

| | Analysis | | | | | | | Date | |
|--------------|----------|---------|-------|-------|-------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Antimony | 6020B | 0.038 J | ug/L | 0.050 | 0.020 | 1 | 10/21/24 16:57 | 10/18/24 | |
| Arsenic | 6020B | 0.87 | ug/L | 0.50 | 0.09 | 1 | 10/21/24 16:57 | 10/18/24 | |
| Cadmium | 6020B | ND U | ug/L | 0.020 | 0.008 | 1 | 10/21/24 16:57 | 10/18/24 | |
| Calcium | 6020B | 6490 | ug/L | 20 | 6 | 1 | 10/21/24 16:57 | 10/18/24 | |
| Chromium | 6020B | 0.12 J | ug/L | 0.20 | 0.03 | 1 | 10/21/24 16:57 | 10/18/24 | |
| Lead | 6020B | 0.012 J | ug/L | 0.020 | 0.006 | 1 | 10/21/24 16:57 | 10/18/24 | |
| Magnesium | 6020B | 1170 | ug/L | 10 | 2 | 1 | 10/21/24 16:57 | 10/18/24 | |
| Mercury | 7470A | ND U | ug/L | 0.20 | 0.02 | 1 | 10/15/24 09:25 | 10/14/24 | |
| Silver | 6020B | ND U | ug/L | 0.020 | 0.009 | 1 | 10/21/24 16:57 | 10/18/24 | |
| Zinc | 6020B | ND U | ug/L | 2.0 | 0.5 | 1 | 10/21/24 16:57 | 10/18/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Service Request: K2410651 **Date Collected:** 10/03/24 14:19 Upper Granite Creek Mines/0031.005.001

Sample Matrix: Date Received: 10/08/24 14:45 Water

CS-SW-4 **Sample Name:** Basis: NA

Lab Code: K2410651-008

Project:

Hardness by ICP-AES Calculation 20th Ed.

Analysis

| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Q |
|--------------------------|-----------|--------|-------|------|-------|------|----------------------|---|
| Hardness, Total as CaCO3 | SM 2340 B | 27.5 | mg/L | 0.09 | 0.023 | 1 | 10/21/24 16:59 | |

Analytical Report

Client: Terraphase Engineering Inc.

Project: Upper Granite Creek Mines/0031.005.001 Date Collected: 10/03/24 14:19

Sample Matrix: Water Date Received: 10/08/24 14:45

Sample Name: CS-SW-4 Basis: NA

Lab Code: K2410651-008

Total Metals

| | Analysis | | | | | | | Date | |
|--------------|----------|---------|-------|-------|-------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Antimony | 6020B | 0.036 J | ug/L | 0.050 | 0.020 | 1 | 10/21/24 16:59 | 10/18/24 | |
| Arsenic | 6020B | 0.92 | ug/L | 0.50 | 0.09 | 1 | 10/21/24 16:59 | 10/18/24 | |
| Cadmium | 6020B | ND U | ug/L | 0.020 | 0.008 | 1 | 10/21/24 16:59 | 10/18/24 | |
| Calcium | 6020B | 8410 | ug/L | 20 | 6 | 1 | 10/21/24 16:59 | 10/18/24 | |
| Chromium | 6020B | 0.14 J | ug/L | 0.20 | 0.03 | 1 | 10/21/24 16:59 | 10/18/24 | |
| Lead | 6020B | ND U | ug/L | 0.020 | 0.006 | 1 | 10/21/24 16:59 | 10/18/24 | |
| Magnesium | 6020B | 1590 | ug/L | 10 | 2 | 1 | 10/21/24 16:59 | 10/18/24 | |
| Mercury | 7470A | ND U | ug/L | 0.20 | 0.02 | 1 | 10/15/24 09:27 | 10/14/24 | |
| Silver | 6020B | ND U | ug/L | 0.020 | 0.009 | 1 | 10/21/24 16:59 | 10/18/24 | |
| Zinc | 6020B | ND U | ug/L | 2.0 | 0.5 | 1 | 10/21/24 16:59 | 10/18/24 | |

Service Request: K2410651

Analytical Report

Client: Terraphase Engineering Inc.

aphase Engineering Inc. Service Request: K2410651

 Project:
 Upper Granite Creek Mines/0031.005.001
 Date Collected:
 10/04/24 09:25

 Sample Matrix:
 Water
 Date Received:
 10/08/24 14:45

Sample Name: CS-SW-5 Basis: NA

Lab Code: K2410651-009

Hardness by ICP-AES Calculation 20th Ed.

Analysis

| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Q |
|--------------------------|-----------|--------|-------|------|-------|------|----------------------|---|
| Hardness, Total as CaCO3 | SM 2340 B | 31.8 | mg/L | 0.09 | 0.023 | 1 | 10/21/24 17:01 | |

Analytical Report

Client: Terraphase Engineering Inc.

Project: Upper Granite Creek Mines/0031.005.001 Date Collected: 10/04/24 09:25

Sample Matrix: Water Date Received: 10/08/24 14:45

Sample Name: CS-SW-5 Basis: NA

Lab Code: K2410651-009

Total Metals

| | Analysis | | | | | | | Date | |
|--------------|----------|---------|-------|-------|-------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Antimony | 6020B | 0.098 | ug/L | 0.050 | 0.020 | 1 | 10/21/24 17:01 | 10/18/24 | |
| Arsenic | 6020B | 1.78 | ug/L | 0.50 | 0.09 | 1 | 10/21/24 17:01 | 10/18/24 | |
| Cadmium | 6020B | 0.010 J | ug/L | 0.020 | 0.008 | 1 | 10/21/24 17:01 | 10/18/24 | |
| Calcium | 6020B | 9550 | ug/L | 20 | 6 | 1 | 10/21/24 17:01 | 10/18/24 | |
| Chromium | 6020B | 0.11 J | ug/L | 0.20 | 0.03 | 1 | 10/21/24 17:01 | 10/18/24 | |
| Lead | 6020B | 0.018 J | ug/L | 0.020 | 0.006 | 1 | 10/21/24 17:01 | 10/18/24 | |
| Magnesium | 6020B | 1930 | ug/L | 10 | 2 | 1 | 10/21/24 17:01 | 10/18/24 | |
| Mercury | 7470A | ND U | ug/L | 0.20 | 0.02 | 1 | 10/15/24 09:28 | 10/14/24 | |
| Silver | 6020B | ND U | ug/L | 0.020 | 0.009 | 1 | 10/21/24 17:01 | 10/18/24 | |
| Zinc | 6020B | 1.8 J | ug/L | 2.0 | 0.5 | 1 | 10/21/24 17:01 | 10/18/24 | |

Service Request: K2410651

Analytical Report

Client: Terraphase Engineering Inc.

Service Request: K2410651 **Date Collected:** 10/04/24 15:23 Upper Granite Creek Mines/0031.005.001

Sample Matrix: Date Received: 10/08/24 14:45 Water

CS-SW-6 **Sample Name:** Basis: NA

Lab Code: K2410651-010

Project:

Hardness by ICP-AES Calculation 20th Ed.

Analysis

| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Q |
|--------------------------|-----------|--------|-------|------|-------|------|----------------|---|
| Hardness, Total as CaCO3 | SM 2340 B | 32.3 | mg/L | 0.09 | 0.023 | 1 | 10/21/24 17:03 | |

Analytical Report

Client: Terraphase Engineering Inc.

Service Request: K2410651 **Date Collected:** 10/04/24 15:23 **Project:** Upper Granite Creek Mines/0031.005.001

Date Received: 10/08/24 14:45 **Sample Matrix:** Water

Sample Name: CS-SW-6 Basis: NA

Lab Code: K2410651-010

Total Metals

| | Analysis | | | | | | | Date | |
|---------------------|----------|---------|-------|-------|-------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Antimony | 6020B | 0.076 | ug/L | 0.050 | 0.020 | 1 | 10/21/24 17:03 | 10/18/24 | |
| Arsenic | 6020B | 2.04 | ug/L | 0.50 | 0.09 | 1 | 10/21/24 17:03 | 10/18/24 | |
| Cadmium | 6020B | ND U | ug/L | 0.020 | 0.008 | 1 | 10/21/24 17:03 | 10/18/24 | |
| Calcium | 6020B | 9710 | ug/L | 20 | 6 | 1 | 10/21/24 17:03 | 10/18/24 | |
| Chromium | 6020B | 0.11 J | ug/L | 0.20 | 0.03 | 1 | 10/21/24 17:03 | 10/18/24 | |
| Lead | 6020B | 0.013 J | ug/L | 0.020 | 0.006 | 1 | 10/21/24 17:03 | 10/18/24 | |
| Magnesium | 6020B | 1960 | ug/L | 10 | 2 | 1 | 10/21/24 17:03 | 10/18/24 | |
| Mercury | 7470A | ND U | ug/L | 0.20 | 0.02 | 1 | 10/15/24 09:33 | 10/14/24 | |
| Silver | 6020B | ND U | ug/L | 0.020 | 0.009 | 1 | 10/21/24 17:03 | 10/18/24 | |
| Zinc | 6020B | 0.7 J | ug/L | 2.0 | 0.5 | 1 | 10/21/24 17:03 | 10/18/24 | |

Analytical Report

Client: Terraphase Engineering Inc.

Service Request: K2410651 **Date Collected:** 10/04/24 13:34 Upper Granite Creek Mines/0031.005.001

Date Received: 10/08/24 14:45 **Sample Matrix:** Water

CS-SW-7 Basis: NA **Sample Name:**

Lab Code: K2410651-011

Project:

Hardness by ICP-AES Calculation 20th Ed.

Analysis

| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Q |
|--------------------------|-----------|--------|-------|------|-------|------|----------------|---|
| Hardness, Total as CaCO3 | SM 2340 B | 36.3 | mg/L | 0.09 | 0.023 | 1 | 10/21/24 17:05 | |

Analytical Report

Client: Terraphase Engineering Inc.

Project: Upper Granite Creek Mines/0031.005.001 Date Collected: 10/04/24 13:34

Sample Matrix: Water Date Received: 10/08/24 14:45

Sample Name: CS-SW-7 Basis: NA

Lab Code: K2410651-011

Total Metals

| | Analysis | | | | | | | Date | |
|---------------------|----------|---------|-------|-------|-------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Antimony | 6020B | 0.104 | ug/L | 0.050 | 0.020 | 1 | 10/21/24 17:05 | 10/18/24 | |
| Arsenic | 6020B | 1.99 | ug/L | 0.50 | 0.09 | 1 | 10/21/24 17:05 | 10/18/24 | |
| Cadmium | 6020B | 0.019 J | ug/L | 0.020 | 0.008 | 1 | 10/21/24 17:05 | 10/18/24 | |
| Calcium | 6020B | 10900 | ug/L | 20 | 6 | 1 | 10/21/24 17:05 | 10/18/24 | |
| Chromium | 6020B | 0.09 J | ug/L | 0.20 | 0.03 | 1 | 10/21/24 17:05 | 10/18/24 | |
| Lead | 6020B | 0.022 | ug/L | 0.020 | 0.006 | 1 | 10/21/24 17:05 | 10/18/24 | |
| Magnesium | 6020B | 2200 | ug/L | 10 | 2 | 1 | 10/21/24 17:05 | 10/18/24 | |
| Mercury | 7470A | ND U | ug/L | 0.20 | 0.02 | 1 | 10/15/24 09:35 | 10/14/24 | |
| Silver | 6020B | ND U | ug/L | 0.020 | 0.009 | 1 | 10/21/24 17:05 | 10/18/24 | |
| Zinc | 6020B | 0.8 J | ug/L | 2.0 | 0.5 | 1 | 10/21/24 17:05 | 10/18/24 | |

Service Request: K2410651

Analytical Report

Client: Terraphase Engineering Inc.

Service Request: K2410651

Date Collected: 10/05/24 10:35 **Project:** Upper Granite Creek Mines/0031.005.001 **Date Received:** 10/08/24 14:45 **Sample Matrix:** Water

CS-SW-8 **Sample Name:** Basis: NA

Lab Code: K2410651-012

Hardness by ICP-AES Calculation 20th Ed.

Analysis

| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Q |
|--------------------------|-----------|--------|-------|------|-------|------|----------------|---|
| Hardness, Total as CaCO3 | SM 2340 B | 36.7 | mg/L | 0.09 | 0.023 | 1 | 10/21/24 17:07 | |

Analytical Report

Client: Terraphase Engineering Inc.

Service Request: K2410651 Upper Granite Creek Mines/0031.005.001 **Date Collected:** 10/05/24 10:35 **Project:**

Date Received: 10/08/24 14:45 **Sample Matrix:** Water

Sample Name: CS-SW-8 Basis: NA

Lab Code: K2410651-012

Total Metals

| | Analysis | | | | | | | Date | |
|--------------|----------|---------|-------|-------|-------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Antimony | 6020B | 0.108 | ug/L | 0.050 | 0.020 | 1 | 10/21/24 17:07 | 10/18/24 | |
| Arsenic | 6020B | 2.21 | ug/L | 0.50 | 0.09 | 1 | 10/21/24 17:07 | 10/18/24 | |
| Cadmium | 6020B | 0.020 J | ug/L | 0.020 | 0.008 | 1 | 10/21/24 17:07 | 10/18/24 | |
| Calcium | 6020B | 10900 | ug/L | 20 | 6 | 1 | 10/21/24 17:07 | 10/18/24 | |
| Chromium | 6020B | 0.11 J | ug/L | 0.20 | 0.03 | 1 | 10/21/24 17:07 | 10/18/24 | |
| Lead | 6020B | 0.084 | ug/L | 0.020 | 0.006 | 1 | 10/21/24 17:07 | 10/18/24 | |
| Magnesium | 6020B | 2310 | ug/L | 10 | 2 | 1 | 10/21/24 17:07 | 10/18/24 | |
| Mercury | 7470A | ND U | ug/L | 0.20 | 0.02 | 1 | 10/15/24 09:36 | 10/14/24 | |
| Silver | 6020B | ND U | ug/L | 0.020 | 0.009 | 1 | 10/21/24 17:07 | 10/18/24 | |
| Zinc | 6020B | 0.8 J | ug/L | 2.0 | 0.5 | 1 | 10/21/24 17:07 | 10/18/24 | |



QC Summary Forms

ALS Environmental—Kelso Laboratory 1317 South 13th Avenue, Kelso, WA 98626 Phone (360) 577-7222 Fax (360) 425-9096 www.alsglobal.com



Metals

ALS Environmental—Kelso Laboratory 1317 South 13th Avenue, Kelso, WA 98626 Phone (360) 577-7222 Fax (360) 425-9096 www.alsglobal.com

Analytical Report

Client: Terraphase Engineering Inc. Service Request: K2410651

Project:Upper Granite Creek Mines/0031.005.001Date Collected: NASample Matrix:WaterDate Received: NA

Sample Name: Method Blank Basis: NA

Lab Code: KQ2416479-01

Total Metals

| | Analysis | | | | | | | Date | |
|--------------|----------|--------|-------|-------|-------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Antimony | 6020B | ND U | ug/L | 0.050 | 0.020 | 1 | 10/21/24 17:13 | 10/18/24 | |
| Arsenic | 6020B | ND U | ug/L | 0.50 | 0.09 | 1 | 10/21/24 17:13 | 10/18/24 | |
| Cadmium | 6020B | ND U | ug/L | 0.020 | 0.008 | 1 | 10/21/24 17:13 | 10/18/24 | |
| Calcium | 6020B | ND U | ug/L | 20 | 6 | 1 | 10/21/24 17:13 | 10/18/24 | |
| Chromium | 6020B | ND U | ug/L | 0.20 | 0.03 | 1 | 10/21/24 17:13 | 10/18/24 | |
| Lead | 6020B | ND U | ug/L | 0.020 | 0.006 | 1 | 10/21/24 17:13 | 10/18/24 | |
| Magnesium | 6020B | ND U | ug/L | 10 | 2 | 1 | 10/21/24 17:13 | 10/18/24 | |
| Silver | 6020B | ND U | ug/L | 0.020 | 0.009 | 1 | 10/21/24 17:13 | 10/18/24 | |
| Zinc | 6020B | ND U | ug/L | 2.0 | 0.5 | 1 | 10/21/24 17:13 | 10/18/24 | |

Analytical Report

Client: Terraphase Engineering Inc. Service Request: K2410651

Project:Upper Granite Creek Mines/0031.005.001Date Collected: NASample Matrix:WaterDate Received: NA

Sample Name: Method Blank Basis: NA

Lab Code: KQ2416532-01

Total Metals

| | Analysis | | | | | | | Date | |
|--------------|----------|--------|--------|------|------|------|----------------|-----------|---|
| Analyte Name | Method | Result | Units | MRL | MDL | Dil. | Date Analyzed | Extracted | Q |
| Mercury | 7470A | ND U | 119/[, | 0.20 | 0.02 | 1 | 10/15/24 09:14 | 10/14/24 | |

QA/QC Report

Client: Terraphase Engineering Inc.

Upper Granite Creek Mines/0031.005.001

Sample Matrix: Water

Service Request: Date Collected:

K2410651

10/05/24

Date Received: Date Analyzed: 10/08/24 10/21/24

Date Extracted:

Basis:

10/18/24

Matrix Spike Summary

Total Metals

Sample Name: CS-SW-1 **Units:**

ug/L NA

Lab Code: **Analysis Method:**

Project:

K2410651-004 6020B

Prep Method:

EPA CLP ILM04.0

Matrix Spike

KQ2416479-04

| Analyte Name | Sample Result | Result | Spike Amount | % Rec | % Rec Limits |
|--------------|---------------|--------|--------------|-------|--------------|
| Antimony | 0.036 J | 9.93 | 10.0 | 99 | 75-125 |
| Arsenic | 0.36 J | 51.1 | 50.0 | 101 | 75-125 |
| Cadmium | ND U | 25.8 | 25.0 | 103 | 75-125 |
| Calcium | 5590 | 15900 | 10300 | 100 | 75-125 |
| Chromium | 0.11 J | 10.6 | 10.0 | 105 | 75-125 |
| Lead | 0.013 J | 51.9 | 50.0 | 104 | 75-125 |
| Magnesium | 996 | 11700 | 10300 | 104 | 75-125 |
| Silver | ND U | 13.4 | 12.5 | 107 | 75-125 |
| Zinc | ND U | 24.9 | 25.0 | 100 | 75-125 |

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

Matrix Spike and Matrix Spike Duplicate Data is presented for information purposes only. The matrix may or may not be relevant to samples reported in this report. The laboratory evaluates system performance based on the LCS and LCSD control limits.

Printed 10/22/2024 4:18:38 PM

QA/QC Report

Client: Terraphase Engineering Inc. **Project:**

Upper Granite Creek Mines/0031.005.001

Sample Matrix: Water

Service Request: Date Collected:

K2410651

Date Received:

10/05/24 10/08/24

Date Analyzed:

10/15/24

Date Extracted:

10/14/24

Matrix Spike Summary

Total Metals

CS-SW-1 Sample Name:

K2410651-004

7470A

Units: Basis:

ug/L NA

Analysis Method: Prep Method:

Lab Code:

Method

Matrix Spike

KQ2416532-04

Analyte Name Sample Result Result Spike Amount % Rec % Rec Limits ND U Mercury 4.91

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

Matrix Spike and Matrix Spike Duplicate Data is presented for information purposes only. The matrix may or may not be relevant to samples reported in this report. The laboratory evaluates system performance based on the LCS and LCSD control limits.

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ALS Group USA, Corp.

dba ALS Environmental

QA/QC Report

Client: Terraphase Engineering Inc.

Service Request: K2410651

Project Upper Granite Creek Mines/0031.005.001

Date Collected: 10/05/24

Sample Matrix: Water

Sample Name:

Date Received: 10/08/24 **Date Analyzed:** 10/21/24

Replicate Sample Summary
Total Metals

CS-SW-1

Units: ug/L

Lab Code: K2410651-004

Basis: NA

Duplicate Sample

| | Analysis | | | Sample | Sample KQ2416479-03 | | | |
|--------------|----------|-------|-------|---------|------------------------|---------|------|------------------|
| Analyte Name | Method | MRL | MDL | Result | Result | Average | RPD | RPD Limit |
| Antimony | 6020B | 0.050 | 0.020 | 0.036 J | 0.027 J | 0.032 | 29 # | 20 |
| Arsenic | 6020B | 0.50 | 0.09 | 0.36 J | 0.33 J | 0.35 | 9 | 20 |
| Cadmium | 6020B | 0.020 | 0.008 | ND U | ND U | ND | - | 20 |
| Calcium | 6020B | 20 | 6 | 5590 | 5530 | 5560 | 1 | 20 |
| Chromium | 6020B | 0.20 | 0.03 | 0.11 J | 0.12 J | 0.12 | 9 | 20 |
| Lead | 6020B | 0.020 | 0.006 | 0.013 J | 0.008 J | 0.011 | 48 # | 20 |
| Magnesium | 6020B | 10 | 2 | 996 | 1020 | 1010 | 2 | 20 |
| Silver | 6020B | 0.020 | 0.009 | ND U | ND U | ND | - | 20 |
| Zinc | 6020B | 2.0 | 0.5 | ND U | ND U | ND | = | 20 |

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

ALS Group USA, Corp.

dba ALS Environmental

QA/QC Report

Client: Terraphase Engineering Inc. Service Request: K2410651

Project Upper Granite Creek Mines/0031.005.001 Date Collected: 10/05/24

Sample Matrix: Water Date Received: 10/08/24

Date Analyzed: 10/15/24

Replicate Sample Summary

Total Metals

Sample Name: CS-SW-1 Units: ug/L

Lab Code: K2410651-004 **Basis:** NA

Duplicate

Sample **VO2416532 03**

Analysis Sample KQ2416532-03 **Analyte Name** Method **MRL MDL** Result Result Average RPD **RPD Limit** 7470A ND U Mercury 0.20 0.02 ND U ND 20

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

QA/QC Report

Client: Terraphase Engineering Inc.

Service Request: K2410651 **Project:** Upper Granite Creek Mines/0031.005.001 **Date Analyzed:** 10/21/24

Sample Matrix: Water

Lab Control Sample Summary Total Metals

Units:ug/L Basis:NA

Lab Control Sample

KQ2416479-02

| Analyte Name | Analytical Method | Result | Spike Amount | % Rec | % Rec Limits |
|--------------|--------------------------|--------|--------------|-------|--------------|
| Antimony | 6020B | 9.49 | 10.0 | 95 | 80-120 |
| Arsenic | 6020B | 50.1 | 50.0 | 100 | 80-120 |
| Cadmium | 6020B | 25.3 | 25.0 | 101 | 80-120 |
| Calcium | 6020B | 10000 | 10300 | 98 | 80-120 |
| Chromium | 6020B | 10.2 | 10.0 | 102 | 80-120 |
| Lead | 6020B | 51.0 | 50.0 | 102 | 80-120 |
| Magnesium | 6020B | 10600 | 10300 | 103 | 80-120 |
| Silver | 6020B | 12.9 | 12.5 | 103 | 80-120 |
| Zinc | 6020B | 25.4 | 25.0 | 101 | 80-120 |

QA/QC Report

Client: Terraphase Engineering Inc.

Service Request: K2410651 **Project:** Upper Granite Creek Mines/0031.005.001 **Date Analyzed:** 10/15/24

Sample Matrix: Water

> **Lab Control Sample Summary Total Metals**

> > Units:ug/L Basis:NA

Lab Control Sample

KQ2416532-02

| Analyte Name | Analytical Method | Result | Spike Amount | % Rec | % Rec Limits |
|--------------|--------------------------|--------|--------------|-------|--------------|
| Mercury | 7470A | 4.68 | 5.00 | 94 | 80-120 |

Appendix D

Data Validation Reports





Data Validation Report

Project Name: Upper Granite Creek Mines Lab Reference Number: K2410639

| Project Number: 0031.005.001 | Laboratory: ALS Environmental Laboratory |
|---|--|
| Validated by: Marie Mueller | Matrix: Soil |
| Sampling Date: 10/2/2024 & 10/3/2024 | Number of Samples: 20 |
| Data Validation Report Date: 11/13/2024 | Analytical Report Date: 10/23/2024 |

The quality control (QC) elements that were reviewed are listed below.

| Data Package Completeness | ٧ | Surrogate Compound Recovery | NA |
|--|----|---|----|
| Verification of EDD to Hardcopy Data Package | ٧ | Sample Duplicate Analysis | 1 |
| Chain-of-Custody and Sample Preservation | 1 | Blank Spike/Blank Spike Duplicate Sample Analyses | NA |
| Holding Times | ٧ | Matrix Spike/Matrix Spike Duplicate Sample Analyses | 1 |
| Retention Time Windows | NE | Trip Blank Sample Analysis | NA |
| Initial Calibration | NE | Equipment Blank Sample Analysis | 1 |
| Initial Calibration Verification | NE | Field Duplicate Sample Analysis | 1 |
| Continuing Calibration | NE | Reference Material Analysis | NE |
| Method Blank Analysis | 1 | Compound Quantitation | ٧ |
| Laboratory Control Samples | ٧ | | |
| | | | |

^{√ –} Method quality objectives (MQO) and QC criteria have been met. No outliers are noted or discussed.

NA – Not applicable

NE – Not evaluated

P – Pending

Overall Assessment

All data, as qualified, are acceptable for use.

Data Package Completeness

The data package included the required elements: chain-of-custody, sample receipt checklist, case narrative, results, and QC results.

Verification of EDD to Hardcopy Data Package

Sample results and related quality control data were received in both an electronic and hardcopy format. Electronic data were verified against the laboratory report; no errors were found.

^{1 –} Quality control results are discussed below, but no data were qualified.

^{2 –} Quality control outliers that impact the reported data were noted. Data qualifiers were issued as discussed in this Data Validation Report.

Chain-of-Custody

All sample identification (ID) numbers listed on the chain-of-custody record are consistent with the sample ID reported in the EDD and hardcopy data package. Several samples listed in the chain-of-custody report include samples that were held and not analyzed by the laboratory.

Chain-of-custody 140510 includes sample IDs for laboratory reports K2410639, K2410642, K2410643, and K2410651.

Chain-of-custody 140510 erroneously notes that equipment blank sample, EB-2024 1003, was sampled on 10/5/2024, however it was sampled on 10/3/2024.

Sample Preservation

Samples were received intact, at temperatures of 4.6, 5.7, 4.4, 4.5, and 4.5 degrees Celsius. Proper preservation includes samples chilled to ≤6.0 degrees Celsius.

Laboratory staff observed temperature blanks at 9.6, 16.8, 6.0, 9.4, and 18.3 degrees Celsius. In the Cooler Receipt Form, laboratory staff noted that ice was at the top of coolers on top of samples and that the temperature blank was under the samples and is not necessarily indicative of sample temperature.

Holding Times

All samples were analyzed within the holding time.

Retention Time Windows

Not evaluated.

Initial Calibration

Not evaluated.

Initial Calibration Verification

Not evaluated.

Continuing Calibration

Not evaluated.

Method Blank Analysis

The method blank sample (lab code KQ2416652-01) had a lead detection of 0.043 mg/kg between the method detection limit (MDL) and the method reporting limit (MRL); the detection was flagged "J" because it was between the MDL and MRL, but project sample data was not qualified.

No other target compounds were detected in the method blank samples.



Laboratory Control Samples

All percent recovery values and relative percent differences (RPDs) for laboratory control samples were within acceptable criteria established by the laboratory for the respective testing methods.

Surrogate Compound Recovery

Surrogate compound recovery was not performed for this sample batch.

Sample Duplicate Analysis

The RPD for sample duplicate of UUMM-WRA-0.5-2 (lab code K2410639-002) analyte lead was calculated by the lab to be above the laboratory limits, and the RPD result was flagged with "*" indicating values were outside control criteria. The laboratory noted in the case narrative that, "the variability in the results was attributed to the heterogeneous character of the sample. Standard mixing techniques were used but were not sufficient for complete homogenization of this sample."

The RPD for sample duplicate of UMM-WRB-0.5-1 (lab code K2410639-002) analyte mercury was calculated by the lab to be above the laboratory limits, and the RPD result was flagged with "*" indicating values were outside control criteria. The laboratory noted in the case narrative that, "the variability in the results was attributed to the heterogeneous character of the sample. Standard mixing techniques were used but were not sufficient for complete homogenization of this sample."

All other RPDs for sample duplicates were within acceptable criteria established by the laboratory for the respective testing methods.

Blank Spike/Blank Spike Duplicate Sample Analyses

Blank spike and blank spike duplicate sample analyses were not performed for this sample batch.

Matrix Spike/Matrix Spike Duplicate Sample Analyses

All percent recoveries and RPDs for matrix spikes (MSs) and matrix spike duplicates (MSDs) were within acceptable criteria established by the laboratory for the respective testing methods, except for the following:

 High recovery was observed for Arsenic in the MS (sample UUMM-WRA-0.5-2 lab code K2410639-002 test batch ID 446350). The result was flagged "#" indicating the control criteria was not applicable.

The laboratory report notes that "Matrix Spike and Matrix Spike Duplicate Data is presented for information purposes only. The matrix may or may not be relevant to samples reported in this report. The laboratory evaluates system performance based on the LCS and LCSD control limits."

Trip Blank Sample Analysis

A trip blank sample was not collected for this sample batch.



Equipment Blank Sample Analysis

Equipment blank sample "EB-2024 1003" was collected on October 3, 2024 and is associated with all samples collected in this sample delivery group. This equipment blank sample was analyzed in report K2410651. The following analyte was detected in the equipment blank sample:

Equipment Blank Analysis

| Analyte | Detection | Discussion |
|---------|-----------|---|
| Arsenic | 0.64 μg/L | Arsenic was detected in project samples at concentrations greater than 5 times the associated blank; therefore no results were qualified. |

Field Duplicate Analyses

Samples UUMM-WRA-0.5-3-DUP, LMM-WRA-0.5-4-DUP, and LMM-WRB-0.5-1-DUP were collected as field duplicates of UUMM-WRA-0.5-3, LMM-WRA-0.5-4, and LMM-WRB-0.5-1, respectively. All RPDs were within the accepted 50% limit except for the following:

Lead, in analysis of Total Metals – IVBA was detected in UUMM-WRA-0.5-3 and UUMM-WRA-0.5-3-DUP at concentrations of 12.6 and 7.14 mg/Kg, respectively. The calculated RPD is 55.5%.

Reference Material Analysis

No reference material analysis was performed.

Compound Quantitation

The laboratory did not apply any flags to project samples in this sample batch.

Sample Index

| Sample Name | Lab ID | Matrix | Date Collected |
|--------------------|--------------|--------|----------------|
| LMM-WRB-0.5-3-DS | K2410639-001 | Soil | 10/3/2024 |
| UUMM-WRA-0.5-2 | K2410639-002 | Soil | 10/2/2024 |
| UUMM-WRF-0.5-1 | K2410639-003 | Soil | 10/2/2024 |
| UUMM-WRD-0.5-1 | K2410639-004 | Soil | 10/2/2024 |
| UUMM-WRA-0.5-3 | K2410639-005 | Soil | 10/2/2024 |
| UUMM-WRA-0.5-3-DUP | K2410639-006 | Soil | 10/2/2024 |
| UUMM-WRA-0.5-3-DS | K2410639-007 | Soil | 10/2/2024 |
| UMM-WRB-0.5-2 | K2410639-008 | Soil | 10/2/2024 |
| UMM-WRB-0.5-2-DS | K2410639-009 | Soil | 10/2/2024 |
| LMM-WRB-0.5-1 | K2410639-010 | Soil | 10/3/2024 |
| LMM-WRB-0.5-1-DUP | K2410639-011 | Soil | 10/3/2024 |
| CM-WRC-0.5-4 | K2410639-012 | Soil | 10/3/2024 |
| UMM-WRA-0.5-1 | K2410639-013 | Soil | 10/2/2024 |



Data Validation Report

| Sample Name | Lab ID | Matrix | Date Collected |
|-------------------|--------------|--------|----------------|
| UMM-WRA-0.5-3 | K2410639-014 | Soil | 10/2/2024 |
| UMM-WRA-0.5-1-DS | K2410639-015 | Soil | 10/2/2024 |
| LMM-WRA-0.5-3 | K2410639-016 | Soil | 10/3/2024 |
| LMM-WRA-0.5-3-DS | K2410639-017 | Soil | 10/3/2024 |
| LMM-WRA-0.5-4 | K2410639-018 | Soil | 10/3/2024 |
| LMM-WRA-0.5-4-DUP | K2410639-019 | Soil | 10/3/2024 |
| UMM-WRB-0.5-1 | K2410639-020 | Soil | 10/2/2024 |

END OF REPORT





Data Validation Report

Project Name: Upper Granite Creek Mines Lab Reference Number: K2410642

| Project Number: 0031.005.001 | Laboratory: ALS Environmental Laboratory |
|---|--|
| Validated by: Marie Mueller | Matrix: Soil |
| Sampling Date: 10/2/2024 - 10/5/2024 | Number of Samples: 20 |
| Data Validation Report Date: 11/13/2024 | Analytical Report Date: 11/01/2024 |

The quality control (QC) elements that were reviewed are listed below.

| Data Package Completeness | ٧ | Surrogate Compound Recovery | NA |
|--|----|---|----|
| Verification of EDD to Hardcopy Data Package | ٧ | Sample Duplicate Analysis | ٧ |
| Chain-of-Custody and Sample Preservation | 1 | Blank Spike/Blank Spike Duplicate Sample Analyses | NA |
| Holding Times | ٧ | Matrix Spike/Matrix Spike Duplicate Sample Analyses | 1 |
| Retention Time Windows | NE | Trip Blank Sample Analysis | NA |
| Initial Calibration | NE | Equipment Blank Sample Analysis | 1 |
| Initial Calibration Verification | NE | Field Duplicate Sample Analysis | NA |
| Continuing Calibration | NE | Reference Material Analysis | NE |
| Method Blank Analysis | 1 | Compound Quantitation | ٧ |
| Laboratory Control Samples | ٧ | | |
| | | | |

V − Method quality objectives (MQO) and QC criteria have been met. No outliers are noted or discussed.

NA – Not applicable

NE – Not evaluated

P – Pending

Overall Assessment

All data, as qualified, are acceptable for use.

Data Package Completeness

The data package included the required elements: chain-of-custody, sample receipt checklist, case narrative, results, and QC results.

Verification of EDD to Hardcopy Data Package

Sample results and related quality control data were received in both an electronic and hardcopy format. Electronic data were verified against the laboratory report; no errors were found.

^{1 –} Quality control results are discussed below, but no data were qualified.

^{2 –} Quality control outliers that impact the reported data were noted. Data qualifiers were issued as discussed in this Data Validation Report.

Chain-of-Custody

All sample identification (ID) numbers listed on the chain-of-custody record are consistent with the sample ID reported in the EDD and hardcopy data package. Several samples listed in the chain-of-custody report include samples that were held and not analyzed by the laboratory.

Chain-of-custody 140510 includes sample IDs for laboratory reports K2410639, K2410642, K2410643, and K2410651.

Chain-of-custody 140510 erroneously notes that equipment blank sample, EB-2024 1003, was sampled on 10/5/2024, however it was sampled on 10/3/2024.

Sample Preservation

Samples were received intact, at temperatures of 4.6, 5.7, 4.4, 4.5, and 4.5 degrees Celsius. Proper preservation includes samples chilled to ≤6.0 degrees Celsius.

Laboratory staff observed temperature blanks at 9.6, 16.8, 6.0, 9.4, and 18.3 degrees Celsius. In the Cooler Receipt Form, laboratory staff noted that ice was at the top of coolers on top of samples and that the temperature blank was under the samples and is not necessarily indicative of sample temperature.

Holding Times

All samples were analyzed within the holding time.

Retention Time Windows

Not evaluated.

Initial Calibration

Not evaluated.

Initial Calibration Verification

Not evaluated.

Continuing Calibration

Not evaluated.

Method Blank Analysis

Arsenic and Lead were detected between the MDL and the RL in the method blank in lab codes KQ2416652-01 and KQ2416391-03. This analyte was detected in project samples at a level at least 10 times that of the method blank therefore no data as qualified.

No other target compounds were detected in the method blank samples.



Laboratory Control Samples

All percent recovery values and relative percent differences (RPDs) for laboratory control samples (LCSs) were within acceptable criteria established by the laboratory for the respective testing methods.

Surrogate Compound Recovery

Surrogate compound recovery was not performed for this sample batch.

Sample Duplicate Analysis

All RPDs for sample duplicates were within acceptable criteria established by the laboratory for the respective testing methods.

Blank Spike/Blank Spike Duplicate Sample Analyses

Blank spike and blank spike duplicate sample analyses were not performed for this sample batch.

Matrix Spike/Matrix Spike Duplicate Sample Analyses

All percent recoveries and RPDs for matrix spikes (MSs) and matrix spike duplicates (MSDs) were within acceptable criteria established by the laboratory for the respective testing methods, except for the following:

- High recovery was observed for arsenic and lead in the MS (sample UMM-TLA-0.5-6 lab code K2410642-005. The results were flagged "#" indicating the control criteria was not applicable.
- Recovery outside of the laboratory criteria was observed for arsenic and lead in the MS (sample UMM-TLB-0.5-1 lab code K2410642-001. The results were flagged "#" indicating the control criteria was not applicable.

The laboratory report notes that "Matrix Spike and Matrix Spike Duplicate Data is presented for information purposes only. The matrix may or may not be relevant to samples reported in this report. The laboratory evaluates system performance based on the LCS and LCSD control limits."

Trip Blank Sample Analysis

A trip blank sample was not collected for this sample batch.

Equipment Blank Sample Analysis

Equipment blank samples EB-2024 1003, EB-2024 1004 and EB-2024 1005 were collected on October 3, 4, and 5, 2024 and are associated with all samples collected on those dates. These equipment blank samples were analyzed in report K2410651. The following analyte was detected in the equipment blank samples:



Equipment Blank Analysis

| Equipment Blank ID | Analyte | Detection | Discussion |
|--------------------|---------|-----------|---|
| EB-2024 1003 | Arsenic | 0.64 μg/L | Arsenic was detected in project samples at concentrations greater than 5 times the associated blank; therefore no results were qualified. |
| EB-2024 1004 | Arsenic | 3.12 μg/L | Arsenic was detected in project samples at concentrations greater than 5 times the associated blank; therefore no results were qualified. |
| EB-2024 1005 | Arsenic | 0.11 μg/L | Arsenic was detected in project samples at concentrations greater than 5 times the associated blank; therefore no results were qualified. |

Field Duplicate Analyses

A field duplicate sample was not collected for this sample batch.

Reference Material Analysis

No reference material analysis was performed.

Compound Quantitation

The laboratory did not apply any flags to project samples in this sample batch.



Sample Index

| Sample Name | Lab ID | Matrix | Date Collected |
|------------------|--------------|--------|----------------|
| UMM-TLB-0.5-1 | K2410642-001 | Soil | 10/2/2024 |
| UMM-TLB-0.5-4 | K2410642-002 | Soil | 10/2/2024 |
| UMM-TLC-0.5-1 | K2410642-003 | Soil | 10/2/2024 |
| UMM-TLC-0.5-2 | K2410642-004 | Soil | 10/2/2024 |
| UMM-TLA-0.5-6 | K2410642-005 | Soil | 10/2/2024 |
| CEM-WRA-0.5-4-DS | K2410642-006 | Soil | 10/5/2024 |
| CEM-WRB-0.5-1 | K2410642-007 | Soil | 10/5/2024 |
| CEM-WRA-0.5-2 | K2410642-008 | Soil | 10/5/2024 |
| CEM-WRC-0.5-1 | K2410642-009 | Soil | 10/5/2024 |
| GF-WRA-0.5-1 | K2410642-010 | Soil | 10/5/2024 |
| GF-WRD-0.5-6 | K2410642-011 | Soil | 10/5/2024 |
| GF-WRD-0.5-4-DS | K2410642-012 | Soil | 10/5/2024 |
| GF-DR-0.5-1 | K2410642-013 | Soil | 10/5/2024 |
| GC5-WRA-0.5-3 | K2410642-014 | Soil | 10/4/2024 |
| GC5-WRA-0.5-4 | K2410642-015 | Soil | 10/4/2024 |
| GC5-WRA-0.5-4-DS | K2410642-016 | Soil | 10/4/2024 |
| GC6-WRA-0.5-2 | K2410642-017 | Soil | 10/4/2024 |
| GC6-WRA-0.5-1 | K2410642-018 | Soil | 10/4/2024 |
| GC7-WRA-0.5-3 | K2410642-019 | Soil | 10/4/2024 |

END OF REPORT





Data Validation Report

Project Name: Upper Granite Creek Mines Lab Reference Number: K2410643

| Project Number: 0031.005.001 | Laboratory: ALS Environmental Laboratory |
|---|--|
| Validated by: Marie Mueller | Matrix: Soil |
| Sampling Date: 10/3/2024 - 10/5/2024 | Number of Samples: 14 |
| Data Validation Report Date: 11/13/2024 | Analytical Report Date: 10/23/2024 |

The quality control (QC) elements that were reviewed are listed below.

| ٧ | Surrogate Compound Recovery | NA |
|----|---|---|
| ٧ | Sample Duplicate Analysis | 1 |
| 1 | Blank Spike/Blank Spike Duplicate Sample Analyses | NA |
| ٧ | Matrix Spike/Matrix Spike Duplicate Sample Analyses | 1 |
| NE | Trip Blank Sample Analysis | NA |
| NE | Equipment Blank Sample Analysis | 1 |
| NE | Field Duplicate Sample Analysis | ٧ |
| NE | Reference Material Analysis | NE |
| 1 | Compound Quantitation | 2 |
| ٧ | | |
| | V 1 V NE NE NE NE 1 | V Sample Duplicate Analysis 1 Blank Spike/Blank Spike Duplicate Sample Analyses V Matrix Spike/Matrix Spike Duplicate Sample Analyses NE Trip Blank Sample Analysis NE Equipment Blank Sample Analysis NE Field Duplicate Sample Analysis NE Reference Material Analysis 1 Compound Quantitation |

V-Method quality objectives (MQO) and QC criteria have been met. No outliers are noted or discussed.

NA – Not applicable

NE – Not evaluated

P – Pending

Overall Assessment

All data, as qualified, are acceptable for use.

Data Package Completeness

The data package included the required elements: chain-of-custody, sample receipt checklist, case narrative, results, and QC results.

Verification of EDD to Hardcopy Data Package

Sample results and related quality control data were received in both an electronic and hardcopy format. Electronic data were verified against the laboratory report; no errors were found.

^{1 –} Quality control results are discussed below, but no data were qualified.

^{2 –} Quality control outliers that impact the reported data were noted. Data qualifiers were issued as discussed in this Data Validation Report.

Chain-of-Custody

All sample identification (ID) numbers listed on the chain-of-custody record are consistent with the sample ID reported in the EDD and hardcopy data package. Several samples listed in the chain-of-custody report include samples that were held and not analyzed by the laboratory.

Chain-of-custody 140510 includes sample IDs for laboratory reports K2410639, K2410642, K2410643, and K2410651.

Chain-of-custody 140510 erroneously notes that equipment blank sample, EB-2024 1003, was sampled on 10/5/2024, however it was sampled on 10/3/2024.

Sample Preservation

Samples were received intact, at temperatures of 4.6, 5.7, 4.4, 4.5, and 4.5 degrees Celsius. Proper preservation includes samples chilled to ≤6.0 degrees Celsius.

Laboratory staff observed temperature blanks at 9.6, 16.8, 6.0, 9.4, and 18.3 degrees Celsius. In the Cooler Receipt Form, laboratory staff noted that ice was at the top of coolers on top of samples and that the temperature blank was under the samples and is not necessarily indicative of sample temperature.

Holding Times

All samples were analyzed within the holding time.

Retention Time Windows

Not evaluated.

Initial Calibration

Not evaluated.

Initial Calibration Verification

Not evaluated.

Continuing Calibration

Not evaluated.

Method Blank Analysis

The method blank sample (lab code KQ2416427-03) had chromium, lead, and zinc detections of 0.06, 0.036, and 0.27 mg/kg which were flagged "J" between the corresponding method detection limit (MDL) and the method reporting limit (MRL); project sample data was not qualified.



The method blank sample (lab code KQ2416652-01) had a lead detection of 0.043 mg/kg between the MDL and the MRL; the detection was flagged "J" because it was between the MDL and MRL, but project sample data was not qualified.

No other target compounds were detected in the method blank samples.

Laboratory Control Samples

All percent recovery values and relative percent differences (RPDs) for laboratory control samples (LCSs) were within acceptable criteria established by the laboratory for the respective testing methods.

Surrogate Compound Recovery

Surrogate compound recovery was not performed for this sample batch.

Sample Duplicate Analysis

All RPDs for sample duplicates were within acceptable criteria established by the laboratory for the respective testing methods except for the following:

• Sample TL-WRA-0.5-3, sample code K2410643-001, RPD for Duplicate Sample KQ2416427-01 analyte silver was flagged "*" indicating the RPD is outside of the laboratory criteria.

Blank Spike/Blank Spike Duplicate Sample Analyses

Blank spike and blank spike duplicate sample analyses were not performed for this sample batch.

Matrix Spike/Matrix Spike Duplicate Sample Analyses

All percent recoveries and RPDs for matrix spikes (MSs) and matrix spike duplicates (MSDs) were within acceptable criteria established by the laboratory for the respective testing methods, except for the following:

Low recovery was observed for arsenic and zinc in the MS of KQ2416427-02 (sample TL-WRA-0.5-3 lab code K2410643-001. The result was flagged "#" indicating the control criteria was not applicable.

The laboratory report notes that "Matrix Spike and Matrix Spike Duplicate Data is presented for information purposes only. The matrix may or may not be relevant to samples reported in this report. The laboratory evaluates system performance based on the LCS and LCSD control limits."

Trip Blank Sample Analysis

A trip blank sample was not collected for this sample batch.



Equipment Blank Sample Analysis

Equipment blank samples EB-2024 1003, EB-2024 1004 and EB-2024 1005 were collected on October 3, 4, and 5, 2024 and are associated with all samples collected on those dates. These equipment blank samples were analyzed in report K2410651. The following analyte was detected in the equipment blank samples:

Equipment Blank Analysis

| Equipment Blank ID | Analyte | Detection | Discussion |
|--------------------|---------|-----------|---|
| EB-2024 1003 | Arsenic | 0.64 μg/L | Arsenic was detected in project samples at concentrations greater than 5 times the associated blank; therefore no results were qualified. |
| EB-2024 1004 | Arsenic | 3.12 μg/L | Arsenic was detected in project samples at concentrations greater than 5 times the associated blank; therefore no results were qualified. |
| EB-2024 1005 | Arsenic | 0.11 μg/L | Arsenic was detected in project samples at concentrations greater than 5 times the associated blank; therefore no results were qualified. |

Field Duplicate Analyses

Sample CS-SD-7-DUP was collected as a field duplicate of CS-SD-7, respectively. All RPDs were within the accepted 50% limit.

Reference Material Analysis

No reference material analysis was performed.

Compound Quantitation

The laboratory applied the following flags:

J Estimated value

Results for the following samples were J-flagged:

| Sample Name | Analyte |
|-------------|----------|
| CS-SD-1 | Mercury |
| CS-SD-2 | Antimony |
| CS-SD-4 | Mercury |



Sample Index

| Sample Name | Lab ID | Matrix | Date Collected |
|-------------------|--------------|--------|----------------|
| TL-WRA-0.5-3 | K2410643-001 | Soil | 10/4/2024 |
| TL-WRB-0.5-4 | K2410643-002 | Soil | 10/4/2024 |
| TL-WRA-0.5-1-DS-2 | K2410643-003 | Soil | 10/4/2024 |
| SH-WRB-0.5-2 | K2410643-004 | Soil | 10/4/2024 |
| SH-WRC-0.5-1 | K2410643-005 | Soil | 10/4/2024 |
| CS-SD-1 | K2410643-006 | Soil | 10/5/2024 |
| CS-SD-2 | K2410643-007 | Soil | 10/3/2024 |
| CS-SD-3 | K2410643-008 | Soil | 10/3/2024 |
| CS-SD-4 | K2410643-009 | Soil | 10/3/2024 |
| CS-SD-5 | K2410643-010 | Soil | 10/4/2024 |
| CS-SD-6 | K2410643-011 | Soil | 10/4/2024 |
| CS-SD-7 | K2410643-012 | Soil | 10/4/2024 |
| CS-SD-7-DUP | K2410643-013 | Soil | 10/4/2024 |
| CS-SD-8 | K2410643-014 | Soil | 10/5/2024 |

END OF REPORT





Data Validation Report

Project Name: Upper Granite Creek Mines Lab Reference Number: K2410651

| Project Number: 0031.005.001 | Laboratory: ALS Environmental Laboratory |
|---|--|
| Validated by: Marie Mueller | Matrix: Water |
| Sampling Date: 10/3/2024 - 10/5/2024 | Number of Samples: 12 |
| Data Validation Report Date: 11/13/2024 | Analytical Report Date: 10/22/2024 |

The quality control (QC) elements that were reviewed are listed below.

| ٧ | Surrogate Compound Recovery | NA |
|----|---|---|
| ٧ | Sample Duplicate Analysis | 1 |
| 1 | Blank Spike/Blank Spike Duplicate Sample Analyses | NA |
| ٧ | Matrix Spike/Matrix Spike Duplicate Sample Analyses | ٧ |
| NE | Trip Blank Sample Analysis | NA |
| NE | Equipment Blank Sample Analysis | NA |
| NE | Field Duplicate Sample Analysis | 1 |
| NE | Reference Material Analysis | NE |
| ٧ | Compound Quantitation | 2 |
| ٧ | | |
| | V 1 V NE NE NE NE V | V Sample Duplicate Analysis 1 Blank Spike/Blank Spike Duplicate Sample Analyses V Matrix Spike/Matrix Spike Duplicate Sample Analyses NE Trip Blank Sample Analysis NE Equipment Blank Sample Analysis NE Field Duplicate Sample Analysis NE Reference Material Analysis V Compound Quantitation |

^{√ –} Method quality objectives (MQO) and QC criteria have been met. No outliers are noted or discussed.

NA – Not applicable

NE – Not evaluated

P-Pending

Overall Assessment

All data, as qualified, are acceptable for use.

Data Package Completeness

The data package included the required elements: chain-of-custody, sample receipt checklist, case narrative, results, and QC results.

Verification of EDD to Hardcopy Data Package

Sample results and related quality control data were received in both an electronic and hardcopy format. Electronic data were verified against the laboratory report; no errors were found.

^{1 –} Quality control results are discussed below, but no data were qualified.

^{2 –} Quality control outliers that impact the reported data were noted. Data qualifiers were issued as discussed in this Data Validation Report.

Chain-of-Custody

All sample identification (ID) numbers listed on the chain-of-custody record are consistent with the sample ID reported in the EDD and hardcopy data package. Several samples listed in the chain-of-custody report include samples that were held and not analyzed by the laboratory.

Chain-of-custody 140510 includes sample IDs for laboratory reports K2410639, K2410642, K2410643, and K2410651.

Chain-of-custody 140510 erroneously notes that equipment blank sample, EB-2024 1003, was sampled on 10/5/2024, however it sampled on 10/3/2024.

Sample Preservation

Samples were received intact, at temperatures of 4.6, 5.7, 4.4, 4.5, and 4.5 degrees Celsius. Proper preservation includes samples chilled to ≤6.0 degrees Celsius.

Laboratory staff observed temperature blanks at 9.6, 16.8, 6.0, 9.4, and 18.3 degrees Celsius. In the Cooler Receipt Form, laboratory staff noted that ice was at the top of coolers on top of samples and that the temperature blank was under the samples and is not necessarily indicative of sample temperature.

Holding Times

All samples were analyzed within the holding time.

Retention Time Windows

Not evaluated.

Initial Calibration

Not evaluated.

Initial Calibration Verification

Not evaluated.

Continuing Calibration

Not evaluated.

Method Blank Analysis

No target compounds were detected in the method blank samples.

Laboratory Control Samples

All percent recovery values and relative percent differences (RPDs) for laboratory control samples were within acceptable criteria established by the laboratory for the respective testing methods.



Surrogate Compound Recovery

Surrogate compound recovery was not performed for this sample batch.

Sample Duplicate Analysis

All RPDs for sample duplicates were within acceptable criteria established by the laboratory for the respective testing methods, except for the following:

- Sample Duplicate RPDs for sample name CS-SW-1 and lab code K2410651-004 analytes
 antimony and lead RPDs were calculated to be above the acceptable criteria established by the
 laboratory for the respective testing methods.
- Sample Duplicate RPDs for sample name CS-SW-1 and lab code K2410651-004 analytes Cadmium, Silver, Zinc and Mercury could not be calculated because results were below reporting limits.

Blank Spike/Blank Spike Duplicate Sample Analyses

Blank spike and blank spike duplicate sample analyses were not performed for this sample batch.

Matrix Spike/Matrix Spike Duplicate Sample Analyses

All percent recoveries and RPDs for matrix spikes and matrix spike duplicates were within acceptable criteria established by the laboratory for the respective testing methods.

The laboratory report notes that "Matrix Spike and Matrix Spike Duplicate Data is presented for information purposes only. The matrix may or may not be relevant to samples reported in this report. The laboratory evaluates system performance based on the LCS and LCSD control limits."

Trip Blank Sample Analysis

A trip blank sample was not collected for this sample batch.

Equipment Blank Sample Analysis

Equipment blank samples EB-2024 1003, EB-2024 1004 and EB-2024 1005 collected on October 3, 4, and 5, 2024 were not associated with the samples analyzed in this report.

Field Duplicate Analyses

Sample CS-SW-2-DUP was collected as a field duplicate of CS-SW-2, respectively. All RPDs were within the accepted 30% limit, except:

• Lead was detected in CS-SW-2 and CS-SW-2-DUP at concentrations of 0.012 and 0.007 μ g/L, respectively. The calculated RPD is 52.6%.



Reference Material Analysis

No reference material analysis was performed.

Compound Quantitation

The laboratory applied the following flags:

J Estimated value

Results for the following samples were J-flagged:

| Sample Name | Analytes |
|--------------|-----------------------------------|
| EB-2024 1005 | Arsenic |
| CS-SW-1 | Antimony, Arsenic, Chromium, Lead |
| CS-SW-2 | Antimony, Chromium, Lead |
| CS-SW-2-DUP | Antimony, Chromium, Lead |
| CS-SW-3 | Antimony, Chromium, Lead |
| CS-SW-4 | Antimony, Chromium |
| CS-SW-5 | Cadmium, Chromium, Lead, Zinc |
| CS-SW-6 | Chromium, Lead, Zinc |
| CS-SW-7 | Cadmium, Chromium, Zinc |
| CS-SW-8 | Cadmium, Chromium, Zinc |

Sample Index

| Sample Name | Lab ID | Matrix | Date Collected |
|--------------|--------------|--------|----------------|
| EB-2024 1003 | K2410642-001 | Water | 10/3/2024 |
| EB-2024 1004 | K2410642-002 | Water | 10/4/2024 |
| EB-2024 1005 | K2410642-003 | Water | 10/5/2024 |
| CS-SW-1 | K2410642-004 | Water | 10/5/2024 |
| CS-SW-2 | K2410642-005 | Water | 10/3/2024 |
| CS-SW-2-DUP | K2410642-006 | Water | 10/3/2024 |
| CS-SW-3 | K2410642-007 | Water | 10/3/2024 |
| CS-SW-4 | K2410642-008 | Water | 10/3/2024 |
| CS-SW-5 | K2410642-009 | Water | 10/4/2024 |
| CS-SW-6 | K2410642-010 | Water | 10/4/2024 |
| CS-SW-7 | K2410642-011 | Water | 10/4/2024 |
| CS-SW-8 | K2410642-012 | Water | 10/5/2024 |

END OF REPORT



Appendix C

Human Health and Ecological Risk Assessment





Human Health and Ecological Risk Assessment Upper Granite Creek Mines Wallowa-Whitman National Forest

May 2011



Conserving Resources. Improving Life

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Human Health and Ecological Risk Assessment Upper Granite Creek Mines Wallowa-Whitman National Forest

| Prepared for: | USDA Forest Service Wallowa-Whitman National Forest |
|------------------------------------|--|
| Site Location: | Granite Creek Mines Wallowa Whitman National Forest Grant County, Oregon |
| Prepared by: | Cascade Earth Sciences 12720 E. Nora Avenue, Suite A Spokane, Washington 99216 (509) 921-0290 |
| Principal Author and Investigator: | Rone Brewer, Senior Ecologist, CES Associate Regina Skarzinskas, Senior Toxicologist, CES Associate |
| Reviewed By: | Dustin G. Wasley, PE, Principal Engineer |
| Report Date: | May 2011 |
| Project Number: | 2723018 |
| | |

Cover Photo: Monumental Mine Millsite

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| | | ACRONYMS | |
| CEEN COI COPI ODE ERA ERBS HHR PRG SI RTE 90UC USEN | C EC Q SC A | conceptual ecological exposure model chemical of interest chemical of potential concern for human health chemical of potential ecological concern Oregon Department of Environmental Quality ecological risk assessment ecological risk-based screening concentration human health risk assessment Preliminary Remediation Goals Site Inspection rare, threatened, or endangered 90 th percentile upper confidence limit on the arithmetic mean United States Environmental Protection Agency | |

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Doc: 2723018 Granite Creek Removal Action HHRA.docx

1.0 INTRODUCTION

- Potential human health and ecological risks associated with mining-related contamination at the Monumental, Cap Martin, Sheridan, Tillicum, Central Mines, Golden Fraction; and Granite Creek (GC)-5, GC-6, and GC-7 (unnamed) Mines (collectively referred to as the Granite Creek Mines) within the Upper Granite Creek Watershed (Site) were assessed through a streamlined risk assessment process.
- The mines are located in the upper portion of the Granite Creek watershed, approximately 5 to 8 aerial miles north of Granite, Oregon in Grant County in the Wallowa-Whitman National Forest (WWNF).
- The risk assessment process follows Oregon Department of Environmental Quality (ODEQ) and U.S. Environmental Protection Agency (USEPA) guidelines.
- Potential risks and hazards were evaluated using site-specific concentrations of chemicals of interest (COIs), selected human and ecological receptors and respective exposure pathways, and appropriate risk-based screening concentrations.

2.0 RISK ASSESSMENT DATA AND INITIAL SCREENING

- This section describes the data set used in this risk analysis and the initial screening for the human health risk assessment (HHRA) and ecological risk assessment (ERA).
- Data were selectively collected in areas where contamination was known or suspected to occur; therefore, the data set is skewed towards an understanding of the magnitude of contamination on Site rather than a full characterization of the Site.
- The data used in the risk assessment are from soil, vegetation, waste rock, surface water, pore water, and sediment samples collected during the Site Inspection (SI) conducted by EA Engineering, Science, and Technology, Inc. (EA) in January 2004 (EA, 2004) and the 2007 data gap investigation conducted by Cascade Earth Sciences (CES). The following samples were collected from five mines within the watershed:
 - o 12 background soil samples
 - o 48 surface and subsurface waste rock samples
 - 35 surface soil samples for the HHRA at 0-1.5 feet below the ground surface,
 - 38 surface soil samples for the ERA at 0-3 feet below the ground surface, and
 - 10 subsurface soil samples at greater than 1.5 feet below the ground surface for the HHRA.
 - o 4 background vegetation samples
 - o 6 vegetation samples
 - o 3 background surface water samples
 - o 17 surface water samples
 - o 3 background pore water samples
 - o 14 pore water samples
 - o 3 background sediment samples
 - o 27 sediment samples
- Overall, the data are likely to overestimate the concentrations found across the Site because samples were located to represent the areas of highest chemical of interest (COI) concentrations, not areas representative of overall human and ecological receptor exposure at and surrounding the Site. This is a conservative approach that is appropriate for screening level risk assessments.
- Initially, all data collected during the SI and deemed appropriate for use in the risk assessment were used to calculate the 90th percentile upper confidence level on the arithmetic mean (90UCL) for each medium:

- The 90UCL is an upper-bound (i.e., conservative) estimate of mean chemical concentration and is specified as an appropriate exposure point concentration (EPC) in Oregon's Revised Cleanup Rules (OAR 340-122-084).
- o If fewer than 10 samples are available in a given medium, it is inappropriate to calculate a 90UCL (USEPA, 2003b). In these cases and if an appropriately calculated 90UCL exceeded the maximum detected concentration, the maximum detected concentrations was used as a substitute for the 90UCL.
- The data were screened using the ODEQ's Guidance for Conduct of Deterministic Risk Assessments (1998), which allows for prescreening of COIs based on the following criteria:
 - o **Essential Nutrients:** calcium, magnesium, potassium, and sodium were removed from further assessment because they are considered to be essential nutrients.
 - **Frequency of Detection:** COIs in each medium that were detected in 5% or less of the samples Site-wide were removed from further assessment.
 - o **Background:** 90UCL or maximum (as described above) concentrations of naturally-occurring chemicals that were present at concentrations less than maximum background concentrations were eliminated from further assessment.
- The results of these initial screening procedures for each potential exposure medium are also shown in Appendices A1 through A7. These appendices also show a sample reporting limit screening to ensure that undetected chemicals had reporting limits below background and below the lowest applicable medium-specific risk-based screening concentrations. If they did not, then that COI was conservatively included for further assessment at one-half the maximum sample reporting limit.
- The selected COIs for the HHRA and ERA are shown in Table 2-1.

Table 2-1. Chemicals of Interest Remaining Following the Initial Screening

| COI | Soi Waste M | | Vegetation | Surface Water | | Pore Water | Sediment | |
|-----------------|----------------|-----|------------|---------------|-----|---------------|----------|-----|
| | HHRA | ERA | ERA | HHRA | ERA | ERA | HHRA | ERA |
| Aluminum | | | | X | X | X | X | X |
| Antimony | X | X | | X | X | | X | X |
| Arsenic, total | X | X | X | X | X | X | X | X |
| Barium | X | X | | X | X | X | X | X |
| Beryllium | | | X | | | | X | X |
| Cadmium | X | X | X | X | X | | X | X |
| Chromium, total | | | X | X | X | | X | X |
| Cobalt | | | | | | | X | X |
| Copper | X | X | X | X | X | | X | X |
| Iron | X | X | X | X | X | | X | X |
| Lead | X | X | X | X | X | X | X | X |
| Manganese | X | X | | X | X | | X | X |
| Mercury | X | X | X | X | X | X | X | X |
| Nickel | | | | | | | X | X |
| Selenium | X | X | | X | X | X | | |
| Silver | X | X | | X | X | X | X | X |
| Thallium | X | X | | | | X | X | X |
| Vanadium | X | X | X | | | | X | X |
| Zinc | X | X | X | X | X | X | X | X |

NOTE: X = COI selected for further screening

3.0 HUMAN HEALTH RISK ASSESSMENT

- A HHRA is an analysis of the potential adverse health effects that could result from current or future
 exposures to hazardous substances released from a site, in the absence of any action to control or
 mitigate these releases.
- The objective of this HHRA is to incorporate analytical data and information on potential human exposure to the COIs in order to provide a baseline assessment of the potential for human health risks to be realized due to Site-related contamination.
- The following are primary elements of the HHRA:
 - Hazard Identification and Selection of Contaminants of Potential Concern: Evaluation of site
 data and identification of elevated concentrations of COIs in human exposure media, resulting in a
 list of contaminants of potential concern (COPCs) for the HHRA.
 - o **Exposure assessment**: Identification of areas that pose human health risks under current or potential future site uses and conservative estimation of exposure.
 - Toxicity assessment: Quantification of the relationship between chemical exposure and adverse effects.
 - o **Risk characterization:** Development of quantitative risk estimates using exposure and toxicity information previously developed for the COPCs.

3.1 Hazard Identification and Selection of COPCS

- This section presents the rationale for the selection of the COPCs; prescreening of the COIs was described in Section 2.0.
- The media of interest for human health included soil, waste rock, surface water, and sediment.
- The COIs retained for further assessment following the initial screening included aluminum, antimony, arsenic, barium, cadmium, chromium, copper, iron, lead, manganese, mercury, selenium, silver, thallium, vanadium and zinc as shown in Appendices A1, A2, A4, and A6 for surface soil, subsurface soil, surface water, and sediment, respectively.
- Maximum concentrations of these COIs were screened against USEPA Region IX Preliminary Remediation Goals (PRGs).
 - o Industrial PRGs were selected as most appropriate screening criteria for soils and sediment.
 - o Tap water PRGs represent a very conservative screen for surface water.
 - o Appendix B1 presents the preliminary remediation goal (PRG) screening and results.
- Arsenic and lead were identified as COPCs for the Site.

3.2 Exposure Assessment

Assessing the exposure at a given site includes the identification of potentially exposed populations, the selection of relevant exposure pathways, and the calculation of exposure point concentrations and chronic daily intakes.

3.2.1 Potentially Exposed Population

- Maps and Figures of the Site are provided in the SI report (EA, 2004). The following is a brief summary of the rational for the potentially exposed population:
 - o The Site consists of five mines located within the Granite Creek watershed.

Monumental Mine

- Monumental Mine, located near the headwaters of Granite Creek, includes two open adits, a shaft, three settling ponds, three waste rock piles, and a former mill site. Access to the mine is by way of FR 7345.
- The mine is situated on moderate to steep hillsides at the headwaters of Granite Creek.

Cascade Earth Sciences – Spokane, WA PN: 2723018 Doc: 2723018 Granite Creek Removal Action HHRA.docx • Water flows from an upper seep into a series of three settling ponds, all of which are connected by surface water flow. In addition, water seeps from the lower adit through a constructed ditch to the lower settling pond. No outlet for the settling pond was observed during SI activities.

Cap Martin Mine

- The Cap Martin Mine is situated approximately 1.4 miles downstream from the headwaters of Granite Creek and contains two observed collapsed adits, one additional reported adit, three waste rock piles, and an outwash fan from the south waste rock pile.
- The mine is located on both sides of Granite Creek and is accessed via FR 7345.

GC-7 Mine

- The GC-7 Mine is situated approximately 0.25 miles downstream from the Cap Martin Mine at the confluence with an unnamed tributary originating from the monumental Mine.
- The mine contains one observed collapsed adit and two waste rock piles.
- A former canal or placer ditch is located just upslope from the mine.
- The mine is located on moderately steep hillsides on the north side of Granite Creek and is accessed via FR 680.

Sheridan Mine

- Sheridan Mine is located about 0.40 miles downstream of the Cap Martin Mine, east of the bank of an unnamed tributary of Granite Creek. The mine includes two possible adits, one of which is collapsed at the portal and contains a seep that discharges into a marshy area. No acid mine drainage (AMD) was observed in the seep. In addition, there is one waste rock pile downgradient from the collapsed adit.
- The mine is situated on moderately steep slopes on the south side of Granite Creek and is accessed by way of FR 7345.

GC-6 Mine

- The GC-6 Mine is situated approximately 0.10 miles downstream from the Sheridan Mine, on the north side of Granite Creek, and contains one partially collapsed adit, and a waste rock pile.
- The mine is located on moderately steep hillsides on the north side of Granite Creek and is accessed via FR 680.

Tillicum Mine

- The Tillicum Mine is located approximately 0.25 miles downstream of the Sheridan Mine along Granite Creek and contains two primary collapsed adits and associated waste rock piles, and reportedly several additional adits. No water emanated from the adits during SI field activities.
- The Mine is situated on moderately steep slopes along the north bank of Granite Creek and is accessed by way of FR 7345.

GC-5 Mine

- The GC-5 Mine is located about 0.25 miles downstream of the Tillicum Mine, and contains one collapsed adit and two waste rock piles.
- FR 680, which accesses the mine, is cut through the larger waste rock pile adjacent to Granite Creek.
- Water was observed flowing from the collapsed adit during the CES data gap field investigation.
- The mine is situated on a moderately steep slope north of Granite Creek.

Golden Fraction Mine

- The Golden Fraction Mine is located about 0.125 miles downstream of the GC-5 Mine.
- The upper portion of the mine, situated just downslope from FR 7345, has an open adit, shaft, collapsed cabin, one large waste rock pile, and four smaller waste rock piles.
- The lower portion of the mine, just upslope from FR 680 along Granite Creek, contains one collapsed adit and two waste rock piles.
- FR 680, which accesses the mine, is cut through the larger waste rock pile adjacent to Granite Creek.
- Water was observed flowing from the collapsed lower adit during the CES data gap field investigation.
- The mine is situated on a moderately steep slope north of Granite Creek.

Central Mine

- The Central Mine is located about 0.125 miles downstream of the Golden Fraction Mine, southeast of the intersection of FR 73 (Elkhorn Drive Scenic Byway) and FR 7345.
- The mine contains two observed adits and one reported adit. The adits did not have water emanating from them at the time of the SI field investigation. Additionally, three waste rock piles are located at the mine. A waste rock berm, created as a result of hydraulic mining activities, runs in east-west direction about 75 to 100 feet upslope of Granite Creek.
- The mine is situated on a moderately steep slope north of Granite Creek.
- Given the types of human uses expected, the potential for long-term exposure to Site-related contaminants is considered very low.
- There are no onsite workers, or occupied structures on the Site or within 200 feet of the Site.
- Access is currently not restricted by fencing, nor were any "No Trespassing" signs observed. In general, land uses in this area are limited to recreation (hiking, fishing, camping, hunting, etc.) and possibly some minerals prospecting on nearby claims.
- The ingestion, dermal contact, and air exposure pathways are considered complete, because hikers, hunters, and campers have the potential to access the Site.
- The most likely pathway of exposure at the Site is inhalation of particulates.
- Fish consumption was eliminated as a potential pathway of concern because, with the exception of tribal fishing, all recreational fishing in Granite Creek and its tributaries was prohibited by the Oregon Department of Fish and Wildlife in 1997 (EA, 2004). The number and size of fish present also severely limits any potential for a recreational or subsistence fishing scenario.

3.2.2 Identification of Potential Exposure Pathways

- The conceptual human exposure model is presented in Figure 3-1.
- Exposures to COPCs were evaluated for all complete pathways for which there was a receptor. These pathways were determined to be:
 - o Inhalation of soil/waste rock particulates.
 - o Dermal contact with soil/waste rock.
 - o Incidental ingestion of surface soil/waste rock,
 - o Dermal contact with surface water
 - o Incidental ingestion of surface water
 - o Dermal contact with sediment, and
 - o Incidental ingestion of sediment by current and future recreational receptors.

3.2.3 Current and Potential Future Receptors

- The Site is not currently occupied, nor is it expected to be occupied in the future.
- The only likely current and future receptors identified for the Site are hikers, campers, and hunters.

Based on the Site topography and its isolated location within the WWNF, it is highly unlikely that
recreational users would engage in activities at the Site that could result in significant ingestion or
contact with soil, sediment or surface water. Therefore, the most likely pathway of exposure at the Site
is inhalation of particulates.

3.2.4 Exposure Assumptions

- Exposure assumptions include factors such as body weight, averaging time, exposure frequency, exposure duration, and chemical bioavailability.
- Separate assumptions are made for both average or central tendency exposure (CTE) and reasonable maximum exposure (RME).
- In general, CTE represents a less conservative model of the Site risk, using exposure factors that are more indicative of the average recreational user rather than a maximally exposed user.
 - The exposure factors and assumptions used in this risk assessment are presented in Appendix B2.

3.2.5 Exposure Point Concentrations

- An EPC is used in coordination with the exposure factors to calculate the Average Daily Dose (ADD) of a chemical of potential concern (COPC).
- The EPC can be the maximum concentration detected or a statistical average.
- It is not reasonable to assume long-term contact with the maximum concentration.
- When sufficient data exists, an upper-bound estimate of average concentrations (i.e., the 90UCL) are
 used because an average concentration is most representative of the concentration contacted over this
 time period.
- As per the USEPA (1997), when data for a particular exposure medium were limited to less than 10 samples, the maximum detected concentration was used as the EPC. Where the data set contained greater than 10 samples, 90UCL was calculated and used as the EPC.
- The EPCs are presented in Table 3-1 and Appendix B3.

Table 3-1. Exposure Point Concentrations

| СОРС | N | Maximum | Central Tendency Exposure ¹ | Reasonable Maximum Exposure ² | Comments |
|----------------------|----|---------|--|--|----------|
| Surface Soil (mg/kg) | | | | | |
| Total Arsenic | 35 | 11,400 | 853 | 2,250 | 90UCL |
| Sediment (mg/kg) | | | | | |
| Total Arsenic | 27 | 303 | 54.4 | 73.9 | 90UCL |
| Surface Water (mg/L) | | | | | |
| Total Arsenic | 17 | 0.0818 | 0.00988 | 0.0188 | 90UCL |

NOTES:

3.2.6 Exposure Doses

• The EPCs are then entered into exposure dose calculations to calculate the ADD of a contaminant for each receptor type. While presented individually in the equations, USEPA Region X allows for the calculation of Summary Intake Factors (Intake Factors) as follows:

¹ Average concentration

² 90UCL if greater than 10 data points; Maximum concentration if less than 10 data points.

Abbreviations: $EPC = Exposure\ point\ concentration,\ mg/kg = milligrams\ per\ kilogram,\ mg/L = milligrams\ per\ liter,\ N = Number\ of\ samples,\ UCL = Upper\ confidence\ Limit.$

- o Intake Factors represent the sum lifetime exposure to contaminated soil, water, or air through the pathway. The Intake Factors are presented in Appendix B4.
- o Dermal absorption factors are required to calculate dermal exposures to surface water and these are shown in Appendices B5 and B6.
- o The Intake Factors when multiplied by the EPC provide the ADD for each chemical.

3.3 Toxicity Assessment

- The purpose of the toxicity assessment is to present the critical toxicity values for the COPCs. Toxicity is defined as the ability of a chemical to induce adverse effects at some dosage in biological systems. The purpose of the toxicity assessment is twofold:
 - To identify the carcinogenic (cancer) and non-carcinogenic (non-cancer) effects that may arise from direct or indirect exposure of humans to the COPCs; and
 - To provide an estimate of the quantitative relationship between the magnitude and duration of exposure, and the probability or severity of adverse effects.

3.3.1 Toxicity Values

- Toxicity values are used to quantitatively describe the relationship between the extent of exposure to a COPC and the potential increased likelihood, or severity, of adverse effects.
- Where toxicity values are available, the following USEPA sources have been used to obtain this information.
 - o Integrated Risk Information System (IRIS) computer database (USEPA, 2004b)
 - o Health Effects Assessment Summary Table (USEPA, 1997)
- Both carcinogenic and non-carcinogenic effects were quantitatively evaluated as noted below:
 - The endpoints for these two different types of effects are assessed differently because the mechanisms by which chemicals cause cancer are assumed to be fundamentally different from the processes that cause non-carcinogenic effects.
 - The principal difference reflects the assumption that non-carcinogenic effects are assumed to exhibit a threshold dose below which no adverse effects occur, where USEPA assumes no such threshold exists for carcinogenic effects.
 - Because exposure to some chemicals may result in both carcinogenic and non-carcinogenic effect, both endpoints associated with a COPC were evaluated quantitatively when sufficient toxicity data are available.

3.3.2 Categorization of Chemicals as Non-Carcinogens or Carcinogen

- Chemicals are classified into those that cause cancer (carcinogens) and those that cause other, non-cancer, health effects (non-carcinogens).
- The methods for assessing the potential for these two different types of health effects are different. Where a chemical can cause both cancer and non-cancer health effects, the risk evaluation calculates the potential for both types of effects.
- The following sections provide background information on the toxicity values for carcinogenic and non-carcinogenic chemicals, how they are determined, and how they are used in the risk analysis.

Potential Adverse Non-carcinogenic Health Effect

- The following summarizes the purpose and usage of reference doses (RfDs):
 - o Reference doses are critical toxicity factors for chemicals that can cause non-carcinogenic health effects.
 - o An RfD represents an estimated intake rate that is unlikely to produce measurable adverse effects over a lifetime of exposure (USEPA, 1989).

- o RfDs are determined by the USEPA RfD Work Group or from the health effects assessment documents developed by the USEPA Office of Research and Development.
- An RfD, expressed in units of milligrams per kilogram per day (mg/kg-day), assumes a threshold for adverse non-carcinogenic effects. An ADD below the RfD is considered unlikely to cause adverse health effects.
- o RfDs are route-specific; that is, RfDs may be different for ingestion, inhalation, or other routes of exposure.
- o RfDs are derived using uncertainty factors and modifying factors.
- The Critical Toxicity Factors for the non-carcinogenic COPCs are presented in Table 3-2 and Appendix B7.

Table 3-2. Critical Toxicity Values for the Non-carcinogenic COPCs

| СОРС | Oral Chronic Reference Dose* (mg/kg-day) | Confidence in Reference Dose | Endpoint |
|---------|---|------------------------------------|-----------------------------|
| Arsenic | 0.0003 | Medium | hyperpigmentation, vascular |

NOTE: * Reference Dose value from Region IX PRG Tables.

Potential Carcinogenic Effects

- Carcinogenic toxicity is not assumed to have a threshold concentration below which adverse effects do
 not occur; therefore, carcinogenic risk from exposure to a COPC is expressed in terms of the probability
 that an exposed receptor will develop cancer over their lifetime.
- Contaminant-specific dose response curves are used to establish slope factors that represent an upperbound excess cancer risk from a lifetime exposure.
- Dose response curves for human carcinogens are developed from tumorgenic and laboratory studies; the slope factor is generated from the 90UCL of the extrapolated dose curve using probabilistic methods and represents a conservative upper-bound estimate of the potential risk associated with exposure.
- Based on USEPA guidelines documents, critical toxicity data for arsenic and chromium are presented in Table 3-3 and Appendix B8 (refer to USEPA 1999 for additional information).

Table 3-3. Critical Toxicity Values for the Carcinogenic COPCs

| СОРС | Slope Factor (mg/kg-day)-1 | | Weight of Evidence Classification * | Type of Cancer | Basis of Slope Factor | |
|---------|----------------------------|------------|--|-----------------------|--------------------------|--|
| | Oral | Inhalation | Ingestion/Inhalation | Ingestion/ Inhalation | Oral/Inhalation | |
| Arsenic | 1.5E+00 | 1.5E+01 | A | Skin | Epidemiologic Studies | |

NOTE: A = Known human carcinogen.

Lead Critical Toxicity Values

- Meaningful oral and inhalation critical toxicity values have not been developed for lead.
- Many of the non-carcinogenic effects associated with lead may not exhibit a threshold, especially in young children.
- USEPA considers lead to be a probable human carcinogen based on sufficient animal data (i.e., a class B2 carcinogen). In lieu of a reference dose or slope factor, USEPA has developed the Integrated Exposure Uptake/Biokinetic Model (IEUBK) and the Adult Lead Model (ALM) which correlate dose with blood lead levels.
- The Federal Action Level for Lead in drinking water is 0.015 mg/L.

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- Lead exposure levels are as follows:
 - O The lowest-observed adverse effect level (LOAEL) of lead is considered to be 10 micrograms per deciliter (μg/dl) in children and fetuses and 30 μg/dl in adults.
 - Empirically-derived ratios of 0.16 and 0.04 µg/dl per micrograms per day (µg/day) ingested by children and adults respectively, recommended by USEPA (1986) and FDA (1990), are used to predict concentrations in young children and adults.
 - O Applying an uncertainty factor of 10 results in provisional tolerable intake levels of 6 μg/day for children six or less, 15 μg/day for children over six, 25 μg/day for pregnant women, and 75 μg/day for men.

3.4 Risk Characterization

- Potential human health impacts associated with exposure to COPCs at the Site were evaluated by estimating the potential for both non-carcinogenic and carcinogenic health effects.
- The following sections discuss the assessment of non-carcinogenic hazards, carcinogenic risks, and lead risk associated with exposure to COPCs at the Site.
- The sampling locations were selected as locations where levels of concentrations were suspected to be the highest.
- Targeted sampling identifies the worst-case situations and is intended to be a conservative data set that is sufficient for the specific purposes of risk assessment.

3.4.1 Non-Carcinogenic Hazard Assessment

- Non-carcinogenic hazard is estimated as the ratio of the ADD of the non-carcinogenic chemical through a specific exposure route to the chronic (or subchronic) RfD for that exposure route.
- For example, intakes from the ingestion route are compared to oral RfDs.
- The assessment is done as follows:
 - o The ADD divided by the RfD for an individual chemical is termed the Hazard Quotient (HQ).
 - o HQs greater than 1.0 indicate the potential for adverse health effects because the intake exceeds the RfD (USEPA, 1989).
 - o An HQ is calculated for each chemical that elicits a non-carcinogenic health effect if an RfD is available for the chemical and exposure route.
 - o The sum of all individual chemical-specific HQs is termed the Hazard Index (HI) and is calculated under each exposure pathway.
 - o The HI considers exposure to a mixture of chemicals having non-carcinogenic effects based on the assumption that the effects of chemical mixtures are additive (USEPA, 1986b).
 - An HI greater than 1.0 indicates the potential for adverse non-carcinogenic effects. When the HI is greater than 1.0, the USEPA guidance allows for segregating HIs by critical effect categories.
 Major categories of critical effects include neurotoxicity, developmental effects, and effects on target organs to name a few.

3.4.2 Excess Cancer Risk Assessment

- Carcinogenic risk is an estimate of the probability that a COPC will produce a carcinogenic effect.
- The excess lifetime carcinogenic risk is the incremental increase in the probability of developing cancer compared to the background incremental probability of developing cancer with no exposure to site contaminants.
- An excess cancer risk (ECR) of 1 x 10⁻⁶, represents an increase of one additional case of cancer (above background) in one million people exposed to a carcinogen over their lifetime (70 years).
- Estimates of carcinogenic risk using the slope factors developed by USEPA are generally upper-bound estimates; actual risks from exposures to chemical constituents at the Sites would likely be lower than the risks estimated herein.

• For estimating carcinogenic risk from exposure to more than one carcinogenic chemical from a single exposure route, risks from each individual chemical are summed to estimate total ECR.

3.4.3 Potential Non-carcinogenic Hazards and Excess Cancer Risks

Discussion of Non-carcinogenic Hazards

- Soils/Waste Rock
 - o Arsenic and lead were identified as COPCs.
 - o Arsenic is the only COPC that can be quantitatively evaluated.
 - o The average concentration and the 90UCL concentration was used as the EPC.
 - o None of the individual constituents exceeded the regulatory standard of 1.0 under CTE and RME exposure conditions (Appendix B9).
- Sediments
 - o Arsenic and lead were identified as the COPCs.
 - o Arsenic is the only COPC that can be quantitatively evaluated
 - o The HQs are below the regulatory standard of 1.0 for both the RME and CTE exposure scenarios (Appendix B9).
- Surface water
 - Arsenic and lead identified as COPCs.
 - o No toxicity values are available for lead in surface water, groundwater, or drinking water.
 - The EPC for lead in surface water, which is also the maximum concentration detected is 0.009 mg/L.
 - o The Federal Action Level for lead in drinking water is 0.015 mg/L.
 - o The HQs are below the regulatory standard of 1.0 for both the RME and CTE exposure scenarios (ppendix B9).

Discussion of Potential Excess Cancer Risks

- Soil/Waste Rock
 - o The only carcinogenic constituent identified was arsenic.
 - o The average concentration and the 90UCL concentration were used as the EPCs for the CTE and RME exposures, respectively.
 - o The ECR exceeded the regulatory standard of 1 x 10⁻⁶ under both CTE and RME exposure conditions (Appendix B10).
 - o For the CTE exposure conditions, ECRs for ingestion (2×10^{-6}) did not exceed the EPA risk range of 1×10^{-6} to 1×10^{-6} but did exceed Oregon's regulatory standard of 1×10^{-6} .
 - o For the RME exposure condition, ECRs for ingestion (2 x 10⁻⁵) and dermal contact (2 x 10⁻⁵) did not exceed the EPA risk range of 1 x 10⁻⁴ to 1 x 10⁻⁶ but did exceed Oregon's regulatory standard of 1 x 10⁻⁶.
 - o Therefore, a carcinogenic risk is possible for exposure to arsenic impacted soil/waste rock under the CTE and the RME exposure scenarios.
 - o Inhalation of particulates did not exceed the regulatory standard 1 x 10⁻⁶ under both CTE and RME exposure conditions (Appendix B10).
- Sediments
 - o The only carcinogenic constituent identified in sediment is arsenic.
 - The ECRs for arsenic in sediment did not exceed the regulatory standard 1 x 10⁻⁶ under both CTE and RME exposure conditions (Appendix B10).
- Surface Water
 - Arsenic was the only carcinogenic constituent identified in surface water, for which exposure could be quantified.

- o The ECRs for arsenic in surface water did not exceed the regulatory stand 1 x 10⁻⁶ under both the CTE and the RME exposure conditions (Appendix B10).
- Lead was identified as a COPC in surface water on the basis of no PRG, and is considered to be carcinogenic, but no toxicity values are available. Therefore it cannot be quantitatively addressed in the same manner as arsenic and is addressed qualitatively below.

Estimation of Potential Human Health Impacts from Exposure to Lead

- The USEPA's lead models simulate soil lead exposures at a single location. Two models have been developed, the IEUBK model and the ALM:
 - o These models require a minimum of three months of continuous exposure of at least one day per week.
 - o Three months exposure is the minimum to produce a quasi-steady-state lead concentration.
 - The reliability of the models for predicting lead concentrations for exposure durations shorter than three months has not been assessed.
 - In order to address non-continuous exposures, the USEPA Office of Solid Waste and Emergency Response has developed a guidance document for evaluating intermittent exposures to lead for scenarios such as recreational users and trespassers.
 - o Since the exposure frequency is less than three months, predicted intake values were compared with the provisional values discussed in Section 3.3.2.3.
 - Table 3-5 present the results of the lead intake calculations and lead screening. Only the ingestion pathway is quantified.

Table 3-5. Lead Intake Screening

| Exposure Point Concentrations | | Intake | | Predicted Intake | | USEPA Provisional Intake Value | USEPA Provisional Intake Value | | | |
|----------------------------------|----------|---------|----------|------------------|-------|--------------------------------------|--------------------------------------|--|--|--|
| mg | /kg | kg/ | day | μg/day | | | | | | |
| CTE | RME | CTE | RME | CTE RME | | Men | Children <6 | | | |
| Soil | | | | | | | | | | |
| 375.8143 661.61739 | | 6.7E-07 | 2.7E-06 | 0.25 | 1.786 | 75 | 6 | | | |
| Sediment | Sediment | | | | | | | | | |
| 24.24 39.3502 | | 2.6E-07 | 2.1E-06 | .006 0.083 | | 75 | 6 | | | |
| | _ | TOTA | L INTAKE | 0.256 | 1.869 | 75 | 6 | | | |

• Summary of Lead Risks:

- O Soil and Waste Rock: The predicted intake was calculated to be 0.25 $\mu g/day$ (CTE) and 1.786 $\mu g/day$ (RME). The USEPA provisional ingestion intake value for men (most likely receptor) is 75 $\mu g/day$ and children under six (least likely receptor) is 6 $\mu g/day$. If you assume that the total intake from dermal exposure and inhalation is equal to the intake from ingestion, no risk is expected for exposure to lead in soil and waste rock.
- O Sediment: The predicted intake was calculated to be 0.006 μg/day (CTE) and 0.083 μg/day (RME). Using the USEPA provisional ingestion intake listed above, no risk is expected for exposure to lead in sediment for the most likely recreational receptor (men), but a risk is possible for exposure to children under six using the RME EPC. Given the steep terrain and remote nature of the Site, children less than six are not expected to spend extended periods of time at the Site; therefore, a risk is not expected from exposure to lead impacted sediment.
- O Surface Water: The maximum concentration of lead in surface water was 9 micrograms per liter (μg/L), which is less than the USEPA National Primary Drinking Water Standard, Maximum

Containment Level of 15 μ g/L (USEPA, 2003b). Therefore, exposure to lead in drinking water is not expected to be a risk.

3.5 Calculation of Cleanup Goals

- Site specific cleanup goals protective of the RME recreational users were calculated for soil/waste rock and sediment based on the regulatory standard of 1 x 10⁻⁶ ECR.
- The site-specific cleanup goals were calculated to be 143 mg/kg for soil/waste rock
- These clean-up goals are used to calculate hot spot concentrations in soil/waste rock

3.6 Determination of Potential Hot Spots

- The 1995 amendments to Oregon Revised Statute [ORS 465.315] and 1997 amendments to the Hazardous Substance Remedial Action Rules [OAR 340-122], commonly referred to as the Environmental Cleanup Rules, require that certain actions be taken for "hot spots" of contamination. These actions are:
 - o The identification of hot spots as part of the Remedial Investigation and Feasibility Study, and
 - The treatment of hot spots, to the extent feasible, as part of a remedial action selected or approved by the Director of the ODEQ.
- The intent of the hot spot rule is to require treatment only for the worst contamination, as opposed to preferring treatment for all contamination at the Site.
- A hot spot in soil is generically defined as an area where the contamination is highly concentrated, highly mobile or cannot be reliably contained. The assessment of "highly concentrated" hot spots is performed by comparing the concentration of each individual site contaminant to its "highly concentrated" hot spot level as follows:
 - o The "highly concentrated" hot spot levels correspond to a lifetime ECR of 1 x 10⁻⁴ for carcinogens and a hazard quotient of 10 for non-carcinogens.
 - Arsenic in surface soil/waste rock exceeded the regulatory standards for carcinogenic health effects.
 - The results of the hot spot evaluations are presented in Appendix B11. Using an ECR of 1 x 10⁻⁴ a hot spot concentration for arsenic in soil/waste rock was calculated to be 14,330 mg/kg.

3.7 Summary of Human Health Risks

- Arsenic was identified as the only COPCs in surface soil/waste rock, surface water, and sediment for non-carcinogenic effects.
- Lead was identified as a COPCs in surface water because there is no PRG for lead in this medium.
- Based on current and future land use, hunters, hikers, and campers were identified as potential receptors.
- No unacceptable non-carcinogenic health effects are anticipated from contact with sediment or soil/waste rock, nor from contact with surface water under CTE conditions.
- Arsenic was the only carcinogenic COPC identified at the Site.
- Risks due to ingestion under CTE exposure conditions, and due to ingestion and dermal contact with arsenic impacted soil under the RME exposure conditions exceeded the ODEQ's regulatory standard of 1 x 10⁻⁶ ECR.
- Based on the Site topography and its isolated location within the Wallowa Whitman National Forest, it
 is highly unlikely that recreational users would engage in activities at the Site that could result in
 significant ingestion of soil, thus, the most likely pathway of exposure at the Site is inhalation of
 particulates.
- The quantitative risk assessment determined that the inhalation pathway did not result in unacceptable health impacts.
- No hot spots were identified at the Site.

4.0 ECOLOGICAL RISK ASSESSMENT

- The goal of the ERA is to provide an understanding of the potential for ecological risks due to Siterelated contamination and to allow a determination of whether remediation or more detailed ecological risk assessment are warranted. This ERA report consists of:
 - O Description of the Site ecology and likely ecological receptors (including rare, threatened or endangered [RTE] species) at or near the Site;
 - o Presentation of the conceptual ecological exposure model (CEEM), which provides a summary of potential and likely exposure media and pathways;
 - o Delineation of assessment endpoints and measures;
 - o Ecological risk-based screening; and
 - o Risk characterization to assess the potential for ecological effects due to Site related COIs.
- An ecological survey was conducted as part of the SI (EA, 2004), which documented ecological features
 and conditions at and near the Site.
- The potential for Site-related ecological impacts were also assessed via an examination of stream benthic macroinvertebrate abundance and diversity.
- The ecological information collected during the SI has been incorporated into this risk assessment as appropriate.
- An ODEQ ecological scoping checklist was completed for this ERA, based on the SI ecological survey, and is provided in Appendix C.

4.1 Problem Formulation

- Problem formulation was completed as follows:
 - o The physical and chemical characteristics of the Site and the important ecological habitats, plants, invertebrates, fish, and wildlife that exist are described.
 - o This information is utilized to identify the COIs, the ecological receptors of concern, exposure pathways, and the exposure media.
 - This in turn, allows development of the CEEM which graphically depicts the expected fate and transport of chemicals at the Site, the potential exposure media, and likely exposure pathways for ecological receptor types of concern.
 - o The problem formulation concludes with identification of the ecological endpoints that delineate the objectives of the remainder of the ERA.
 - o Generally, problem formulation includes a description of the Site and summary of previous investigations; however, this information is provided in the SI, and is not repeated herein.

4.1.1 Ecological Stressors

- Ecological receptors may be affected through exposure to chemicals (i.e., toxicity), physical stresses (i.e., destruction of habitat), and biological stresses (i.e., viruses and bacteria).
- Biological stressors were assessed as follows:
 - While biological stressors may affect ecological receptors, they are more frequently associated with waste food or human waste and in areas where wildlife congregate in large numbers. Because the remote nature of the Site limits human presence and wastes, they are not considered to pose a threat to ecological receptors. Because of the lack of suitable habitat, ecological receptors are also unlikely to congregate in the vicinity of the Site in numbers that could result in significant biological infection or passage of wildlife diseases. Thus, biological stressors are unlikely to be a significant factor and are not considered further.
- Physical stressors were assessed as follows:
 - Past physical disturbances include development and operation of the mines and supporting structures, and possibly historic as well as current logging operations. Because the Site has been abandoned for decades, current physical disturbance is reduced to a relatively low number of

Cascade Earth Sciences – Spokane, WA PN: 2723018 recreational users that visit or drive by the Site. Given the relatively remote nature of the Site within the Wallowa Whitman National Forest, the ecological impacts of ongoing current physical disturbances are limited.

4.1.2 Ecological Setting

- The regional and Site-specific ecology are briefly described in this section to provide an understanding of the climate, plants, invertebrates, wildlife, and fish that may inhabit the Site and surrounding region:
 - Other than RTE species that must be considered on an individual level, a particular species must be potentially present on or utilize the Site in numbers adequate to allow an exposure level that may result in effects to the species' population. Such significant exposure to Site related COIs will only occur for those species known or expected to use the Site on a regular basis and in high numbers or that bioaccumulated metals to a significant degree.
 - More detailed information on the regional and Site ecology, sensitive environments, and RTE species is presented in the SI.
 - O Bull trout (Salvelinus confluentus) and the mid-Columbia steelhead (Oncorhynchus mykiss) were the only threatened or endangered (i.e., protected) species observed or expected at or in the vicinity of the Site (EA, 2005). Bull trout were identified in Granite Creek. Steelhead are expected primarily downstream of the site.
 - Four distinct habitat types were observed at the Site by EA. These include; drier south facing slopes, moister north facing slopes, riparian zones along Granite Creek, and spruce forest at Monumental Mine.
 - A lack of understory ground species was noted during SI activities and logging, fire, and insect infestations have likely occurred in areas surrounding the Site. Waste Rock piles typically contained early-successional coniferous species.
 - Overall, the relatively large number of species identified during this limited ecological survey suggested that numerous species are present in the vicinity of the Site and that they utilize varied habitat and foraging methods.
 - o Granite Creek flows throughout the Site and is generally less than one meter wide, with a riparian area less than 20 meters wide. EA described the riparian vegetation as being dominated by red alder (EA, 2004), although it is more likely mountain alder that was observed.

4.1.3 Conceptual Ecological Exposure Model

- The CEEM (Figure 4-1) graphically depicts the sources of contamination, contaminant release and transport mechanisms, impacted exposure media, and exposure routes for ecological receptor types observed or expected at the Site. Based on current understanding of Site conditions, the potentially contaminated exposure media for ecological receptors include:
 - o Surface soil/waste rock in the vicinity of the Site;
 - o Vegetation at the Site;
 - o Surface water in Granite Creek, adit and waste rock seep drainages;
 - o Pore water within Granite Creek; and
 - o Sediment in Granite Creek.
- Given these exposure media, the possible and likely ecological receptor groups include:
 - o Terrestrial plants exposed to COIs in soil/waste rock;
 - o Terrestrial invertebrates exposed to COIs in soil/waste rock;
 - Terrestrial and semi-aquatic wildlife (including birds, mammals, and reptiles) exposed to COIs in soil/waste rock, surface/adit water, pore water, and sediment;
 - o Aquatic life (including aquatic plants, aquatic invertebrates, fish, and amphibians) exposed to COIs in surface/adit water, and pore water; and
 - o Benthic invertebrates, birds, and mammals exposed to COIs in sediment.

4.1.4 Assessment Endpoints and Measures

Assessment Endpoints

- Assessment endpoints represent the ecological aspects to be protected at a site and link the ERA to risk management decisions.
- Within a screening level ERA, assessment endpoints are generalized to reflect the risk-based screening process and protective ecological risk-based screening concentrations (ERBSCs). The assessment endpoints for this ERA include:
 - o Protection of the reproduction and survival of plants, terrestrial invertebrates, birds, mammals, and reptiles exposed to COIs in surface soil/waste rock and vegetation at the Site;
 - o Protection of aquatic life reproduction survival exposed to COIs in water within the adit/seep drainages and Granite Creek;
 - Protection of the reproduction and survival of birds and mammals that may drink water from adit/seep drainages and Granite creek;
 - o Protection of the reproduction and survival of aquatic life exposed to COIs in pore water within Granite Creek:
 - o Protection of reproduction and survival of benthic macroinvertebrates exposed to COIs in sediment within Granite Creek; and
 - Protection of reproduction and survival of birds and mammals exposed via the aquatic/benthic food chain to COIs in sediment within Granite Creek.

Assessment Measures

- Assessment measures are characteristics of the Site, selected ecological receptors, or ecosystem aspects
 that are measured through monitoring or sampling activities and then related qualitatively or
 quantitatively to the selected assessment endpoint(s) to determine whether an ecological effect is
 occurring. For this ERA, the assessment measures are comprised of the following:
 - o Measured concentrations in soil/waste rock, surface water, pore water, and sediment; and
 - o Readily-available ERBSCs.

4.2 Ecological Risk-Based Screening

- Ecological risk-based screening begins with a list of COIs in the media of concern, a determination of EPCs, and a comparison of the EPCs to ERBSCs with consideration of exposure to multiple chemicals and media, reporting limit adequacy, and the inordinate contribution of individual chemicals to the overall receptor group risk.
- The result is a list of Site-related chemicals of potential ecological concern (COPECs) with the potential to pose risks to ecological receptors at the Site.
- The initial screening was completed in Section 2.0 and the chemicals retained as ecological COIs were presented in Table 2-1.
- The ERBSCs used in the risk-based screening were provided by ODEQ (ODEQ, 2001).
 - When a screening level value was not available for a given COI, then an alternative ecological riskbased screening concentration (ERBSC) was selected from peer-reviewed literature or a surrogate chemical ERBSC was substituted.
 - The ERBSCs are presented in Appendix D1.
- As per ODEQ guidance (2001), the EPCs for each medium were compared to the ERBSCs for each chemical and receptor group in each medium, resulting in chemical/receptor group-specific risk ratios (R_{ii} in Appendices D2 through D5). Assessment of risk ratios was as follows:
 - o Risk ratios were summed for all chemicals within a receptor group to obtain receptor group-specific risk ratios (R_i in Appendices D2 through D5).
 - The potential for bioaccumulation of each COI was assessed, reporting limit adequacy was checked for undetected COIs, and the inordinate contribution of any given chemical to the overall receptor

- group risk was determined. Risk ratios greater than 1 were considered unacceptable and indicative of potential risks for protected ecological receptors (bull trout and steelhead), aquatic life, and benthic macroinvertebrates.
- o Risk ratios greater than 5 were considered unacceptable for other ecological receptors.
- o The COIs for which potential ecological risks were indicated became COPECs for the Site.
- No ERBSCs are available for vegetation, so a risk-based screening was not conducted for vegetation. The potential for COPECs in vegetation to result in ecological risks is discussed further in the risk characterization section below.
- The risk ratios for receptor groups exposed to COPECs are shown in Tables 4-1 through 4-4.

Table 4-1. Chemicals of Potential Ecological Concern and Risk Ratios for Surface Soil/Waste Rock

| COPEC Terrestr Plants (R _{ij}) | | n* | Terrestrial Invertebrates (R _{ij}) | n* | Birds (R _{ij}) | n* | Mammals (R _{ij}) | n* |
|--|---------------------------------|----|--|----|-----------------------------|----|----------------------------|----|
| Antimony | ony 8 4 0.5 0 No ERBSC | | 0 | 3 | 0 | | | |
| Total Arsenic | 99 | 25 | 30 | 9 | 42 | 25 | 39 | 16 |
| Cadmium | m 1 0 0.2 0 0.8 Bioaccumulation | | | 0 | 0.04 Bioaccumulation | 0 | | |
| Iron | 2,782 | 17 | 139 | 17 | No ERBSC | 0 | No ERBSC | 0 |
| Lead | 12 | 6 | 1 | 0 | 37 | 12 | 0.1 | 0 |
| Manganese | 1 | 0 | 6 | 8 | 0.1 | 0 | 0.05 | 0 |
| Mercury | 208 | 4 | 625 | 5 | 42 | 2 | 0.9 | 0 |
| Selenium | 0.7 | 0 | 0.01 | 0 | 0.4 Bioaccumulation | 0 | 0.03 Bioaccumulation | 0 |
| Silver | 23 | 7 | 0.9 | 0 | No ERBSC | 0 | No ERBSC | 0 |
| Vanadium | 22 | 5 | No ERBSC | 0 | 1 | 0 | 2 | 0 |
| Zinc | 7 | 11 | 2 | 1 | 6 | 8 | 0.02 | 0 |
| Total Receptor Group Risk (R _i) | 3,168 | | 807 | | 131 | | 46 | |

NOTES:

Bold = COPEC with risk ratio greater than acceptable levels; (>1 for protected species - none are expected; >5 for unprotected species) Non-bold = selected as COPECs for reasons other than exceedance of an ERBSC.

^{*} n = number of stations with an unacceptable risk ratio.

Table 4-2. Chemicals of Potential Ecological Concern and Risk Ratios For Surface Water

| COPEC | Aquatic Life (R _{ij}) | n* | Birds (R _{ij}) | n* | Mammals (R _{ij}) | n* |
|--|------------------------------------|----|----------------------------|----------|-----------------------------|----|
| Antimony 0.0006 | | 0 | 0 No ERBSC | | 0.0009 | 0 |
| Arsenic, Total 0.1 | | 0 | 0.001 Bioaccumulation | 0 | 0.003 Bioaccumulation | 0 |
| Barium | 16 | 13 | 0.0004 | 0.0004 0 | | 0 |
| Cadmium | Cadmium 0.2 0 | | 0.00004 Bioaccumulation | 0 | 0.00006 Bioaccumulation | 0 |
| Iron | 0.6 | 0 | No ERBSC | | No ERBSC | |
| Lead | 0.9 | 0 | 0.00008 Bioaccumulation | 0 | 0.000007 Bioaccumulation | 0 |
| Mercury | 0.1 | 0 | 0.00002 Bioaccumulation | 0 | 0.000008 Bioaccumulation | 0 |
| Selenium | 0.3 | 0 | 0.0003 Bioaccumulation | 0 | 0.0008 Bioaccumulation | 0 |
| Silver | 0.8 Reporting Limit Too High | 0 | No ERBSC | | No ERBSC | |
| Zinc | 2 | 1 | 0.002 | 0 | 0.0002 | 0 |
| Total Receptor Group Risk (R _j) | 22 | | 0.004 | | 0.01 | |

NOTES:

Bold = COPEC with risk ratio greater than acceptable levels (>1 for aquatic life; >5 for other species).

Non-bold = selected as COPECs for reasons other than exceedance of an ERBSC.

Table 4-3. Chemicals of Potential Ecological Concern and Risk Ratios for Pore Water

| COPEC | Aquatic Life (R _{ij}) | n* |
|--|------------------------------------|----|
| | 0.04 | 0 |
| Arsenic, Total | Bioaccumulation | |
| Barium | 12 | 11 |
| | 0.5 | 0 |
| Lead | Bioaccumulation | |
| | 0.07 | 0 |
| Mercury | Bioaccumulation | |
| | 0.3 | 0 |
| Selenium | Bioaccumulation | |
| Silver | Reporting Limit Too High | 0 |
| Total Receptor Group Risk (R _i) | 13 | |

NOTES:

Bold = COPEC with risk ratio greater than acceptable levels

(>1 for aquatic life; >5 for other species).

Non-bold = selected as COPECs for reasons other than exceedance of an ERBSC.

^{*} n = number of stations with an unacceptable risk ratio.

^{*} n = number of stations with an unacceptable risk ratio.

Table 4-4. Chemicals of Potential Ecological Concern in Sediment

| СОРЕС | $\begin{array}{c} \text{Benthic} \\ \text{Macroinvertebrates} \\ (R_{ii}) \end{array}$ | n* | Birds and Mammals (\mathbf{R}_{ij}) | n* |
|--|--|----|---------------------------------------|----|
| Aluminum | Aluminum No ERBSC | | No ERBSC | |
| Arsenic, Total | 13 | 8 | 19 | 8 |
| Barium | No ERBSC | | No ERBSC | |
| Cadmium | 1 | 0 | 216 | 9 |
| Cobalt | No ERBSC | | No ERBSC | |
| Iron | No ERBSC | | No ERBSC | |
| | | 0 | No ERBSC | |
| Mercury | 0.5 | | Bioaccumulation | |
| Selenium | No ERBSC | 0 | 5 | 0 |
| Thallium | No ERBSC | | 1 | 0 |
| Vanadium | Vanadium No ERBSC | | No ERBSC | |
| Zinc 0.7 | | 1 | 28 | 19 |
| Total Receptor Group Risk (R _j) | 18 | | 265 | |

NOTES:

Bold = COPEC with risk ratio greater than acceptable levels (>1 for benthic invertebrates; >5 for other species).

Non-bold = selected as COPECs for reasons other than exceedance of an ERBSC.

4.3 **Ecological Risk Characterization**

4.3.1 Risk Description

• Risk description involves examining the predicted risks in each medium to determine whether they are likely, or artifacts of the risk assessment process.

Surface Soil/Waste Rock

- The COPECs for soil/waste rock were listed in Table 4-1.
- Nine of 11 COPECs had at least one exceedance of an ERBSC but only 6 COPECs had exceedances at more than 5 sample locations. Total arsenic was the only COPEC with ERBSC exceedances at more than half of the sample locations. This suggests that other than total arsenic, the COPECs are not at consistently elevated concentrations across all of the mines.
 - Cadmium and selenium were selected as COPECs solely due to their potential to bioaccumulate. However, the synthetic precipitation leaching procedure results for these two COPECs (EA, 2005) suggest that they are strongly bound to soil/waste rock particles, and thus, are not readily bioavailable. As such, it is unlikely they will bioaccumulate to any significant degree in birds or mammals. Given this argument and the lack of an exceedance of ERBSCs at the EPC, cadmium and selenium are not considered to present a significant risk to ecological receptors.
 - O Total arsenic, iron, and mercury risk ratios were inordinately high for at least one receptor group. Mercury only exceeded ERBSCs at 5 out of 38 sample locations. The highest three of these exceedances were in samples collected at the Monumental Mine. The largest exceedances of ERBSCs by mercury were for plants and invertebrates with the only other exceedances being for birds at two sample locations and mammals at one sample location, all at the Monumental Mine. While iron exceeded ERBSCs at 17 sample locations, it exceeded 2 times its background concentration in only one sample (GF-WR-2). Overall, predicted risks for total arsenic are spread across receptor groups and sampling locations, whereas predicted risks for mercury and iron are limited primarily to plants and invertebrates at the Monumental Mine.

^{*} n = number of stations with an unacceptable risk ratio.

- Total arsenic, iron, lead, manganese, silver, vanadium, and zinc had unacceptable risk ratios at more than five sample locations. Potential risks due to iron were discussed above. Total arsenic had multiple unacceptable risk ratios for multiple receptors at all the mines with a majority at the Monumental Mine, but the Tillicum and Golden Fraction Mines also had unacceptable risk ratios for all receptors. Lead had unacceptable risk ratios (six for plants and 12 for birds) an 12 sample locations at five of the mines. Manganese had exceedances of ERBSCs for invertebrates at six Monumental and Tillicum Mine sample locations and in two samples (WR-01 and WR-02) collected at GC-5, but did not exceed its background concentration by more than a factor of two. Silver had only eight unacceptable risk ratios (seven plant and one invertebrate) in four samples collected at the Monumental Mine and one each at GC-7, GC-3, and Golden Fraction Mine (GF-WR-2). Vanadium had five unacceptable risk ratios for plants spread across the Monumental, Tillicum, Cap Martin, Central, and Sheridan mines but only exceeded its background concentration by more than a factor of two in one sample from the Central Mine. Zinc had 19 unacceptable risk ratios (11 for plants, one for invertebrates, and 8 for birds), in samples located at the Monumental, Tillicum, Cap Martin, Central and Golden Fraction Mines, and at GC-3.
- Based on the magnitude of the risk ratio and the number and locations of samples where the
 unacceptable exceedances of ERBSCs and background concentrations occurred, the results of the riskbased screening suggest that:
 - O Total arsenic, lead, and zinc are the COPECs with the highest predicted potential to present risks at more than a few localized areas. The majority of risks were predicted for samples collected at the Monumental and Tillicum Mines. Mercury may also present a relatively high risk to plants and invertebrates in a few very limited areas.
- As discussed above, individual birds or small mammals that inhabit or feed within the waste rock piles have been indicated to be at risk due to exposure to the COPECs. However, given the small size of the waste rock piles in comparison to the surrounding high quality habitat, and the relatively large home range of most wildlife species, populations of mobile and wide-ranging wildlife are unlikely to spend large amounts of time on or around any one mine area. Thus, other than for their possible exposure to total arsenic, which has elevated concentrations at all the mines, wildlife species are considered unlikely to be impacted by the COPECs.

Vegetation

- Vegetation samples were collected from four background and six locations likely to be impacted by Site-related COPECs.
- The COPECs present in vegetation above background concentrations were total arsenic, beryllium, cadmium, total chromium, copper, iron, lead, mercury, vanadium, and zinc (See Appendix A4).
- The maximum ratios of on-Site concentrations to background concentrations were total arsenic, (10), beryllium (1), cadmium (7), total chromium (5), copper (1), iron (2), lead (2), mercury (2), vanadium (1), and zinc (3).
- Beryllium, copper, iron, lead, mercury, and vanadium are present at less than or approximately
 equivalent to two times the background concentration, and thus are not considered to present a
 significant potential for ecological impacts.
- Zinc is a essential nutrient in the environment that only moderately elevated in vegetation compared to its background concentrations. This diminishes the predicted potential for impacts due to zinc.
- Total arsenic and cadmium significantly exceeded background concentrations at the Monumental Mine, while total chromium significantly exceeded background concentrations at the Central Mine.
- Overall, total arsenic, cadmium, and total chromium are the COPECs of most concern in vegetation.
- There is a very limited amount of vegetation on or near the waste rock piles at the Site. This also significantly reduces the potential exposure of herbivores to site-related contamination.

Surface Water

- The COPECs for surface water are listed in Table 4-2. The only exceedance of ERBSCs was for barium. No background concentrations were determined for barium. Given that the differences between the highest and lowest detected barium concentrations was less than a factor of three, barium is not considered to be significantly elevated at the Site.
- Antimony and iron were selected as a COPECs due solely to a lack of ERBSCs. Iron concentrations exceeded background by a factor of more than two at four adit seep sample locations (CMM-AS-01, 02, GC5-AS-01, and GF-AS-01). Antimony was not detected (0.4 μg/L) in background samples but was detected in only two adit seep samples (GC5-AS-01 and GF-AS-01) at concentrations less than 2 times the background detection limit. Silver also had no ERBSCs for birds and mammals, and for data collected in 2003 had elevated reporting limits compared to the ERBSC for aquatic life. However, new data with adequate detection limits were collected in 2007 and none of these new samples had concentrations that exceeded the ERBSCs and were very near the detection limits for background samples. Given these arguments, antimony, iron, and silver are not considered to present a significant risk in surface water at the Site.
- Total arsenic, lead, mercury, and selenium concentrations did not exceed ERBSCs, but were selected as COPECs due solely to their potential to bioaccumulate. Out of 17 total samples, total arsenic was detected in 7 samples; lead was detected in 6 samples; mercury in 6 samples; and selenium in 2 samples. These detections occurred primarily in two adit seeps (GC5-AS-01 and GF-AS-01), at the Monumental Mine (MM-SP-SFW-18, MM-SP-SFW-19, and MM-SP-SFW-51), downstream in Granite Creek (GC-ST-SFW-53 and 54). These represent some of the farthest upstream and/or the farthest downstream samples. While the limited number of detections suggests that these COPECs are not widespread and thus, are not likely to bioaccumulate significantly, the fact that they are present at the Monumental Mine area and then reappear downstream of the last mine suggests a potential for the Monumental Mine and Central Mine to be sources of these COPECs to Granite Creek.
- Overall, slightly elevated concentrations of a few COPECs were noted primarily at upstream and downstream stations, but are not consistently elevated, suggesting that widespread (i.e., significant population level) direct or bioaccumulation-related ecological impacts are unlikely due to COPECs in surface water.

Pore Water

- The COPECs for pore water were listed above in Table 4-3. Barium was the only detected COPEC that exceeded an ERBSC. Similar to surface water, barium was not analyzed in background pore water and so, did not have a respective background concentration determined. However, the difference between the lowest and highest detected concentrations was less than a factor of 2 across the 11 samples, all of which had detected concentrations of barium. Thus, barium is not considered to be significantly elevated at the Site.
- Total arsenic, lead, mercury, and selenium concentrations did not exceed ERBSCs, but were selected as COPECs due solely to their potential to bioaccumulate. However, similar to surface water, their presence in only a few sample locations at very low concentrations strongly suggests their presence is not likely to result in population level ecological impacts. However, the highest detected total arsenic concentrations were at the two farthest downstream stations.
- Silver was not detected in pore water at the site, but one-half the maximum reporting limit exceeds the ERBSC by a maximum factor of 12. Given that silver was not detected in any surface water nor pore water samples and the detection limits are still relatively low (2.9 μg/L), it is deemed unlikely that silver contributes to ecological risks at the site.

Sediment

- The COPECs for sediment were listed above in Table 4-4. Total arsenic, cadmium, and zinc were the only COPECs with unacceptable risk ratios. Concentrations of total arsenic, cadmium, and zinc exceeded background concentration by more than a factor of 2 at 5, 8, 7, and 10 samples (out of 27 possible), respectively. Most of the concentrations of these COPECS that exceeded ERBSCs were downstream from the Cap Martin Mine, with the highest concentrations at or downstream of the Tillicum Mine.
- Hazard quotients for aluminum (3), barium (4), cobalt (5), iron (7), thallium (14), and vanadium (12) were selected solely due to a lack of ERBSCs. Iron was the only one of these COPECs with a respective background concentrations and exceeded this by more than a factor of two in only four samples, including a maximum background exceedences factor of three at GC-ABS-3. With no background concentrations for comparison, the difference between the highest detection and lowest detection limit was examined for the remaining COPECs. Aluminum, barium, cobalt, and iron all had differences of less than a factor of 10. Thallium and vanadium had differences that were factors of 14 and 12, respectively. Three stations (SM-ST-PSD-06, TM-ST-PSD-08, and TM-ST-RSD-07) had high concentrations of aluminum, barium, and cobalt. Aluminum was also high at GC-ST-RSD-53 and GC-ST-PSD-53. Three different stations (CMM-ST-PSD-03, SM-ST-RSD-06, and CM-ST-RSD-10) contained the highest concentrations of thallium and vanadium. However, these 6 stations do not correspond to the locations of the highest concentrations of total arsenic and cadmium which are more likely related to past mining activities.
- Mercury was selected as a COPEC due to the lack of a bird/mammal ERBSC and its potential for bioaccumulation. The maximum mercury detection is approximately 34 times higher than the lowest detection at station GC-ST-PSD-54 and 24 times higher at GC-ABS-1. The remainder of the highest detected concentrations were approximately a factor of 4 greater than the lowest detected concentrations, located at or downstream from the Tillicum Mine.
- Overall, iron, selenium, thallium, vanadium, and zinc had a few elevated concentrations that were spread
 along Granite Creek, while elevated concentrations of total arsenic and cadmium and mercury were
 detected primarily at multiple downstream locations. Aluminum, barium, and cobalt had elevated
 concentrations in the vicinity of the Sheridan and Tillicum Mines.

4.3.2 Ecological Hot Spots

- For this ERA, hot spot levels corresponded to a chemical concentrations that exceed both ERBSCs and background concentrations by a factor of 10 or more. For COPECs without corresponding background concentrations, the hot spot analysis is based solely upon exceedance of the ERBSC by a factor of 10 or more.
- There are ecological hot spots in waste rock for antimony, total arsenic, copper, lead, mercury, silver, and zinc. Hot spot concentrations for these were 50, 180, 500, 160, 3, 20, and 905 mg/kg, respectively for waste rock.
- Ecological hot spots were identified for barium and silver in surface water and pore water. A hot spots for zinc also was identified in surface water. The hot spot concentrations (based on exceedance of the ERBSC only) for barium and silver were 40 and 1.2 μg/L, respectively. The hot spot screening for these two COPECs in these two media should not be used for removal action decisions without prior consideration for the lack of background concentrations. A hot spot was also identified for zinc in surface water, with a hot spot concentration of 1,200 μg/L.
- One ecological hot spot was identified for cadmium in sediment. The hot spot concentration for cadmium was 2.2 mg/kg. Aluminum, barium, cobalt, and vanadium could not be assessed for hot spots because no background concentrations were determined for them and no sediment ERBSCs were available.

Table 4-5. Locations of Ecological Hot Spots

| Soil | Surface Water | Pore Water | Sediment |
|---------------|--|--------------|----------|
| MM-ML-SS-12 | See text above prior to upore water hot spots decision n | GC-ST-PSD-54 | |
| MM-ML-SSS-16 | MM-SP-SFW-18 | TM-ST-PWP-07 | |
| MM-ML-SSS-38 | MM-SP-SFW-19 | TM-ST-PWP-08 | |
| MM-WP-SSS-13 | MM-SP-SFW-51 | CM-ST-PWP-09 | |
| MM-WP-SSS-14 | SM-ST-SFW-06 | CM-ST-PWP-10 | |
| MM-WP-SSS-15 | TM-ST-SFW-07 | CM-ST-PWR-10 | |
| MM-WP-SSS-17 | TM-ST-SFW-08 | GC-ST-PWP-53 | |
| CMM-WP-SUS-21 | CM-ST-SFW-09 | GC-ST-PWP-54 | |
| CM-WP-SSS-31 | CM-ST-SFW-10 | | |
| GF-WR-2 | GC-ST-SFW-53 | | |
| TILL-WR-1 | GC-ST-SFW-54 | | |
| CMM-WR4-1 | CMM-AS-01 | | |
| GC3-WR-01 | | | |
| GC7-WR-03 | | | |

4.3.3 Uncertainty Analysis

- The uncertainty analysis lists the common uncertainties associated with ecological risk-based screening and assesses whether they are likely to over- or underestimate the potential for ecological risks to be realized at the Site.
- This information is combined with that provided above in the risk description section to present
 conclusions regarding ecological risks. The primary uncertainties associated with this ecological riskbased screening and the impacts on the prediction of the potential for ecological risks are discussed
 below:
 - The lack of background concentrations for some COIs in surface water, pore water, and sediment, may result in the inclusion of COIs as COPECs that would otherwise be excluded, and increases the number of chemicals and sample locations predicted as hot spots.
 - The risk-based screening assumes the receptors are constantly exposed to the chemical at a concentration equal to the EPC. While this may be true for immobile species such as plants and some terrestrial invertebrates, unless the contamination is widely and evenly spread, it is not realistic for wildlife species. Because the metals are primarily located around waste rock piles and small centers of mining activity, the risks calculated above overestimate the actual risks posed to wildlife.
 - The use of maximum detected concentration or 90UCL as the EPC is a conservative approach that
 is purposefully designed to result in some overestimation of the potential for ecological risks.
 Because of this, the risks predicted are likely to overestimate actual ecological risks.
 - Including a sample reporting limit screening is a conservative approach that includes COIs as COPECs when they are actually not detected. Because the undetected COI is likely present at concentrations less than the reporting limit, possibly much less, including the COI as a COPEC result in an overestimation of the potential for ecological risks.
 - The lack of site specific bioavailability data does not allow for a formal assessment of risks due to some COPECs for upper trophic level receptors (i.e., birds and mammals). However, the fact that many metals, especially those that have been exposed to the surface for many years, tend to bind strongly to soil and sediment particles suggesting that many of the metals may not be readily bioavailable. Given this evidence, risks due to the bioaccumulation of COPECs are likely overestimated.
 - Except for aquatic life and benthic macroinvertebrates, the ERBSCs used for this ERA are intended to be no-observed-adverse-effect-levels (NOAELs). Because actual ecological effects occur at an unknown concentration somewhere between the NOAEL and the LOAEL, simply exceeding an

- ERBSC does not necessarily indicate the potential for significant ecological effects. Thus, the use of NOAEL-based ERBSCs likely results in an overestimation of the potential for ecological risk.
- o The lack of ERBSCs for some receptors precludes the calculation of risk for those receptors. This may result in an over- or underestimation of the potential for ecological risks. The use of a bioaccumulation screening is a conservative measure used to assess the potential for risks posed to upper trophic level ecological receptors when appropriate ERBSCS are missing.
- Within this ERA, predictions are made regarding the significance of ecological exposures under current conditions at the Site. Overall, the risk-based screening is designed to overestimate the potential for ecological risks.

4.4 Summary Of Ecological Risks

- Predicted risks due to total arsenic in waste rock piles were predicted at all nine mines, but are especially prevalent at the Monumental, Tillicum, and Golden Fraction Mines, and in waste rock sample collected along Granite Creek. Antimony, lead, mercury, silver, and zinc also contributed notably to the overall predicted risks, but to a lesser extent than total arsenic. It is likely that immobile receptors such as terrestrial plants and invertebrates are adversely impacted within and near waste rock piles. Individual birds and small mammals are likely to be exposed to COPECs in the waste rock piles and may be impacted, but population level impacts are not expected to these terrestrial species because of the relatively limited distribution of the COPECs compared to the home ranges of these more wide-ranging species. The most hot spots were noted for total arsenic at the Monumental Mine. Antimony, lead, mercury, and silver also had hot spots spread primarily across the Monumental Mine, but also present at the Tillicum, Golden Fraction, Cap Martin, and Central Mines and in a couple sample collected from waste rock along Granite Creek.
- Total arsenic, cadmium, and total chromium in vegetation were the only COPECs present at concentrations greater than five times higher than in background vegetation. Only total arsenic was elevated more than 10 times higher than background.
- The only elevated risk ratios for COPECs in surface water and pore water were for barium and zinc. Silver also had elevated risk ratios in pore water. The risks attributed to barium and silver likely would not have been as pronounced if background COPEC concentrations were available for these media. All other COPECs other than barium were selected solely due to their potential to bioaccumulate or a lack of ERBSCs. While barium and silver were indicated as having hot spots in both surface water and pore water, these hot spots may be solely related to the lack of background concentrations for barium and the elevated detection limits for silver. The farthest upstream and farthest downstream stations have the highest concentrations of several COPECs in surface water and pore water. This suggests Monumental Mine and Tillicum Mine (or other downstream source) may be contributing a majority of the COPECs to the Creek.
- Total arsenic, cadmium, and zinc in sediment had elevated risk ratios. These appear likely to have the
 potential to impact immobile receptors or those that are frequently exposed to COPECs in sediment.
 Cadmium was the only COPEC that had a hot spot that exceeded both the ERBSC and background
 concentrations by a factor of more than 10.

5.0 CONCLUSIONS

- The following conclusions were developed from the human health risk assessment:
 - The risk assessment determined that there are no unacceptable non-carcinogenic human health risks from exposure to waste rock, and sediment.
 - Ingestion of arsenic in waste rock exceeded the regulatory standard for ECR under CTE exposure conditions.
 - Risks from ingestion and dermal contact with arsenic impacted soil under the RME exposure conditions exceeded the ODEQ's regulatory standard of 1×10^{-6} .

- O Based on the Site topography and its isolated location within the WWNF, it is highly unlikely that recreational users would engage in activities at the Site that could result in significant ingestion of soil, thus, the most likely pathway of exposure at the Site is inhalation of particulates. The quantitative risk assessment determined that the inhalation pathway did not result in unacceptable health impacts.
- o No hot spots were identified at the Site.
- The following conclusions were developed from the ecological risk assessment:
 - Ecological impacts were predicted primarily for terrestrial plants and terrestrial invertebrates (i.e., immobile species), due to COPECs in soil/waste rock at several of the mines. Local and regional populations of these and other terrestrial species are unlikely to be significantly impacted.
 - Likely insignificant ecological impacts were predicted for aquatic life and wildlife exposed to COPECs in surface water and pore water. However, the lack of background concentrations for some COPECs in these media made it difficult to predict the potential for impacts.
 - o Benthic invertebrates and wildlife appear to have the potential to be impacted due primarily to total arsenic, cadmium, and zinc, which are present at elevated concentrations in many sediment sample locations, but are particularly prevalent in the downstream portions of the creek.
 - o The Monumental and Tillicum Mines appear to have more locations with elevated COPEC concentrations in waste rock than the other mines and, in general, the sediment sample locations near and downstream of the Tillicum Mine had the highest COPEC concentrations.

6.0 REFERENCES

- CCME, 1999. Canadian Soil Quality Guidelines. Canadian Council of Resource and Environmental Ministers. Canadian Council of Ministers of the Environment. Winnipeg.
- EA, 2004. Site Inspection Report. Granite Creek Mines. Wallowa Whitman National Forest. January. EA, Engineering, Science, and Technology. Bellevue, Washington.
- Efroymson, R.A., M.E. Will, and G.W. Suter II, 1997a. Toxicological Benchmarks for Contaminants of Potential Concern for Effects on Soil and Litter Invertebrates and Heterotrophic Process: 1997 Revision. ES/ER/TM-126/R2. Prepared for the U.S. Department of Energy, Office of Environmental Management.
- Efroymson, R.A., G.W. Suter II, B.E. Sample, and D.S. Jones, 1997b. Preliminary Remediation Goals for Ecological Endpoints. ES/ER/TM-162/R2. Prepared for the U.S. Department of Energy, Office of Environmental Management.
- FDA, 1990. Contaminants Team, Division of Toxicological Review and Evaluation, Food and Drug Administration, Public Health Service, U.S. Department of Health and Human services; Memorandum to Elizabeth Campbell, Division of Regulatory Guidance as cited in State of California Guidance, Office of the Science Advisor. Assessment of Health Risks from Inorganic Lead in Soil. August.
- ODEQ, 1998. Guidance for Conduct of Deterministic Human Health Risk Assessment, Final. Waste Management and Cleanup Division Cleanup Policy and Program Development. Oregon Department of Environmental Quality.
- ODEQ, 2001. Guidance for Ecological Risk Assessment. Waste Management and Cleanup Division, Oregon Department of Environmental Quality. December. Oregon Department of Environmental Quality.
- USEPA, 1986. Environmental Criteria And Assessment Office, U.S. Environmental Protection Agency. Air Quality Criteria for Lead, EPA 600/8-83-028, June 1986.

- USEPA, 1989. Risk Assessment Guidance for Superfund (RAGS) Human Health Evaluation Manual. Part A Office of Emergency and Remedial Response. EPA/540/1-89/002. United States Environmental Protection Agency. December 1989
- USEPA, 1997. Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments, Interim Final. Environmental Response Team. Edison, New Jersey. United States Environmental Protection Agency. June 1997.
- USEPA, 1999. Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities. Solid Waste and Emergency Response. EPA530-D-99-001C. Table E-1, Page E-13. United States Environmental Protection Agency.
- USEPA, 2003b. National Primary Drinking Water Standards. Office of Water (4606M). EPA 816-F-03-016. United States Environmental Protection Agency.
- USEPA, 2005a. Ecological Soil Screening Levels for Antimony Interim Final. Office of Solid Waste and Emergency Response. OSWER Directive 9285.7-61. February.
- USEPA, 2005b. Ecological Soil Screening Levels for Arsenic Interim Final. Office of Solid Waste and Emergency Response. OSWER Directive 9285.7-62. March.
- USEPA, 2005c. Ecological Soil Screening Levels for Beryllium Interim Final. Office of Solid Waste and Emergency Response. OSWER Directive 9285.7-64. February.
- USEPA, 2005d. Ecological Soil Screening Levels for Cobalt Interim Final. Office of Solid Waste and Emergency Response. OSWER Directive 9285.7-67. March.

Figure 3-1. Conceptual Human Health Exposure Model

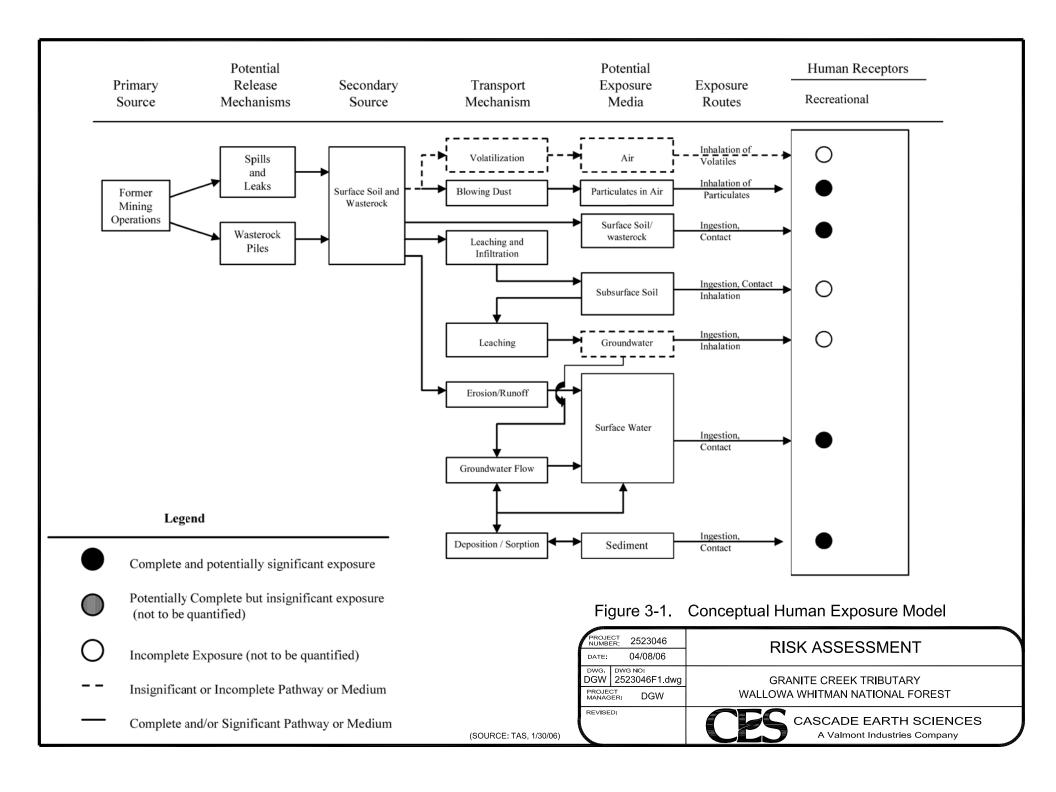
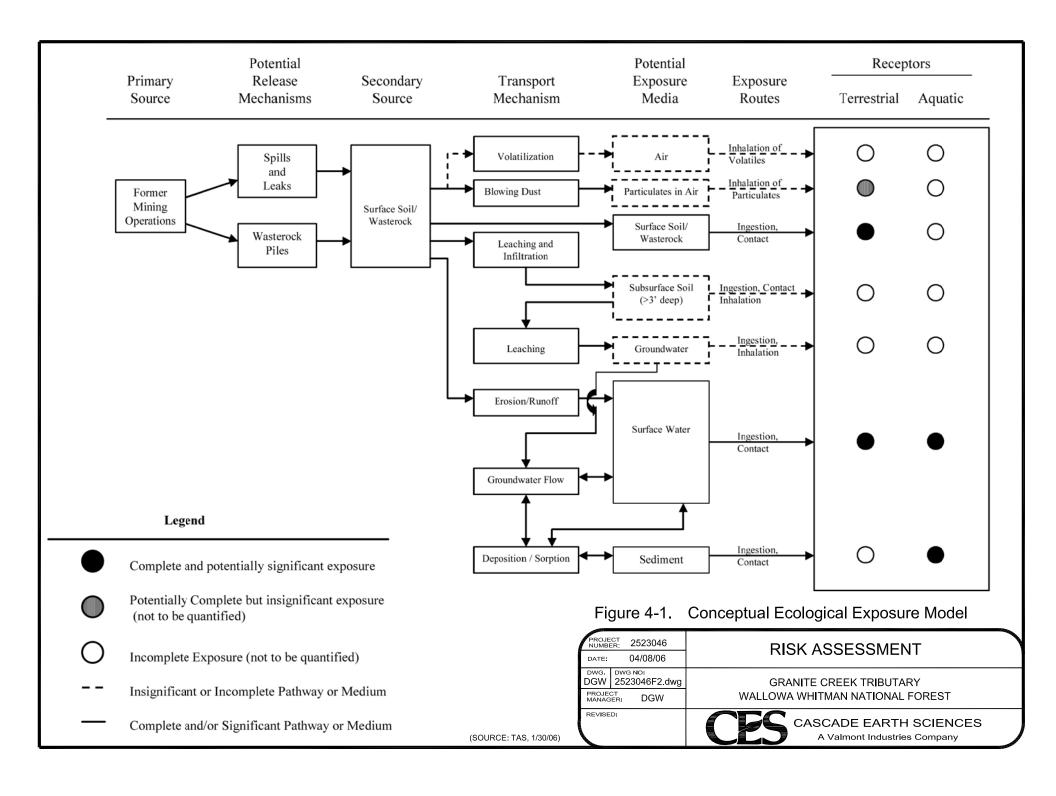


Figure 4-1. Conceptual Ecological Exposure Model



Appendix A. Data Summary and Initial Screening

Appendix A1. Data Summary and Initial Ecological Screening for Surface Soil
Upper Granite Creek Mines Human Health and Ecological Risk Assessment, Wallowa-Whitman National Forest, Oregon

| Chemical of Interest | Number of Analyses | Number of Detections | Frequency of Detection | Minimum Detected Concentration | Maximum Detected Concentration | 90% Upper Confidence Limit | Exposure Point Concentration ¹ | Half of Minimum Sample Reporting Limit mg/kg | Half of Maximum Sample Reporting Limit | Minimum Soil Ecological Risk-Based Screening Concentration | Minimum Human Health Risk-Based Screening Concentration | Maximum Background Concentration 1 | Exceeds 5% Frequency of Detection? | Reporting Limit Too High For Ecological Receptors? | Reporting Limit Too High for Human Health? | Maximum Concentration Exceeds Background? | Ecological Chemical of Interest? | Human Health Chemical of Interest? |
|----------------------------|--------------------------|----------------------------|------------------------------|--------------------------------------|--------------------------------------|----------------------------------|---|---|--|--|---|------------------------------------|------------------------------------|--|--|--|---|--|
| Metals | | | | | | | | | | | | | | | | | | |
| Aluminum | 17 | 17 | 100% | 1.11E+03 | 1.75E+04 | 1.06E+04 | 1.06E+04 | NA | NA | 5.00E+01 | 1.00E+05 | 3.12E+04 | Yes | No | No | No | No | No |
| Antimony | 38 | 31 | 82% | 3.00E-01 | 3.68E+02 | 4.11E+01 | 4.11E+01 | 1.00E-01 | 5.00E-01 | 5.00E+00 | 4.09E+02 | 8.40E-01 | Yes | No | No | Yes | Yes | Yes |
| Arsenic, total | 38 | 38 | 100% | 1.70E+00 | 1.14E+04 | 1.79E+03 | 1.79E+03 | NA | NA | 1.00E+01 | 1.59E+00 | 4.35E+01 | Yes | No | No | Yes | Yes | Yes |
| Barium | 17 | 17 | 100% | 3.28E+01 | 3.22E+02 | 1.82E+02 | 1.82E+02 | NA | NA | 8.50E+01 | 6.66E+04 | 3.19E+02 | Yes | No | No | Yes | Yes | Yes |
| Beryllium | 38 | 31 | 82% | 3.30E-02 | 7.00E-01 | 3.40E-01 | 3.40E-01 | 1.00E-01 | 1.00E-01 | 1.00E+01 | 1.94E+03 | 1.20E+00 | Yes | No | No | No | No | No |
| Cadmium | 38 | 34 | 89% | 1.70E-01 | 2.34E+01 | 4.77E+00 | 4.77E+00 | 1.25E-02 | 3.20E-02 | 4.00E+00 | 4.51E+02 | 2.03E+00 | Yes | No | No | Yes | Yes | Yes |
| Chromium, Total | 38 | 37 | 97% | 1.40E+00 | 2.00E+01 | 8.64E+00 | 8.64E+00 | 5.00E-01 | 5.00E-01 | 4.00E-01 | 4.48E+02 | 7.00E+01 | Yes | No | No | No | No | No |
| Cobalt | 17 | 17 | 100% | 6.00E-01 | 1.05E+01 | 7.49E+00 | 7.49E+00 | NA | NA | 2.00E+01 | 1.92E+03 | 1.13E+01 | Yes | No | No | No | No | No |
| Copper | 38 | 38 | 100% | 3.00E+00 | 6.98E+02 | 5.21E+01 | 5.21E+01 | NA | NA | 5.00E+01 | 4.09E+04 | 6.70E+01 | Yes | No | No | Yes | Yes | Yes |
| Iron | 38 | 38 | 100% | 2.65E+03 | 9.73E+04 | 2.78E+04 | 2.78E+04 | NA | NA | 1.00E+01 | 1.00E+05 | 3.53E+04 | Yes | No | No | Yes | Yes | Yes |
| Lead | 38 | 38 | 100% | 8.50E-01 | 2.43E+03 | 5.95E+02 | 5.95E+02 | NA | NA | 1.60E+01 | 8.00E+02 | 8.40E+00 | Yes | No | No | Yes | Yes | Yes |
| Manganese | 38 | 38 | 100% | 2.53E+01 | 1.26E+03 | 5.85E+02 | 5.85E+02 | NA | NA | 1.00E+02 | 1.95E+04 | 1.06E+03 | Yes | No | No | Yes | Yes | Yes |
| Mercury | 38 | 33 | 87% | 4.80E-02 | 7.84E+02 | 6.25E+01 | 6.25E+01 | 2.00E-02 | 2.50E-02 | 1.00E-01 | 3.07E+02 | 1.40E-01 | Yes | No | No | Yes | Yes | Yes |
| Nickel | 38 | 37 | 97% | 4.00E-01 | 9.60E+00 | 4.97E+00 | 4.97E+00 | 5.00E-01 | 5.00E-01 | 3.00E+01 | 2.04E+04 | 7.00E+01 | Yes | No | No | No | No | No |
| Selenium | 38 | 38 | 100% | 1.70E-01 | 3.26E+00 | 7.21E-01 | 7.21E-01 | NA | NA | 1.00E+00 | 5.11E+03 | 7.60E-01 | Yes | No | No | Yes | Yes | Yes |
| Silver | 38 | 37 | 97% | 8.00E-02 | 3.19E+02 | 4.70E+01 | 4.70E+01 | 1.05E-01 | 1.05E-01 | 2.00E+00 | 5.11E+03 | 6.30E-01 | Yes | No | No | Yes | Yes | Yes |
| Thallium | 17 | 13 | 76% | 3.40E-01 | 3.30E+00 | 1.52E+00 | 1.52E+00 | 1.15E-01 | 2.30E-01 | 1.00E+00 | 6.75E+01 | 9.70E-01 | Yes | No | No | Yes | Yes | Yes |
| Vanadium | 17 | 17 | 100% | 5.10E+00 | 9.61E+01 | 4.49E+01 | 4.49E+01 | NA | NA | 2.00E+00 | 1.02E+03 | 4.78E+01 | Yes | No | No | Yes | Yes | Yes |
| Zinc | 38 | 38 | 100% | 4.00E+00 | 2.41E+03 | 3.67E+02 | 3.67E+02 | NA | NA | 5.00E+01 | 1.00E+05 | 1.45E+02 | Yes | No | No | Yes | Yes | Yes |

Abbreviations: mg/kg = milligrams per kilogram, NA = not applicable.

1 90th percentile upper confidence limit on the mean or maximum (whichever is lower).

Appendix A2. Data Summary and Initial Human Health Screening for Surface Soil

Upper Granite Creek Mines Human Health and Ecological Risk Assessment, Wallowa-Whitman National Forest, Oregon

| Chemical of Interest | Number of Analyses | Number of Detections | Frequency of Detection | Minimum Detected Concentration | Maximum Detected Concentration | 90% Upper Confidence Limit | Exposure Point Concentration ¹ | Half of Minimum Sample Reporting Limit mg/kg | Half of Maximum Sample Reporting Limit | Minimum Soil Ecological Risk-Based Screening Concentration | Minimum Human Health Risk-Based Screening Concentration | Maximum Background Concentration 1 | Exceeds 5% Frequency of Detection? | Reporting Limit Too High For Ecological Receptors? | Reporting Limit Too High for Human Health? | Maximum Concentration Exceeds Background? | Ecological Chemical of Interest? | Human Health Chemical of Interest? |
|----------------------------|--------------------------|----------------------------|------------------------------|--------------------------------------|--------------------------------------|----------------------------------|---|---|--|--|---|------------------------------------|------------------------------------|--|--|--|---|--|
| Metals | | | | | | | | | | | | | | | | | | |
| Aluminum | 14 | 14 | 100% | 1.11E+03 | 1.75E+04 | 1.03E+04 | 1.03E+04 | NA | NA | 5.00E+01 | 1.00E+05 | 3.12E+04 | Yes | No | No | No | No | No |
| Antimony | 35 | 28 | 80% | 3.00E-01 | 3.68E+02 | 4.44E+01 | 4.44E+01 | 1.00E-01 | 5.00E-01 | 5.00E+00 | 4.09E+02 | 8.40E-01 | Yes | No | No | Yes | Yes | Yes |
| Arsenic, total | 35 | 35 | 100% | 1.70E+00 | 1.14E+04 | 2.25E+03 | 2.25E+03 | NA | NA | 1.00E+01 | 1.59E+00 | 4.35E+01 | Yes | No | No | Yes | Yes | Yes |
| Barium | 14 | 14 | 100% | 3.28E+01 | 3.22E+02 | 1.86E+02 | 1.86E+02 | NA | NA | 8.50E+01 | 6.66E+04 | 3.19E+02 | Yes | No | No | Yes | Yes | Yes |
| Beryllium | 35 | 28 | 80% | 3.30E-02 | 7.00E-01 | 3.33E-01 | 3.33E-01 | 1.00E-01 | 1.00E-01 | 1.00E+01 | 1.94E+03 | 1.20E+00 | Yes | No | No | No | No | No |
| Cadmium | 35 | 32 | 91% | 1.70E-01 | 2.34E+01 | 4.51E+00 | 4.51E+00 | 1.35E-02 | 3.20E-02 | 4.00E+00 | 4.51E+02 | 2.03E+00 | Yes | No | No | Yes | Yes | Yes |
| Chromium, Total | 35 | 34 | 97% | 1.40E+00 | 2.00E+01 | 8.81E+00 | 8.81E+00 | 5.00E-01 | 5.00E-01 | 4.00E-01 | 4.48E+02 | 7.00E+01 | Yes | No | No | No | No | No |
| Cobalt | 14 | 14 | 100% | 6.00E-01 | 1.05E+01 | 7.36E+00 | 7.36E+00 | NA | NA | 2.00E+01 | 1.92E+03 | 1.13E+01 | Yes | No | No | No | No | No |
| Copper | 35 | 35 | 100% | 3.00E+00 | 6.98E+02 | 5.46E+01 | 5.46E+01 | NA | NA | 5.00E+01 | 4.09E+04 | 6.70E+01 | Yes | No | No | Yes | Yes | Yes |
| Iron | 35 | 35 | 100% | 2.65E+03 | 9.73E+04 | 2.84E+04 | 2.84E+04 | NA | NA | 1.00E+01 | 1.00E+05 | 3.53E+04 | Yes | No | No | Yes | Yes | Yes |
| Lead | 35 | 35 | 100% | 8.50E-01 | 2.43E+03 | 7.19E+02 | 7.19E+02 | NA | NA | 1.60E+01 | 8.00E+02 | 8.40E+00 | Yes | No | No | Yes | Yes | Yes |
| Manganese | 35 | 35 | 100% | 2.53E+01 | 1.26E+03 | 5.92E+02 | 5.92E+02 | NA | NA | 1.00E+02 | 1.95E+04 | 1.06E+03 | Yes | No | No | Yes | Yes | Yes |
| Mercury | 35 | 30 | 86% | 4.80E-02 | 7.84E+02 | 6.78E+01 | 6.78E+01 | 2.00E-02 | 2.50E-02 | 1.00E-01 | 3.07E+02 | 1.40E-01 | Yes | No | No | Yes | Yes | Yes |
| Nickel | 35 | 34 | 97% | 4.00E-01 | 9.60E+00 | 5.03E+00 | 5.03E+00 | 5.00E-01 | 5.00E-01 | 3.00E+01 | 2.04E+04 | 7.00E+01 | Yes | No | No | No | No | No |
| Selenium | 35 | 35 | 100% | 1.70E-01 | 3.26E+00 | 7.28E-01 | 7.28E-01 | NA | NA | 1.00E+00 | 5.11E+03 | 7.60E-01 | Yes | No | No | Yes | Yes | Yes |
| Silver | 35 | 34 | 97% | 8.00E-02 | 3.19E+02 | 6.33E+01 | 6.33E+01 | 1.05E-01 | 1.05E-01 | 2.00E+00 | 5.11E+03 | 6.30E-01 | Yes | No | No | Yes | Yes | Yes |
| Thallium | 14 | 11 | 79% | 3.40E-01 | 3.30E+00 | 1.60E+00 | 1.60E+00 | 1.30E-01 | 2.30E-01 | 1.00E+00 | 6.75E+01 | 9.70E-01 | Yes | No | No | Yes | Yes | Yes |
| Vanadium | 14 | 14 | 100% | 5.10E+00 | 9.61E+01 | 4.58E+01 | 4.58E+01 | NA | NA | 2.00E+00 | 1.02E+03 | 4.78E+01 | Yes | No | No | Yes | Yes | Yes |
| Zinc | 35 | 35 | 100% | 4.00E+00 | 2.41E+03 | 3.61E+02 | 3.61E+02 | NA | NA | 5.00E+01 | 1.00E+05 | 1.45E+02 | Yes | No | No | Yes | Yes | Yes |

Abbreviations: mg/kg = milligrams per kilogram, NA = not applicable.

Doc: App A Initial Screening-Calcs.xlsx (A2 HHRA SurfSoil)

^{1 90}th percentile upper confidence limit on the mean or maximum (whichever is lower).

Appendix A3. Data Summary and Initial Human Health Screening for Subsurface Soil
Upper Granite Creek Mines Human Health and Ecological Risk Assessment, Wallowa-Whitman National Forest, Oregon

| Chemical of Interest | Number of Analyses | Number of Detections | Frequency of Detection | Minimum Detected Concentration | Maximum Detected Concentration | 90% Upper Confidence Limit | Exposure Point Concentration ¹ | Half of Minimum Sample Reporting Limit mg/kg | Half of Maximum Sample Reporting Limit | Minimum Soil Ecological Risk-Based Screening Concentration | Minimum Human Health Risk-Based Screening Concentration | Maximum Background Concentration 1 | Exceeds 5% Frequency of Detection? | Reporting Limit Too High For Ecological Receptors? | Reporting Limit Too High for Human Health? | Maximum Concentration Exceeds Background? | Human Health Chemical of Interest? |
|----------------------------|--------------------------|----------------------------|------------------------------|--------------------------------------|--------------------------------------|----------------------------------|---|--|--|--|---|------------------------------------|------------------------------------|--|--|--|--|
| Metals | | | | | | | | | | | | | | | | | |
| Aluminum | 10 | 10 | 100% | 4.68E+03 | 1.76E+04 | 1.30E+04 | 1.30E+04 | NA | NA | 5.00E+01 | 1.00E+05 | 3.12E+04 | Yes | No | No | No | No |
| Antimony | 10 | 10 | 100% | 3.80E-01 | 6.00E+00 | 3.74E+00 | 3.74E+00 | NA | NA | 5.00E+00 | 4.09E+02 | 8.40E-01 | Yes | No | No | Yes | Yes |
| Arsenic, total | 10 | 10 | 100% | 1.01E+01 | 5.44E+02 | 2.41E+02 | 2.41E+02 | NA | NA | 1.00E+01 | 1.59E+00 | 4.35E+01 | Yes | No | No | Yes | Yes |
| Barium | 10 | 10 | 100% | 1.38E+02 | 2.25E+02 | 1.91E+02 | 1.91E+02 | NA | NA | 8.50E+01 | 6.66E+04 | 3.19E+02 | Yes | No | No | No | No |
| Beryllium | 10 | 10 | 100% | 2.10E-01 | 5.00E-01 | FALSE | 5.00E-01 | NA | NA | 1.00E+01 | 1.94E+03 | 1.20E+00 | Yes | No | No | No | No |
| Cadmium | 10 | 8 | 80% | 5.20E-01 | 1.41E+01 | 5.35E+00 | 5.35E+00 | 1.25E-02 | 1.35E-02 | 4.00E+00 | 4.51E+02 | 2.03E+00 | Yes | No | No | Yes | Yes |
| Chromium, Total | 10 | 10 | 100% | 3.30E+00 | 1.33E+01 | 8.42E+00 | 8.42E+00 | NA | NA | 4.00E-01 | 4.48E+02 | 7.00E+01 | Yes | No | No | No | No |
| Cobalt | 10 | 10 | 100% | 6.40E+00 | 9.90E+00 | 8.62E+00 | 8.62E+00 | NA | NA | 2.00E+01 | 1.92E+03 | 1.13E+01 | Yes | No | No | No | No |
| Copper | 10 | 10 | 100% | 5.50E+00 | 4.35E+01 | FALSE | 4.35E+01 | NA | NA | 5.00E+01 | 4.09E+04 | 6.70E+01 | Yes | No | No | No | No |
| Iron | 10 | 10 | 100% | 1.88E+04 | 2.82E+04 | 2.34E+04 | 2.34E+04 | NA | NA | 1.00E+01 | 1.00E+05 | 3.53E+04 | Yes | No | No | No | No |
| Lead | 10 | 10 | 100% | 3.60E+00 | 1.20E+02 | 5.37E+01 | 5.37E+01 | NA | NA | 1.60E+01 | 8.00E+02 | 8.40E+00 | Yes | No | No | Yes | Yes |
| Manganese | 10 | 10 | 100% | 2.70E+02 | 8.33E+02 | 6.82E+02 | 6.82E+02 | NA | NA | 1.00E+02 | 1.95E+04 | 1.06E+03 | Yes | No | No | No | No |
| Mercury | 10 | 10 | 100% | 2.60E-02 | 6.10E-01 | 2.96E-01 | 2.96E-01 | NA | NA | 1.00E-01 | 3.07E+02 | 1.40E-01 | Yes | No | No | Yes | Yes |
| Nickel | 10 | 10 | 100% | 3.90E+00 | 9.70E+00 | 6.54E+00 | 6.54E+00 | NA | NA | 3.00E+01 | 2.04E+04 | 7.00E+01 | Yes | No | No | No | No |

Abbreviations: mg/kg = milligrams per kilogram, NA = not applicable.

^{1 90}th percentile upper confidence limit on the mean or maximum (whichever is lower).

Data Summary and Initial Ecological Screening for Vegetation Appendix A4. Upper Granite Creek Mines Human Health and Ecological Risk Assessment, Wallowa-Whitman National Forest, Oregon

| Chemical of Interest | Number of Analyses | Number of Detections | Frequency of Detection | Minimum Detected Concentration | Maximum Detected Concentration | 90% Upper Confidence Limit | Exposure Point Concentration ¹ | Half of Minimum Sample Reporting Limit | Half of Maximum Sample Reporting Limit | Minimum Terrestrial Ecological Risk-Based Screening Concentration | Maximum Background Concentration ¹ | Exceeds 5% Frequency of Detection? | Reporting Limit Too High For Ecological Receptors? | Maximum Concentration Exceeds Background? | Ecological Chemical of Interest? |
|----------------------------|--------------------------|----------------------------|------------------------------|--------------------------------------|--------------------------------------|----------------------------------|---|--|--|---|---|------------------------------------|--|--|---|
| | | | | | | | mg/kg | <u> </u> | | | | | | | |
| Metals | 1 . | | 1000/ | 1.725.02 | 2047-02 | | 2045 02 | | 37. | | 2.125.02 | T | | ., | |
| Aluminum | 6 | 6 | 100% | 1.53E+02 | 2.84E+02 | NA | 2.84E+02 | NA | NA | No Data | 3.12E+02 | Yes | No | No | No |
| Antimony | 6 | 0 | 0% | ND | ND | NA | 0.00E+00 | 4.70E-01 | 6.50E-01 | No Data | 0.00E+00 | No | No | No | No |
| Arsenic, total | 6 | 3 | 50% | 1.00E+00 | 1.06E+01 | NA | 1.06E+01 | 6.00E-01 | 7.00E-01 | No Data | 0.00E+00 | Yes | No | Yes | Yes |
| Barium | 6 | 6 | 100% | 5.19E+01 | 2.90E+02 | NA | 2.90E+02 | NA | NA | No Data | 5.05E+02 | Yes | No | No | No |
| Beryllium | 6 | 6 | 100% | 8.70E-02 | 1.60E-01 | NA | 1.60E-01 | NA | NA | No Data | 1.20E-01 | Yes | No | Yes | Yes |
| Cadmium | 6 | 5 | 83% | 5.00E-01 | 2.60E+00 | NA | 2.60E+00 | 7.50E-02 | 7.50E-02 | No Data | 3.70E-01 | Yes | No | Yes | Yes |
| Chromium, Total | 6 | 2 | 33% | 4.80E-01 | 1.70E+00 | NA | 1.70E+00 | 1.80E-01 | 1.90E-01 | No Data | 0.00E+00 | Yes | No | Yes | Yes |
| Cobalt | 6 | 0 | 0% | ND | ND | NA | 0.00E+00 | 2.00E-01 | 2.85E-01 | No Data | 0.00E+00 | No | No | No | No |
| Copper | 6 | 6 | 100% | 4.60E+00 | 6.10E+00 | NA | 6.10E+00 | NA | NA | No Data | 5.70E+00 | Yes | No | Yes | Yes |
| Iron | 6 | 6 | 100% | 1.97E+02 | 6.42E+02 | NA | 6.42E+02 | NA | NA | No Data | 3.15E+02 | Yes | No | Yes | Yes |
| Lead | 6 | 6 | 100% | 5.00E-01 | 2.70E+00 | NA | 2.70E+00 | NA | NA | No Data | 1.10E+00 | Yes | No | Yes | Yes |
| Manganese | 6 | 6 | 100% | 1.18E+02 | 2.91E+02 | NA | 2.91E+02 | NA | NA | No Data | 3.24E+02 | Yes | No | No | No |
| Mercury | 6 | 4 | 67% | 5.00E-02 | 9.20E-02 | NA | 9.20E-02 | 2.30E-02 | 2.60E-02 | No Data | 0.00E+00 | Yes | No | Yes | Yes |
| Nickel | 6 | 0 | 0% | ND | ND | NA | 0.00E+00 | 2.10E-01 | 3.00E-01 | No Data | 0.00E+00 | No | No | No | No |
| Selenium | 6 | 2 | 33% | 7.00E-01 | 9.10E-01 | NA | 9.10E-01 | 4.35E-01 | 4.85E-01 | No Data | 1.40E+00 | Yes | No | No | No |
| Silver | 6 | 0 | 0% | ND | ND | NA | 0.00E+00 | 2.20E-01 | 3.15E-01 | No Data | 0.00E+00 | No | No | No | No |
| Thallium | 6 | 0 | 0% | ND | ND | NA | 0.00E+00 | 5.50E-01 | 8.00E-01 | No Data | 0.00E+00 | No | No | No | No |
| Vanadium | 6 | 6 | 100% | 7.60E-01 | 1.20E+00 | NA | 1.20E+00 | NA | NA | No Data | 9.40E-01 | Yes | No | Yes | Yes |
| Zinc | 6 | 6 | 100% | 1.67E+01 | 7.02E+01 | NA | 7.02E+01 | NA | NA | No Data | 2.14E+01 | Yes | No | Yes | Yes |

Abbreviations: mg/kg = milligrams per kilogram, NA = not applicable, ND = not detected.

1 90th percentile upper confidence limit on the mean or maximum (whichever is lower).

Doc: App A Initial Screening-Calcs.xlsx (A4 Veg)

Appendix A5. Data Summary and Initial Screening for Surface Water

Upper Granite Creek Mines Human Health and Ecological Risk Assessment, Wallowa-Whitman National Forest, Oregon

| Chemical of Interest | Number of Analyses | Number of Detections | Frequency of Detection | Minimum Detected Concentration | Maximum Detected Concentration | 90% Upper Confidence Limit | Exposure Point Concentration ¹ | Half of Minimum Sample Reporting Limit mg/L | Half of Maximum Sample Reporting Limit | Minimum Surface Water Ecological Risk-Based Screening Concentration | Minimum Human Health Risk-Based Screening Concentration | Maximum Background Concentration ¹ | Exceeds 5% Frequency of Detection? | Reporting Limit Too High For Ecological Receptors? | Reporting Limit Too High for Human Health? | Maximum Concentration Exceeds Background? | Ecological Chemical of Interest? | Human Health Chemical of Interest? |
|----------------------------|--------------------------|----------------------------|------------------------------|--------------------------------------|--------------------------------------|----------------------------------|---|--|--|---|---|---|------------------------------------|--|--|--|---|--|
| Metals | | | | | | | | | | | | | | | | | | |
| Aluminum | 13 | 3 | 23% | 2.64E-02 | 1.26E-01 | 4.87E-02 | 4.87E-02 | 1.18E-02 | 3.16E-02 | 8.70E-02 | 3.65E+01 | 0.00E+00 | Yes | No | No | Yes | Yes | Yes |
| Antimony | 17 | 2 | 12% | 7.00E-04 | 9.00E-04 | 2.27E-03 | 9.00E-04 | 2.00E-04 | 2.50E-03 | 1.00E+00 | 1.46E-02 | 0.00E+00 | Yes | No | No | Yes | Yes | Yes |
| Arsenic, Total | 17 | 7 | 41% | 1.30E-03 | 8.18E-02 | 1.78E-02 | 1.78E-02 | 2.50E-04 | 3.00E-03 | 1.50E-01 | 4.48E-05 | 6.00E-04 | Yes | No | Yes | Yes | Yes | Yes |
| Barium | 13 | 13 | 100% | 3.49E-02 | 9.95E-02 | 6.22E-02 | 6.22E-02 | NA | NA | 4.00E-03 | 2.55E+00 | 0.00E+00 | Yes | No | No | Yes | Yes | Yes |
| Beryllium | 17 | 0 | 0% | ND | ND | 1.53E-04 | 0.00E+00 | 5.00E-05 | 2.00E-04 | 5.30E-03 | 7.30E-02 | 0.00E+00 | No | No | No | No | No | No |
| Cadmium | 17 | 2 | 12% | 1.00E-04 | 7.00E-04 | 4.47E-04 | 4.47E-04 | 5.00E-05 | 6.00E-04 | 2.20E-03 | 1.82E-02 | 0.00E+00 | Yes | No | No | Yes | Yes | Yes |
| Chromium, Total | 17 | 1 | 6% | 7.40E-04 | 7.40E-04 | 2.37E-03 | 7.40E-04 | 7.00E-04 | 5.00E-03 | 1.10E-02 | No Data | 0.00E+00 | Yes | No | No | Yes | Yes | Yes |
| Cobalt | 13 | 0 | 0% | ND | ND | 1.62E-03 | 0.00E+00 | 9.00E-04 | 1.85E-03 | 2.30E-02 | 7.30E-01 | 0.00E+00 | No | No | No | No | No | No |
| Copper | 17 | 2 | 12% | 7.00E-04 | 3.80E-03 | 1.56E-03 | 1.56E-03 | 2.50E-04 | 1.65E-03 | 9.00E-03 | 1.46E+00 | 0.00E+00 | Yes | No | No | Yes | Yes | Yes |
| Iron | 17 | 6 | 35% | 3.23E-02 | 2.03E+00 | 6.43E-01 | 6.43E-01 | 8.40E-03 | 3.34E-02 | 1.00E+00 | 1.09E+01 | 1.00E-01 | Yes | No | No | Yes | Yes | Yes |
| Lead | 17 | 6 | 35% | 1.00E-04 | 9.00E-03 | 2.13E-03 | 2.13E-03 | 5.00E-05 | 7.50E-04 | 2.50E-03 | No Data | 1.00E-04 | Yes | No | No | Yes | Yes | Yes |
| Manganese | 17 | 13 | 76% | 7.20E-04 | 3.74E-01 | 1.01E-01 | 1.01E-01 | 3.50E-04 | 9.50E-04 | 1.20E-01 | 8.76E-01 | 0.00E+00 | Yes | No | No | Yes | Yes | Yes |
| Mercury | 17 | 6 | 35% | 9.50E-07 | 2.00E-04 | 7.57E-05 | 7.57E-05 | 5.00E-05 | 5.00E-05 | 7.70E-04 | 1.09E-02 | 4.80E-07 | Yes | No | No | Yes | Yes | Yes |
| Nickel | 17 | 0 | 0% | ND | ND | 2.88E-03 | 0.00E+00 | 1.00E-03 | 5.00E-03 | 5.20E-02 | 7.30E-01 | 0.00E+00 | No | No | No | No | No | No |
| Selenium | 17 | 2 | 12% | 5.00E-04 | 2.60E-03 | 1.26E-03 | 1.26E-03 | 5.00E-05 | 1.70E-03 | 5.00E-03 | 1.82E-01 | 0.00E+00 | Yes | No | No | Yes | Yes | Yes |
| Silver | 17 | 1 | 6% | 9.00E-05 | 9.00E-05 | 1.20E-03 | 9.00E-05 | 2.50E-05 | 1.45E-03 | 1.20E-04 | 1.82E-01 | 0.00E+00 | Yes | Yes | No | Yes | Yes | Yes |
| Thallium | 13 | 0 | 0% | ND | ND | 2.22E-03 | 0.00E+00 | 1.40E-03 | 2.85E-03 | 4.00E-02 | 2.41E-03 | 0.00E+00 | No | No | Yes | No | No | Yes |
| Vanadium | 13 | 0 | 0% | ND | ND | 1.52E-03 | 0.00E+00 | 1.00E-03 | 1.80E-03 | 2.00E-02 | 3.65E-02 | 0.00E+00 | No | No | No | No | No | No |
| Zinc | 17 | 14 | 82% | 2.00E-03 | 1.31E+00 | 2.31E-01 | 2.31E-01 | 2.85E-03 | 5.00E-03 | 1.20E-01 | 1.09E+01 | 1.00E-02 | Yes | No | No | Yes | Yes | Yes |

Abbreviations: mg/L = milligrams per liter, NA = not applicable, ND = not detected.

1 90th percentile upper confidence limit on the mean or maximum (whichever is lower).

Appendix A6. Data Summary and Initial Screening for Pore Water
Upper Granite Creek Mines Human Health and Ecological Risk Assessment, Wallowa-Whitman National Forest, Oregon

| Chemical of Interest | Number of Analyses | Number of Detections | Frequency of Detection | Minimum Detected Concentration | Maximum Detected Concentration | 90% Upper Confidence Limit | Exposure Point Concentration 1 | Half of Minimum Sample Reporting Limit | Half of Maximum Sample Reporting Limit | Minimum Surface Water Ecological Risk-Based Screening Concentration | Maximum Background Concentration ¹ | Exceeds 5% Frequency of Detection? | Reporting Limit Too High For Ecological Receptors? | Maximum Concentration Exceeds Background? | Ecological Chemical of Interest? |
|----------------------------|--------------------------|----------------------------|------------------------------|--------------------------------------|--------------------------------------|----------------------------------|--------------------------------|--|--|---|---|------------------------------------|--|--|---|
| Metals | | | | | | | mg/L | 4 | | | | | | | |
| Aluminum | 11 | 2 | 18% | 4.57E-02 | 6.05E-02 | 3.17E-02 | 3.17E-02 | 1.18E-02 | 3.16E-02 | 8.70E-02 | 0.00E+00 | Yes | No | Yes | Yes |
| Antimony | 14 | 0 | 0% | ND | ND | 2.24E-03 | 0.00E+00 | 2.00E-04 | 2.50E-03 | 1.00E+00 | 0.00E+00 | No | No | No | No |
| Arsenic, Total | 14 | 7 | 50% | 8.00E-04 | 1.67E-02 | 6.49E-03 | 6.49E-03 | 2.40E-03 | 3.00E-03 | 1.50E-01 | 3.40E-03 | Yes | No | Yes | Yes |
| Barium | 11 | 11 | 100% | 3.10E-02 | 6.08E-02 | 4.85E-02 | 4.85E-02 | NA | NA | 4.00E-03 | 0.00E+00 | Yes | No | Yes | Yes |
| Beryllium | 14 | 0 | 0% | ND | ND | 4.42E-04 | 0.00E+00 | 1.00E-04 | 1.00E-03 | 5.30E-03 | 0.00E+00 | No | No | No | No |
| Cadmium | 14 | 0 | 0% | ND | ND | 3.75E-04 | 0.00E+00 | 5.00E-05 | 6.00E-04 | 2.20E-03 | 0.00E+00 | No | No | No | No |
| Chromium, Total | 14 | 3 | 21% | 1.00E-02 | 1.00E-02 | 4.41E-03 | 4.41E-03 | 7.00E-04 | 9.50E-04 | 1.10E-02 | 1.00E-02 | Yes | No | No | No |
| Cobalt | 11 | 0 | 0% | ND | ND | 1.39E-03 | 0.00E+00 | 1.00E-03 | 1.85E-03 | 2.30E-02 | 0.00E+00 | No | No | No | No |
| Copper | 14 | 0 | 0% | ND | ND | 2.79E-03 | 0.00E+00 | 1.20E-03 | 5.00E-03 | 9.00E-03 | 0.00E+00 | No | No | No | No |
| Iron | 14 | 2 | 14% | 2.33E-02 | 5.56E+00 | 1.21E+00 | 1.21E+00 | 8.40E-03 | 3.34E-02 | 1.00E+00 | 5.56E+00 | Yes | No | No | No |
| Lead | 14 | 6 | 43% | 2.00E-04 | 2.40E-03 | 1.16E-03 | 1.16E-03 | 6.50E-04 | 6.50E-04 | 2.50E-03 | 3.00E-04 | Yes | No | Yes | Yes |
| Manganese | 14 | 11 | 79% | 7.00E-04 | 2.59E-01 | 5.61E-02 | 5.61E-02 | 9.50E-04 | 2.50E-03 | 1.20E-01 | 2.59E-01 | Yes | No | No | No |
| Mercury | 14 | 3 | 21% | 2.40E-07 | 1.20E-04 | 5.74E-05 | 5.74E-05 | 5.00E-08 | 5.00E-05 | 7.70E-04 | 6.60E-07 | Yes | No | Yes | Yes |
| Nickel | 14 | 0 | 0% | ND | ND | 2.70E-03 | 0.00E+00 | 1.05E-03 | 5.00E-03 | 5.20E-02 | 0.00E+00 | No | No | No | No |
| Selenium | 14 | 1 | 7% | 3.50E-03 | 3.50E-03 | 1.47E-03 | 1.47E-03 | 5.00E-05 | 1.70E-03 | 5.00E-03 | 0.00E+00 | Yes | No | Yes | Yes |
| Silver | 14 | 0 | 0% | ND | ND | 1.12E-03 | 0.00E+00 | 2.50E-05 | 1.45E-03 | 1.20E-04 | 0.00E+00 | No | Yes | No | Yes |
| Thallium | 11 | 1 | 9% | 4.10E-03 | 4.10E-03 | 2.76E-03 | 2.76E-03 | 1.40E-03 | 2.85E-03 | 4.00E-02 | 0.00E+00 | Yes | No | Yes | Yes |
| Vanadium | 11 | 0 | 0% | ND | ND | 1.36E-03 | 0.00E+00 | 1.00E-03 | 1.80E-03 | 2.00E-02 | 0.00E+00 | No | No | No | No |
| Zinc | 14 | 11 | 79% | 1.70E-03 | 5.90E-03 | 4.52E-03 | 4.52E-03 | 5.00E-03 | 5.00E-03 | 1.20E-01 | 0.00E+00 | Yes | No | Yes | Yes |

Abbreviations: mg/L = milligrams per liter, NA = not applicable, ND = not detected.

1 90th percentile upper confidence limit on the mean or maximum (whichever is lower).

Doc: App A Initial Screening-Calcs.xlsx (A6 PoreWatDissolved)

Appendix A7. Data Summary and Initial Screening for Sediment

Upper Granite Creek Mines Human Health and Ecological Risk Assessment, Wallowa-Whitman National Forest, Oregon

| Chemical of Interest | Number of Analyses | Number of Detections | Frequency of Detection | Minimum Detected Concentration | Maximum Detected Concentration | 90% Upper Confidence Limit | Exposure Point Concentration ¹ | Half of Minimum Sample Reporting Limit mg/kg | Half of Maximum Sample Reporting Limit | Minimum Sediment Ecological Risk-Based Screening Concentration | Minimum Human Health Risk-Based Screening Concentration | Maximum Background Concentration ¹ | Exceeds 5% Frequency of Detection? | Reporting Limit Too High For Ecological Receptors? | Reporting Limit Too High for Human Health? | Maximum Concentration Exceeds Background? | Ecological Chemical of Interest? | Human Health Chemical of Interest? |
|----------------------------|--------------------------|----------------------------|------------------------------|--------------------------------------|--------------------------------------|----------------------------------|---|---|--|--|---|---|------------------------------------|--|--|--|---|---|
| Metals | | | | | | | | | | | | | | | | | | |
| Aluminum | 20 | 20 | 100% | 3.82E+03 | 1.17E+04 | 7.89E+03 | 7.89E+03 | NA | NA | No Data | 1.00E+05 | 0.00E+00 | Yes | No | No | Yes | Yes | Yes |
| Antimony | 27 | 16 | 59% | 3.00E-01 | 5.10E+00 | 1.43E+00 | 1.43E+00 | 1.00E-01 | 2.75E-01 | 3.00E+00 | 4.09E+02 | 3.00E-01 | Yes | No | No | Yes | Yes | Yes |
| Arsenic, total | 27 | 27 | 100% | 6.30E+00 | 3.03E+02 | 7.71E+01 | 7.71E+01 | NA | NA | 4.00E+00 | 1.59E+00 | 3.65E+01 | Yes | No | No | Yes | Yes | Yes |
| Barium | 20 | 20 | 100% | 5.23E+01 | 2.17E+02 | 1.35E+02 | 1.35E+02 | NA | NA | No Data | 6.66E+04 | 0.00E+00 | Yes | No | No | Yes | Yes | Yes |
| Beryllium | 27 | 25 | 93% | 1.10E-01 | 8.00E-01 | 3.50E-01 | 3.50E-01 | 1.00E-01 | 1.00E-01 | 1.22E+02 | 1.94E+03 | 8.00E-01 | Yes | No | No | No | No | No |
| Cadmium | 27 | 15 | 56% | 6.90E-02 | 2.80E+00 | 6.47E-01 | 6.47E-01 | 2.65E-02 | 4.30E-02 | 3.00E-03 | 4.51E+02 | 2.20E-01 | Yes | No | No | Yes | Yes | Yes |
| Chromium, Total | 27 | 27 | 100% | 2.30E+00 | 4.56E+01 | 1.71E+01 | 1.71E+01 | NA | NA | 3.70E+01 | 4.48E+02 | 1.00E+01 | Yes | No | No | Yes | Yes | Yes |
| Cobalt | 20 | 20 | 100% | 1.90E+00 | 9.60E+00 | 6.72E+00 | 6.72E+00 | NA | NA | No Data | 1.92E+03 | 0.00E+00 | Yes | No | No | Yes | Yes | Yes |
| Copper | 27 | 27 | 100% | 1.30E+00 | 3.00E+01 | 9.92E+00 | 9.92E+00 | NA | NA | 1.00E+01 | 4.09E+04 | 0.00E+00 | Yes | No | No | Yes | Yes | Yes |
| Iron | 27 | 27 | 100% | 5.65E+03 | 5.46E+04 | 2.46E+04 | 2.46E+04 | NA | NA | No Data | 1.00E+05 | 1.66E+04 | Yes | No | No | Yes | Yes | Yes |
| Lead | 27 | 27 | 100% | 1.89E+00 | 1.48E+02 | 3.39E+01 | 3.39E+01 | NA | NA | 3.50E+01 | 8.00E+02 | 2.63E+00 | Yes | No | No | Yes | Yes | Yes |
| Manganese | 27 | 27 | 100% | 1.00E+02 | 6.11E+02 | 3.03E+02 | 3.03E+02 | NA | NA | 1.10E+03 | 1.95E+04 | 2.98E+02 | Yes | No | No | Yes | Yes | Yes |
| Mercury | 27 | 18 | 67% | 2.70E-02 | 3.20E-01 | 1.14E-01 | 1.14E-01 | 9.50E-03 | 2.50E-02 | 2.00E-01 | 3.07E+02 | 1.00E-01 | Yes | No | No | Yes | Yes | Yes |
| Nickel | 27 | 25 | 93% | 1.00E+00 | 7.60E+00 | 4.43E+00 | 4.43E+00 | 5.00E-01 | 5.00E-01 | 1.80E+01 | 2.04E+04 | 1.00E+00 | Yes | No | No | Yes | Yes | Yes |
| Selenium | 27 | 27 | 100% | 9.00E-02 | 8.80E-01 | 5.06E-01 | 5.06E-01 | NA | NA | 1.00E-01 | 5.11E+03 | 3.10E-01 | Yes | No | No | Yes | Yes | Yes |
| Silver | 27 | 24 | 89% | 5.00E-02 | 7.90E+00 | 2.02E+00 | 2.02E+00 | 4.70E-02 | 5.00E-02 | 4.50E+00 | 5.11E+03 | 1.30E-01 | Yes | No | No | Yes | Yes | Yes |
| Thallium | 20 | 12 | 60% | 3.00E-01 | 1.80E+00 | 7.89E-01 | 7.89E-01 | 1.25E-01 | 3.35E-01 | 7.00E-01 | 6.75E+01 | 0.00E+00 | Yes | No | No | Yes | Yes | Yes |
| Vanadium | 20 | 20 | 100% | 1.30E+01 | 1.54E+02 | 7.10E+01 | 7.10E+01 | NA | NA | No Data | 1.02E+03 | 0.00E+00 | Yes | No | No | Yes | Yes | Yes |
| Zinc | 27 | 27 | 100% | 2.07E+01 | 1.86E+02 | 8.28E+01 | 8.28E+01 | NA | NA | 3.00E+00 | 1.00E+05 | 3.60E+01 | Yes | No | No | Yes | Yes | Yes |

Abbreviations: mg/kg = milligrams per kilogram, NA = not applicable.

1 90th percentile upper confidence limit on the mean or maximum (whichever is lower).

Appendix B. Human Health Risk-Based Screening Tables

Appendix B1. Selection of Human Health Chemicals of Potential Concern Upper Granite Creek Mines Human Health and Ecological Risk Assessment, Wallowa-Whitman National Forest, Oregon

| | | Media | : Surface So | oil | | | Media: S | Subsurface | soil | | | Medi | a: Sedimen | t | | | Media: Surface | e Water | | All Expos | sure Media |
|----------------------------|------------------------------------|------------------------------------|------------------------|---|--|------------------------------------|------------------------------------|------------------------|--------------------------------|--|----------|------------------------------|------------------------|---|--|----------|------------------------------------|------------------------|---|--|--------------------------------------|
| Chemical of Interest | Preliminary Remediation Goal | Exposure Point Concentration | Risk Ratio (Rij) | Chemical of Potential Concern? | Inordinate Contribution to Medium- Specific Risks? | Preliminary Remediation Goal | Exposure Point Concentration | Risk Ratio (Rij) | Chemical of Potential Concern? | Inordinate Contribution to Medium- Specific Risks? | Goal | Exposure Point Concentration | Risk Ratio (Rij) | Chemical of Potential Concern? | Inordinate Contribution to Medium- Specific Risks? | Goal | Exposure Point Concentration | Risk Ratio (Rij) | Chemical of Potential Concern? | Sum of Medium- Specific Risk Ratios | Chemical of Potential Concern? |
| Aluminum | | - | | | | | | | | | 1.00E+05 | 7.89E+03 | 7.89E-02 | No | No | 3.65E+04 | 4.87E-02 | 1.33E-06 | No | 7.89E-02 | No |
| Antimony | 4.09E+02 | 4.44E+01 | 1.08E-01 | No | No | 4.09E+02 | 3.74E+00 | 9.14E-03 | No | No | 4.09E+02 | 1.43E+00 | 3.49E-03 | No | No | 1.46E+01 | 9.00E-04 | 6.16E-05 | No | 1.21E-01 | No |
| Arsenic | 1.59E+00 | 2.25E+03 | 1.42E+03 | YES | YES | 1.59E+00 | 2.41E+02 | 1.51E+02 | YES | YES | 1.59E+00 | 7.71E+01 | 4.85E+01 | YES | YES | 4.48E-02 | 1.78E-02 | 3.97E-01 | No | 1.62E+03 | YES |
| Barium | 6.66E+04 | 1.86E+02 | 2.80E-03 | No | No | | | | | | 6.66E+04 | 1.35E+02 | 2.02E-03 | No | No | 2.55E+03 | 6.22E-02 | 2.43E-05 | No | 4.84E-03 | No |
| Beryllium | | | | | | | | | | | 1.94E+03 | 3.50E-01 | 1.80E-04 | No | No | | | | | 1.80E-04 | No |
| Cadmium | 4.50E+02 | 4.51E+00 | 1.00E-02 | No | No | 4.50E+02 | 5.35E+00 | 1.19E-02 | No | No | 4.50E+02 | 6.47E-01 | 1.44E-03 | No | No | 1.82E+01 | 4.47E-04 | 2.45E-05 | No | 2.34E-02 | No |
| Chromium | | | | | | | | | | | 2.10E+02 | 1.71E+01 | 8.12E-02 | No | No | 5.47E+04 | 7.40E-04 | 1.35E-08 | No | 8.12E-02 | No |
| Cobalt | | | | | | | | | | | 1.92E+03 | 6.72E+00 | 3.50E-03 | No | No | | | | | 3.50E-03 | No |
| Copper | 4.09E+04 | 5.46E+01 | 1.34E-03 | No | No | | | | | | 4.09E+04 | 9.92E+00 | 2.43E-04 | No | No | 1.46E+03 | 1.56E-03 | 1.07E-06 | No | 1.58E-03 | No |
| Iron | 1.00E+05 | 2.84E+04 | 2.84E-01 | No | No | | | | | | 1.00E+05 | 2.46E+04 | 2.46E-01 | No | No | 1.09E+04 | 6.43E-01 | 5.87E-05 | No | 5.30E-01 | No |
| Lead | 8.00E+02 | 7.19E+02 | 8.99E-01 | No | No | 8.00E+02 | 5.37E+01 | 6.71E-02 | No | No | 8.00E+02 | 3.39E+01 | 4.24E-02 | No | No | 1.50E+01 | 2.13E-03 | 1.42E-04 | No | 1.01E+00 | YES |
| Manganese | 1.95E+04 | 5.92E+02 | 3.04E-02 | No | No | | | | | | 1.95E+04 | 3.03E+02 | 1.55E-02 | No | No | 8.76E+02 | 1.01E-01 | 1.16E-04 | No | 4.61E-02 | No |
| Mercury | 3.07E+02 | 6.78E+01 | 2.21E-01 | No | No | 3.07E+02 | 2.96E-01 | 9.67E-04 | No | No | 3.07E+02 | 1.14E-01 | 3.73E-04 | No | No | 1.09E+01 | 7.57E-05 | 6.91E-06 | No | 2.22E-01 | No |
| Nickel | | | | | | | | | | | 1.60E+03 | 4.43E+00 | 2.77E-03 | No | No | | | | | 2.77E-03 | No |
| Selenium | 5.11E+03 | 7.28E-01 | 1.42E-04 | No | No | 5.11E+03 | 8.37E-01 | 1.64E-04 | No | No | | | | | | 1.82E+02 | 1.26E-03 | 6.90E-06 | No | 3.13E-04 | No |
| Silver | 5.11E+03 | 6.33E+01 | 1.24E-02 | No | No | 5.11E+03 | 1.18E+01 | 2.31E-03 | No | No | 5.11E+03 | 2.02E+00 | 3.96E-04 | No | No | 1.82E+02 | 9.00E-05 | 4.93E-07 | No | 1.51E-02 | No |
| Thallium | 6.75E+01 | 1.60E+00 | 2.37E-02 | No | No | 6.75E+01 | 1.65E+00 | 2.45E-02 | No | No | 6.75E+01 | 7.89E-01 | 1.17E-02 | No | No | 2.41E+00 | 2.85E-03 | 1.18E-03 | No | 6.11E-02 | No |
| Vanadium | 1.02E+03 | 4.58E+01 | 4.48E-02 | No | No | 1.02E+03 | 5.31E+01 | 5.20E-02 | No | No | 1.02E+03 | 7.10E+01 | 6.94E-02 | No | No | | | | | 1.66E-01 | No |
| Zinc | 1.00E+05 | 3.61E+02 | 3.61E-03 | No | No | 1.00E+05 | 2.43E+02 | 2.43E-03 | No | No | 1.00E+05 | 8.28E+01 | 8.28E-04 | No | No | 1.09E+04 | 2.31E-01 | 2.11E-05 | No | 6.89E-03 | No |

Sum of Rij: 1.4E+03 Sum of Rij: 1.5E+02 Sum of Rij: 4.9E+01 Sum of Rij: 4.0E-01 No. of Samples: 1.4E+01 No. of Samples: 1.0E+01 No. of Samples: 1.8E+01 No. of Samples: 1.5E+01 1/No. of Samples: 7.1E-02 1/No. of Samples: 1.0E-01 1/No. of Samples: 5.6E-02 1/No. of Samples 6.7E-02

NOTE:

Abbreviation: mg/kg = milligrams per kilogram.

Appendix B2. Chemical Exposure and Intake Factors
Upper Granite Creek Mines Human Health and Ecological Risk Assessment
Wallowa-Whitman National Forest, Oregon

| | | Recreation | al Receptor | | |
|---|----------|------------|-------------|------------|---------------|
| | Ch | ild | Ac | lult | |
| Exposure Factors | Central | Reasonable | Central | Reasonable | Source |
| | Tendency | Maximum | Tendency | Maximum | |
| | Exposure | Exposure | Exposure | Exposure | |
| Body Weight (kg) | 15 | 15 | 70 | 70 | EPA, 1997 |
| Exposure Frequency (d/yr) soil | 6 | 12 | 6 | 24 | Site Specific |
| Exposure Frequency (d/yr) sediment | 6 | 12 | 6 | 24 | Site Specific |
| Exposure Frequency (d/yr) surface water | 6 | 12 | 6 | 24 | Site Specific |
| Event time (hrs/event) soil | 1 | 2 | 2 | 2 | Site Specific |
| Event Frequency (events per day) | 1 | 1 | 1 | 1 | Site Specific |
| Exposure Duration (yr) | 6 | 6 | 9 | 24 | EPA, 1997 |
| Averaging Time (d) ¹ | | | | | |
| carcinogens | 25,550 | 25,550 | 25,550 | 25,550 | EPA, 1989 |
| noncarcinogens | 2,190 | 2,190 | 3,285 | 8,760 | EPA, 1989 |
| Intake Factors | | | | | |
| Ingestion of soil (mg/d) | 100 | 200 | 50 | 100 | EPA, 1997 |
| Incidental ingestion of sediment (mg/d) | 50 | 100 | 25 | 50 | EPA, 1997 |
| Incidental surface water ingestion (L/hr) | 0.05 | 0.05 | 0.05 | 0.05 | EPA, 1997 |
| Exposed skin surface area (cm ²) | 6,600 | 7,300 | 18,000 | 22,000 | EPA, 2004a |
| Inhalation rate (m ³ /d) | 8.3 | 8.3 | 15.2 | 15.2 | EPA, 1997 |
| Dermal absorption factor | | | | | |
| volatile vp> 12000 Pa | 0.0005 | 0.0005 | 0.0005 | 0.0005 | EPA, 2004a |
| volatile vp< 12000 Pa | 0.03 | 0.03 | 0.03 | 0.03 | EPA, 2004a |
| inorganics | 0.1 | 0.01 | 0.01 | 0.01 | EPA, 2004a |
| Soil Adherence Factor (mg/cm ² -event) | 0.01 | 0.07 | 0.01 | 0.07 | EPA, 2004a |
| PEF (mg ³ /kg) | 1.32E+09 | 1.32E+09 | 1.32E+09 | 1.32E+09 | EPA, 2004a |

Abbreviations: cm^2 = square centimeters, d = day, d/yr = days per year, kg = kilograms, L/hr = liters per hour, $m^3/d = cubic$ meters per day, $mg/cm^2 = milligrams$ per square centimeter, $mg^3/kg = cubic$ milligrams per kilogram, mg/d = milligrams per day, Pa = Pascal, PEF = Particulate Emission Factor, vp = vapor pressure, vp = vapor press

SOURCES:

EPA, 1989. Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual (Part A). EPA/540/1-89/002.

EPA, 1997. "Exposure Factors Handbook". Volumes I - III. EPA Office of Research and Development. August

EPA, 2004a. "Risk Assessment Guide for Superfund, Part E, Supplemental Guidance for Dermal Risk Assessment." July

EPA, 2004b. "Region IV Preliminary Remediation Goals". 2004 Update. EPA. December

Cascade Earth Sciences - Spokane, WA

PN: 2723018

Doc: App B GraniteCrk AppB-PRG Screening.xlsx (B2 Exposure Factors)

May 2011

¹ Averaging Time = Exposure Duration (yrs) X 365 days per year.

Appendix B3. Exposure Point Concentrations
Upper Granite Creek Mines Human Health and Ecological Risk Assessment
Wallowa-Whitman National Forest, Oregon

| Chemical of Potential Concern | n | Maximum Concentrations | Central Tendency Exposure ¹ | Reasonable Maximum Exposure ² |
|----------------------------------|----|---------------------------|--|--|
| Surface Soil (mg/kg) | | | | |
| Arsenic | 35 | 1.14E+04 | 8.53E+02 | 2.25E+03 |
| Sediment (mg/kg) | | | | |
| Arsenic | 27 | 3.03E+02 | 5.44E+01 | 7.71E+01 |
| Surface Water (mg/L) | | | | |
| Arsenic | 17 | 8.18E-02 | 9.88E-03 | 1.78E-02 |

Abbreviations: mg/kg = milligrams per kilogram, mg/L = milligrams per liter, n = number of samples.

¹ Average Concentration

^{2 90%} Upper Confidence Limit on the mean if greater then 10 datapoints or maximum concentration if less than 10 datapoints.

| | Carci | nogen | Noncar | cinogen |
|----------------------------|----------|------------|----------|------------|
| Scenario | Central | Reasonable | Central | Reasonable |
| (Recreational) | Tendency | Maximum | Tendency | Maximum |
| (Recreational) | Exposure | Exposure | Exposure | Exposure |
| | | mg/k | g-day | |
| Surface Soil | | | | |
| Ingestion | 9.1E-10 | 5.8E-09 | 1.0E-08 | 4.4E-08 |
| Inhalation of particulates | 1.29E-12 | 9.78E-12 | 1.23E-11 | 4.92E-11 |
| Dermal | 5.43E-01 | 7.09E+00 | 4.23E+00 | 2.07E+01 |
| Sediments | | | | |
| Ingestion | 1.1E-09 | 2.9E-09 | 5.1E-09 | 2.2E-08 |
| Dermal | 5.43E-01 | 7.09E+00 | 4.23E+00 | 2.07E+01 |
| Surface Water | | | | |
| Ingestion | 2.2E-07 | 1.0E-06 | 6.3E-08 | 6.7E-07 |
| Dermal | 8.01E-01 | 2.01E+00 | 7.23E+00 | 1.60E+01 |

Abbreviation: mg/kg-day = milligrams per kilogram per day.

Appendix B5. Human Health Dermal Absorption Factors for Soil Non-Carcinogenic Dermal Exposure Upper Granite Creek Mines Human Health and Ecological Risk Assessment Wallowa-Whitman National Forest, Oregon

| Chemical of | Dermal | C . | Adharana | ational ce Factors | Recrea Dermal A | ational bsorption |
|----------------------|----------------------|----------------------|---------------------------------|-----------------------------------|---------------------------------|-----------------------------------|
| Potential Concern | Absorption Factor | Conversion Factor | Central Tendency Exposure | Reasonable Maximum Exposure | Central Tendency Exposure | Reasonable Maximum Exposure |
| Arsenic | 0.01 | 0.000001 | 1.00E-02 | 7.00E-02 | 1.00E-10 | 7.00E-10 |

Appendix B6. Human Health Dermal Absorption Factors for Carinogens
Upper Granite Creek Mines Human Health and Ecological Risk Assessment
Wallowa-Whitman National Forest, Oregon

| Chemical of | Dermal | Commonsion | Adharana | ational ce Factors | Recrea Dermal A | ational bsorption |
|----------------------|----------------------|----------------------|--|-----------------------|---------------------------------|-----------------------------------|
| Potential Concern | Absorption Factor | Conversion Factor | Central Reasonabl Tendency Maximum Exposure Exposure | | Central Tendency Exposure | Reasonable Maximum Exposure |
| Arsenic | 0.01 | 0.000001 | 1.00E-02 | 7.00E-02 | 1.00E-10 | 7.00E-10 |

Appendix B7. Critical Toxicity Factors for Non-Carcinogenic Chemicals of Potential Concern Upper Granite Creek Mines Human Health and Ecological Risk Assessment Wallowa-Whitman National Forest, Oregon

| Contaminant | CAS Number | Chronic Oral RfD ¹ Oral Inhalation mg/kg-day | | Oral Inhalation | | Confidence in RfD | Endpoint |
|-------------|---------------|---|----|-----------------|-----------------------------|-------------------|----------|
| Arsenic | 7440-38-2 | 0.0003 | NA | Medium | hyperpigmentation, vascular | | |

Abbreviations: CAS = chemical abstracts scientific (registration), mg/kg-day = milligrams per kilograms per day, RfD = non-cancer reference dose.

1 RfD value from Region IX Preliminarty Remediation goal tables.

Appendix B8. Critical Toxicity Factors for Carcinogenic Chemicals of Potential Concern
Upper Granite Creek Mines Human Health and Ecological Risk Assessment
Wallowa-Whitman National Forest, Oregon

| Contaminant | CAS | Slope Factor (mg/kg-day)-1 | | • | | Weight of Evidence Classification | Type of Cancer | Basis of Slope Factor |
|-------------|-----------|-------------------------------|------------|-----------------|---------------------|--------------------------------------|-------------------|--------------------------|
| Contaminant | Number | Oral | Inhalation | Oral/Inhalation | Oral/ Inhalation | Oral/ Inhalation | | |
| Arsenic | 7440-38-2 | 1.5E+00 | 1.5E+01 | A | skin | EPI studies | | |

Abbreviations: A = known human carcinogen, CAS = chemical abstracts scientific (registration), mg/kg-day = milligrams per kilograms per day.

Appendix B9. Hazard Quotients for Non-Carcinogenic Chemicals of Potential Concern - Recreation Scenario
Upper Granite Creek Mines Human Health and Ecological Risk Assessment, Wallowa-Whitman National Forest, Oregon

| Dente | Chemicals | - | re Point ntration | Average D | Daily Dose 1 | Oral | Oral Hazard Quotient ² | |
|----------------------|----------------------------|---------------------------------|-----------------------------------|---------------------------------|-----------------------------------|-----------------------|-----------------------------------|-----------------------------------|
| Route of Exposure | of Potential Concern | Central Tendency Exposure | Reasonable Maximum Exposure | Central Tendency Exposure | Reasonable Maximum Exposure | Reference Dose | Central Tendency Exposure | Reasonable Maximum Exposure |
| Soil | | mg | /kg | | mg/kg-day | | | |
| Ingestion | Arsenic | 6.82E+02 | 1.80E+03 | 1.01E-08 | 4.44E-08 | 3.00E-04 | 2.E-02 | 3.E-01 |
| Dermal | Arsenic | 6.82E+02 | 1.80E+03 | 4.23E-10 | 1.45E-08 | 3.00E-04 | 1.E-03 | 9.E-02 |
| Sediments | | mg | /kg | mg/kg-day | | | | |
| Ingestion | Arsenic | 4.35E+01 | 6.17E+01 | 5.06E-09 | 2.22E-08 | 3.00E-04 | 7.E-04 | 5.E-03 |
| Dermal | Arsenic | 4.35E+01 | 6.17E+01 | 4.23E-10 | 1.45E-08 | 3.00E-04 | 6.E-05 | 3.E-03 |
| Surface Water | | m | g/L | | mg/L-day | | | |
| Ingestion | Arsenic | 7.90E-03 | 1.42E-02 | 6.29E-08 | 6.71E-07 | 3.00E-04 | 2.E-06 | 3.E-05 |
| Dermal | Arsenic | 7.90E-03 | 1.42E-02 | 7.23E-06 | 1.60E-05 | 3.00E-04 | 2.E-04 | 8.E-04 |
| | | | | | | Total HI ³ | 2.E-02 | 4.E-01 |

Abbreviations: HI = Hazard Index, mg/kg = milligrams per kilogram, mg/kg-day = milligrams per kilogram per day, mg/L = milligrams per liter, mg/L-day = milligrams per liter per day.

¹ Average Daily Dose = Exposure Point Concentration x Intake (Appendix B4).

² Hazard quotient = Average Daily Dose / Oral Reference Dose (RfDo).

³ Hazard Index = sum of all Hazard Quotients.

Appendix B10. Excess Cancer Ricks for Carcinogenic Chemicals of Potential Concern - Recreational Scenario
Upper Granite Creek Mines Human Health and Ecological Risk Assessment, Wallowa-Whitman National Forest, Oregon

| | Chemicals | - | re Point ntration | Average 1 | Daily Dose | Oral | Inhalation | Excess Cancer Risk ¹ | |
|----------------------------|----------------------------|---------------------------------|-----------------------------------|---------------------------------|-----------------------------------|-----------------|-----------------|---------------------------------|-----------------------------------|
| Route of Exposure | of Potential Concern | Central Tendency Exposure | Reasonable Maximum Exposure | Central Tendency Exposure | Reasonable Maximum Exposure | Slope Factor | Slope Factor | Central Tendency Exposure | Reasonable Maximum Exposure |
| Soil | | mg | g/kg | | mg/k | g-day | | | |
| Ingestion | Arsenic | 6.82E+02 | 1.80E+03 | 9.09E-10 | 5.81E-09 | 1.5E+00 | | 9.E-07 | 2.E-05 |
| dermal | Arsenic | 6.82E+02 | 1.80E+03 | 5.43E-11 | 4.96E-09 | 1.5E+00 | | 6.E-08 | 1.E-05 |
| Inhalation of particulates | Arsenic | 6.82E+02 | 1.80E+03 | 1.29E-12 | 9.78E-12 | | 1.5E+01 | 1.E-08 | 3.E-07 |
| Sediments | | mg | g/kg | mg/kg-day | | | | | |
| Ingestion | Arsenic | 4.35E+01 | 6.17E+01 | 1.15E-09 | 2.91E-09 | 1.5E+00 | | 7.E-08 | 3.E-07 |
| dermal | Arsenic | 4.35E+01 | 6.17E+01 | 5.43E-11 | 4.96E-09 | 1.5E+00 | | 4.E-09 | 5.E-07 |
| Surface Water | | m | g/L | | mg/l | L-day | | | |
| Ingestion | Arsenic | 7.90E-03 | 1.42E-02 | 2.17E-07 | 1.03E-06 | 1.5E+00 | | 3.E-09 | 2.E-08 |
| dermal | Arsenic | 7.90E-03 | 1.42E-02 | 8.01E-07 | 2.01E-06 | 1.5E+00 | | 9.E-09 | 4.E-08 |
| | | | | | | Total Excess | Cancer Risk | 1.E-06 | 3.E-05 |



Abbreviations: mg/kg = milligrams per kilogram, mg/kg-day = milligrams per kilogram per day, mg/L = milligrams per liter.

Bold = Unacceptable Excess Cancer Risk

1 Excess Cancer Risk = Exposure Point Concentration x Average Daily Dose x Slope Factor (Sfo or Sfi).

Upper Granite Creek Removal Action

Appendix B11. Human Health Hotspot Evaluation
Upper Granite Creek Mines Human Health and Ecological Risk
Assessment, Wallowa-Whitman National Forest, Oregon

| | Sampling | Arsenic, | Hotspot | |
|---|----------|----------|---------------|----------|
| Sample Number | Depth | Total | Concentration | Hotspot? |
| F-10-1-10-10-10-10-10-10-10-10-10-10-10-1 | feet | | ng/kg | F |
| GF-WR-01 | | 2.9E+01 | 1.43E+04 | No |
| GF-WR-2 | | 1.3E+03 | 1.43E+04 | No |
| GF-WR-3 | | 8.9E+01 | 1.43E+04 | No |
| TILL-WR-01 | | 1.4E+02 | 1.43E+04 | No |
| TM-TA-SSS-30 | 0.4 | 7.3E+01 | 1.43E+04 | No |
| CMM-WR1-1-0.5' | 0.5 | 7.5E+03 | 1.43E+04 | No |
| CMM-WR2-1-0.5' | 0.5 | 4.5E+03 | 1.43E+04 | No |
| CMM-WR2-2-0.5' | 0.5 | 8.6E+02 | 1.43E+04 | No |
| CMM-WR3-1-0.5' | 0.5 | 6.2E+02 | 1.43E+04 | No |
| CMM-WR4-1-0.5' | 0.5 | 5.7E+02 | 1.43E+04 | No |
| CM-WP-SSS-31 | 0.5 | 1.1E+04 | 1.43E+04 | No |
| GC3-WR-01 | 0.5 | 2.0E+01 | 1.43E+04 | No |
| GC5-WR-01 | 0.5 | 9.7E+00 | 1.43E+04 | No |
| GC5-WR-02 | 0.5 | 2.7E+01 | 1.43E+04 | No |
| GC6-WR-01 | 0.5 | 1.3E+02 | 1.43E+04 | No |
| GC6-WR-02 | 0.5 | 2.6E+02 | 1.43E+04 | No |
| GC6-WR-03 | 0.5 | 6.3E+00 | 1.43E+04 | No |
| GC7-WR-01 | 0.5 | 1.7E+01 | 1.43E+04 | No |
| GC7-WR-02 | 0.5 | 2.6E+01 | 1.43E+04 | No |
| GC7-WR-03 | 0.5 | 3.7E+02 | 1.43E+04 | No |
| GC7-WR-04 | 0.5 | 5.9E+01 | 1.43E+04 | No |
| GF-WR2-1-0.5' | 0.5 | 8.8E+01 | 1.43E+04 | No |
| MM-ML-SSS-16 | 0.5 | 1.8E+02 | 1.43E+04 | No |
| MM-ML-SSS-38 | 0.5 | 2.7E+01 | 1.43E+04 | No |
| MM-WP-SSS-15 | 0.5 | 3.0E+02 | 1.43E+04 | No |
| SM-WR2-1-0.5' | 0.5 | 3.4E+02 | 1.43E+04 | No |
| MM-ML-SSS-12 | 0.7 | 1.6E+02 | 1.43E+04 | No |
| MM-WP-SSS-14 | 0.7 | 1.7E+02 | 1.43E+04 | No |
| TM-WP-SSS-27 | 0.8 | 9.3E+00 | 1.43E+04 | No |
| TM-WP-SSS-28 | 0.8 | 6.6E+00 | 1.43E+04 | No |
| MM-WP-SSS-13 | 1 | 1.7E+00 | 1.43E+04 | No |
| MM-WP-SSS-17 | 1 | 1.9E+02 | 1.43E+04 | No |
| CMM-TA-SUS-22 | 1.5 | 1.4E+02 | 1.43E+04 | No |
| CM-TA-SUS-33 | 1.5 | 2.2E+02 | 1.43E+04 | No |
| SM-TA-SUS-25 | 1.5 | 2.3E+01 | 1.43E+04 | No |

Abbreviation: mg/kg = milligrams per kilogram.

Doc: App B GraniteCrk AppB-PRG Screening.xlsx (B11 Hotspot Eval)

Appendix C. Ecological Scoping Checklist

Ecological Scoping Checklist

| Site Name | Granite Creek Mines |
|-------------------------|--|
| Date of Site Inspection | Summer 2005 |
| Site Location | Wallowa Whitman National Forest; Granite, Oregon |
| Site Visit Conducted by | EA Engineering, Science, and Technology |

Part **①**

| CONTAMINANTS OF INTEREST Types, Classes, Or Specific Hazardous Substances [‡] Known Or Suspected | Onsite | Adjacent to or in locality of the facility [†] |
|---|--------|---|
| Metals | Yes | Yes |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

[‡] As defined by OAR 340-122-115(34) [†] As defined by OAR 340-122-115(38)

Part 2

| OBSERVED IMPACTS ASSOCIATED WITH THE SITE | Finding |
|---|---------|
| Onsite vegetation (None, Limited, Extensive) | Е |
| Vegetation in the locality of the site (None, Limited, Extensive) | L |
| Onsite wildlife such as macroinvertebrates, reptiles, amphibians, birds, mammals, other | N |
| (None, Limited, Extensive) | |
| Wildlife such as macroinvertebrates, reptiles, amphibians, birds, mammals, other in the | L |
| locality of the site (None, Limited, Extensive) | |
| Other readily observable impacts (None, Discuss below) | D |
| Discussion: | |
| Drainage from several adits. | |
| Vegetation is sparse on waste material piles and in the vicinity of the disturbed mine areas. | |
| Past forest cutting surrounding mines | |
| | |
| | |
| | |
| | |

Ecological Scoping Checklist (cont'd) Part ❸

| SPECIFIC EVALUATION OF ECOLOGICAL RECEPTORS / HABITAT | Finding |
|---|-----------------|
| Terrestrial – Wooded | |
| Percentage of site that is wooded | 82 |
| Dominant vegetation type (Evergreen, Deciduous, Mixed) | Е |
| Prominent tree size at breast height, i.e., four feet (<6", 6" to 12", >12") | 6"- 12" |
| Evidence / observation of wildlife (Macroinvertebrates, Reptiles, Amphibians, Birds, | Ma, B, M |
| Mammals, Other) | |
| Terrestrial – Natural Scrub/Shrub/Grasses | |
| Percentage of site that is scrub/shrub/Grass | 3 |
| Dominant vegetation type (Scrub, Shrub, Grasses, Other) | G |
| Prominent height of vegetation (<2', 2' to 5', >5') | 2'-5' |
| Density of vegetation (Dense, Patchy, Sparse) | P |
| Evidence / observation of wildlife (Macroinvertebrates, Reptiles, Amphibians, Birds, | Ma, B |
| Mammals, Other) | |
| Terrestrial – Ruderal | |
| Percentage of site that is ruderal | 10 |
| Dominant vegetation type (Landscaped, Agriculture, Bare ground) | B, Successional |
| Prominent height of vegetation (0', >0' to <2', 2' to 5', >5') | <2 and >5' |
| Density of vegetation (Dense, Patchy, Sparse) | S |
| Evidence / observation of wildlife (Macroinvertebrates, Reptiles, Amphibians, Birds, | Ma, B |
| Mammals, Other) | |
| Aquatic – Non-flowing (lentic) | |
| Percentage of site that is covered by lakes or ponds | 0 |
| Type of water bodies (Lakes, Ponds, Vernal pools, Impoundments, Lagoon, Reservoir, | |
| Canal) | |
| Size (acres), average depth (feet), trophic status of water bodies | |
| Source water (River, Stream, Groundwater, Industrial discharge, Surface water runoff) | |
| Water discharge point (None, River, Stream, Groundwater, Wetlands impoundment) | |
| Nature of bottom (Muddy, Rocky, Sand, Concrete, Other) | |
| Vegetation present (Submerged, Emergent, Floating) | |
| Obvious wetlands present (Yes / No) | |
| Evidence / observation of wildlife (Macroinvertebrates, Reptiles, Amphibians, Birds, | |
| Mammals, Other) | |

| Aquatic - Flowing (lotic) | | |
|---|--|--|
| Percentage of site that is covered by rivers, streams (brooks, creeks), intermittent streams, dry wash, arroyo, ditches, or channel waterway | 2 | |
| Type of water bodies (Rivers, Streams, Intermittent Streams, Dry Wash, Arroyo, Ditches, Channel waterway) | Adit Drainage into stream | |
| Size (acres), average depth (feet), approximate flow rate (cfs) of water bodies | ~1-5 ft wide, 0.1- 0.5 ft deep, 1-5 cfs | |
| Bank environment (cover: Vegetated, Bare / slope: Steep, Gradual / height (in feet)) | B/G to $S0 - 2 ft.$ | |
| Source water (River, Stream, Groundwater, Industrial discharge, Surface water runoff) | Adit, groundwater, and surface runoff, | |
| Tidal influence (Yes / No) | N | |
| Water discharge point (None, River, Stream, Groundwater, Wetlands impoundment) | River | |
| Nature of bottom (Muddy, Rocky, Sand, Concrete, Other) | Rocky, Sand | |
| Vegetation present (Submerged, Emergent, Floating) | None | |
| Obvious wetlands present (Yes / No) | Y | |
| Evidence / observation of wildlife (Macroinvertebrates, Reptiles, Amphibians, Fish, Birds, Mammals, Other) | Ma, Fish | |
| Aquatic – Wetlands | | |
| Obvious or designated wetlands present (Yes / No) | 3 | |
| Wetlands suspected at site is/has (Adjacent to water body, in Floodplain, Standing water, Dark wet soils, Mud cracks, Debris line, Water marks) | , Adj.; Fl.; St. Wat.; Veg. | |
| Vegetation present (Submerged, Emergent, Scrub/shrub, Wooded) | Emergent | |
| Size (acres) and depth (feet) of suspected wetlands | <1 acre/0.5 ft | |
| Source water (River, Stream, Groundwater, Industrial discharge, Surface water runoff) | Str.; Grdwat.; Surf Wat. | |
| Water discharge point (None, River, Stream, Groundwater, Impoundment) | Stream | |
| Tidal influence (Yes / No) | No | |
| Evidence / observation of wildlife (Macroinvertebrates, Reptiles, Amphibians, Birds, Mammals, Other) | Ma; B | |

^{*} P: Photographic documentation of these features is highly recommended.

Part **4**

| ECOLOGICALLY IMPORTANT SPECIES / HABITATS OBSERVED |
|--|
| |
| |
| |
| |
| |

Evaluation of Receptor-Pathway Interactions

| EVALUATION OF RECEPTOR-PATHWAY INTERACTIONS | Y | N | U |
|--|---|---|---|
| Are hazardous substances present or potentially present in surface waters? | X | | |
| AND | | | |
| Are ecologically important species or habitats present? | X | | |
| AND | | | |
| Could hazardous substances reach receptors via surface water? | X | | |
| When answering the above questions, consider the following: | | | |
| Known or suspected presence of hazardous substances in surface waters. | | | |
| Ability of hazardous substances to migrate to surface waters. | | | |
| Terrestrial organisms may be dermally exposed to water-borne contaminants as a result of | | | |
| wading or swimming in contaminated waters. Aquatic receptors may be exposed through | | | |
| osmotic exchange, respiration or ventilation of surface waters. | | | |
| Contaminants may be taken-up by terrestrial plants whose roots are in contact with surface | | | |
| waters. | | | |
| Terrestrial receptors may ingest water-borne contaminants if contaminated surface waters are | | | |
| used as a drinking water source. | | | |
| Are hazardous substances present or potentially present in groundwater? | | | X |
| AND | | | |
| Are ecologically important species or habitats present? | | X | |
| AND | | | |
| Could hazardous substances reach these receptors via groundwater? | | X | |
| When answering the above questions, consider the following: | | | |
| Known or suspected presence of hazardous substances in groundwater. | | | |
| Ability of hazardous substances to migrate to groundwater. | | | |
| Potential for hazardous substances to migrate via groundwater and discharge into habitats | | | |
| and/or surface waters. | | | |
| Contaminants may be taken-up by terrestrial and rooted aquatic plants whose roots are in | | | |
| contact with groundwater present within the root zone (~1m depth). | | | |
| Terrestrial wildlife receptors generally will not contact groundwater unless it is discharged to | | | |
| the surface. | | | |

[&]quot;Y" = yes; "N" = No, "U" = Unknown (counts as a "Y")

ATTACHMENT 2

Evaluation of Receptor-Pathway Interactions (cont'd)

| EVALUATION OF RECEPTOR-PATHWAY INTERACTIONS | Y | N | U |
|---|---|---|---|
| Are hazardous substances present or potentially present in sediments? | X | | |
| AND | | | |
| Are ecologically important species or habitats present? | X | | |
| AND | | | |
| Could hazardous substances reach these receptors via contact with sediments? | X | | |
| When answering the above questions, consider the following: | | | |
| Known or suspected presence of hazardous substances in sediment. | | | |
| Ability of hazardous substances to leach or erode from surface soils and be carried into sediment via surface runoff. | | | |
| Potential for contaminated groundwater to upwell through, and deposit contaminants in, sediments. | | | |
| If sediments are present in an area that is only periodically inundated with water, terrestrial | | | |
| species may be dermally exposed during dry periods. Aquatic receptors may be directly | | | |
| exposed to sediments or may be exposed through osmotic exchange, respiration or ventilation | | | |
| of sediment pore waters. | | | |
| Terrestrial plants may be exposed to sediment in an area that is only periodically inundated | | | |
| with water. | | | |
| If sediments are present in an area that is only periodically inundated with water, terrestrial | | | |
| species may have direct access to sediments for the purposes of incidental ingestion. Aquatic receptors may regularly or incidentally ingest sediment while foraging. | | | |
| Are hazardous substances present or potentially present in prey or food items of ecologically | | | X |
| important receptors? | | | |
| AND | | | |
| Are ecologically important species or habitats present? | X | | |
| AND | | | |
| Could hazardous substances reach these receptors via consumption of food items? | X | | |
| When answering the above questions, consider the following: | | | |
| Higher trophic level terrestrial and aquatic consumers and predators may be exposed through | | | |
| consumption of contaminated food sources. | | | |
| In general, organic contaminants with log $K_{ow} > 3.5$ may accumulate in terrestrial mammals | | | |
| and those with a log $K_{ow} > 5$ may accumulate in aquatic vertebrates. | | | |

[&]quot;Y" = yes; "N" = No, "U" = Unknown (counts as a "Y")

ATTACHMENT 2

Evaluation of Receptor-Pathway Interactions (cont'd)

| EVALUATION OF RECEPTOR-PATHWAY INTERACTIONS | Y | N | U |
|--|---|-----|---|
| Are hazardous substances present or potentially present in surficial soils? | X | | |
| AND | | | |
| Are ecologically important species or habitats present? | X | | |
| AND | | | |
| Could hazardous substances reach these receptors via incidental ingestion of or dermal contact | X | | |
| with surficial soils? | | | |
| When answering the above questions, consider the following: | | | |
| Known or suspected presence of hazardous substances in surficial (~1m depth) soils. | | | |
| Ability of hazardous substances to migrate to surficial soils. | | | |
| Significant exposure via dermal contact would generally be limited to organic contaminants | | | |
| which are lipophilic and can cross epidermal barriers. | | | |
| Exposure of terrestrial plants to contaminants present in particulates deposited on leaf and | | | |
| stem surfaces by rain striking contaminated soils (i.e., rain splash). | | | |
| Contaminants in bulk soil may partition into soil solution, making them available to roots. | | | |
| Incidental ingestion of contaminated soil could occur while animals grub for food resident in | | | |
| the soil, feed on plant matter covered with contaminated soil or while grooming themselves | | | |
| clean of soil. | | | |
| Are hazardous substances present or potentially present in subsurface soils? | X | | |
| AND | | 3.7 | |
| Are ecologically important species or habitats present? | | X | |
| AND | | | |
| Could hazardous substances reach these receptors via vapors or fugitive dust carried in surface | | v | |
| air or confined in burrows? | | X | |
| When answering the above questions, consider the following: | | | |
| Volatility of the hazardous substance (volatile chemicals generally have Henry's Law constant $> 10^{-5}$ atm-m ³ /mol and molecular weight < 200 g/mol). | | | |
| Exposure via inhalation is most important to organisms that burrow in contaminated soils, | | | |
| given the limited amounts of air present to dilute vapors and an absence of air movement to | | | |
| disperse gases. | | | |
| Exposure via inhalation of fugitive dust is particularly applicable to ground-dwelling species | | | |
| that could be exposed to dust disturbed by their foraging or burrowing activities or by wind | | | |
| movement. | | | |
| Foliar uptake of organic vapors would be limited to those contaminants with relatively high | | | |
| vapor pressures. | | | |
| Exposure of terrestrial plants to contaminants present in particulates deposited on leaf and | | | |
| stem surfaces. | | | |

[&]quot;Y" = yes; "N" = No, "U" = Unknown (counts as a "Y")

Appendix D. Ecological Risk-Based Screening Tables

Appendix D1. Ecological Risk-Based Screening Concentrations

Upper Granite Creek Mines Human Health and Ecological Risk Assessment, Wallowa-Whitman National Forest, Oregon

| Chemical | | Oregon Soil Sci | reening Level Values | | Oregon | Freshwater Screening Lev | el Values | Oregon Sediment Sc | reening Level Values |
|-----------------|----------------------|-----------------------|---------------------------------|----------------------|----------------------|--------------------------|----------------------|--------------------------|--------------------------|
| of | Plants | Invertebrates | Birds | Mammals | Aquatic Life | Birds | Mammals | Freshwater | Bioaccumulation |
| Interest | | 1 | mg/kg | | | mg/L | | mş | g/kg |
| Aluminum | 5.0E+01 pH<5.5 | 6.0E+02 pH<5.5 | 4.5E+02 pH<5.5 | 1.07E+02 pH<5.5 | 8.70E-02 | 7.97E+02 | 8.00E+00 | No Data | No Data |
| Antimony | 5.0E+00 | 7.80E+01 USEPA, 2005a | No Data | 1.50E+01 | 1.60E+00 | No Data | 1.00E+00 | 3.00E+00 | 1.00E+01 |
| Arsenic, Total | 1.8E+01 USEPA, 2005b | 6.0E+01 Arsenic III | 4.3E+01 USEPA, 2005b | 4.6E+01 USEPA, 2005b | 1.50E-01 Arsenic III | 1.80E+01 Arsenic III | 6.00E+00 Arsenic III | 6.00E+00 Arsenic III | 4.00E+00 Arsenic III |
| Barium | 5.0E+02 | 3.0E+03 | 8.5E+01 | 6.4E+02 | 4.00E-03 | 1.50E+02 | 3.90E+01 | No Data | No Data |
| Beryllium | 1.0E+01 | 4.0E+01 USEPA, 2005c | 1.0E+01 Efroymsen et. al., 1997 | 8.3E+01 | 5.30E-03 | No Data | No Data | No Data | 1.22E+02 |
| Cadmium | 4.0E+00 | 2.0E+01 | 6.0E+00 | 1.3E+02 | 2.20E-03 | 1.00E+01 | 8.00E+00 | 6.00E-01 | 3.00E-03 |
| Chromium, Total | 1.0E+00 Chromium III | 4.0E-01 Chromium III | 4.0E+00 Chromium III | 4.1E+02 Chromium VI | 1.10E-02 Chromium VI | 7.20E+00 Chromium III | 2.50E+01 Chromium VI | 3.70E+01 Chromium, Total | 4.20E+03 Chromium, Total |
| Cobalt | 2.0E+01 | 1.0E+03 | 1.2E+02 USEPA, 2005d | 1.5E+02 | 2.30E-02 | No Data | 9.00E+00 | No Data | No Data |
| Copper | 1.0E+02 | 5.0E+01 | 1.9E+02 | 3.9E+02 | 9.00E-03 | 3.41E+02 | 5.30E+01 | 3.60E+01 | 1.00E+01 |
| Iron | 1.0E+01 | 2.0E+02 | No Data 5>pH>8 | No Data 5>pH>8 | 1.00E+00 | No Data | No Data | No Data | No Data |
| Lead | 5.0E+01 | 5.0E+02 | 1.6E+01 | 4.0E+03 | 2.50E-03 | 2.80E+01 | 3.23E+02 | 3.50E+01 | 1.28E+02 |
| Manganese | 5.0E+02 | 1.0E+02 | 4.1E+03 | 1.1E+04 | 1.20E-01 | 7.24E+03 | 6.76E+02 | 1.10E+03 | No Data |
| Mercury | 3.0E-01 | 1.0E-01 | 1.5E+00 | 7.3E+01 | 7.70E-04 | 3.30E+00 | 1.00E+01 | 2.00E-01 | No Data |
| Nickel | 3.0E+01 | 2.0E+02 | 3.2E+02 | 6.3E+02 | 5.20E-02 | 5.62E+02 | 3.80E+01 | 1.80E+01 | 3.16E+02 |
| Selenium | 1.0E+00 | 7.0E+01 | 2.0E+00 | 2.5E+01 | 5.00E-03 | 3.60E+00 | 1.50E+00 | No Data | 1.00E-01 |
| Silver | 2.0E+00 | 5.0E+01 | No Data | No Data | 1.20E-04 | No Data | No Data | 4.50E+00 | No Data |
| Thallium | 1.0E+00 | 1.0E+00 CCME, 1999 | No Data | 1.0E+00 | 4.00E-02 | No Data | 6.00E-02 | No Data | 7.00E-01 |
| Vanadium | 2.0E+00 | No Data | 4.7E+01 | 2.5E+01 | 2.00E-02 | 8.20E+01 | 1.60E+00 | No Data | No Data |
| Zinc | 5.0E+01 | 2.0E+02 | 6.0E+01 | 2.0E+04 | 1.20E-01 | 1.05E+02 | 1.23E+03 | 1.23E+02 | 3.00E+00 |

Use of surrogate chemical toxicity data indicated by chemical name adjacent to concentration.

Abbreviations: mg/kg = milligrams per kilogram, mg/L = milligrams per liter.

SOURCES:

CCME, 1999. Canadian Soil Quality Guidelines. Canadian Council of Resource and Environmental Ministers. Canadian Council of Ministers of the Environment, Winnipeg.

Efroymson, R.A., G.W. Suter II, B.E. Sample, and D.S. Jones, 1997. Preliminary Remediation goals for Ecological Endpoints. ES/ER/TM-162/R2. Prepared for the U.S. Department of Energy, Office of Environmental Management.

USEPA, 2005a. Ecological Soil Screening Levels for Antimony - Interim Final. Office of Solid Waste and Emergency Response. OSWER Directive 9285.7-61. February.

USEPA, 2005b. Ecological Soil Screening Levels for Arsenic - Interim Final. Office of Solid Waste and Emergency Response. OSWER Directive 9285.7-62. March.

USEPA, 2005c. Ecological Soil Screening Levels for Beryllium - Interim Final. Office of Solid Waste and Emergency Response. OSWER Directive 9285.7-64. February.

USEPA, 2005d. Ecological Soil Screening Levels for Cobalt – Interim Final. Office of Solid Waste and Emergency Response. OSWER Directive 9285.7-67. March.

Appendix D2. Ecological Risk-Based Screening for Surface Soil/Waste Rock
Upper Granite Creek Mines Human Health and Ecological Risk Assessment, Wallowa-Whitman National Forest, Oregon

| | 3.6 | | TT 10 034 | | Risk-Based Sc | reening Value | | | Risk Ra | tio for | | |
|---|--------------------------------|---|--|----------|---------------|---------------|----------|------------------------------|----------------------------------|-----------------------------|-----------------|---|
| Chemical of Interest ¹ | Maximum Detected Concentration | Exposure Point Concentration ² | Half of Maximum Sample Reporting Limit | Plants | Invertebrates | Birds | Mammals | Plants (Rij) ³ | Invertebrates (Rij) ³ | Birds (Rij) ³ | Mammals (Rij) 3 | Potential Bioaccumulator? ⁴ |
| | | | | mg/kg | | | | | | | | |
| Metals | | | | | | | | | | | | |
| Antimony | 3.68E+02 | 4.11E+01 | 5.00E-01 | 5.00E+00 | 7.80E+01 | No Data | 1.50E+01 | 8E+00 | 5E-01 | 0E+00 | 3E+00 | No |
| Arsenic, Total | 1.14E+04 | 1.79E+03 | NA | 1.80E+01 | 6.00E+01 | 4.30E+01 | 4.60E+01 | 9.9E+01 | 3.0E+01 | 4.2E+01 | 3.9E+01 | Yes |
| Barium | 3.22E+02 | 1.82E+02 | NA | 5.00E+02 | 3.00E+03 | 8.50E+01 | 6.38E+02 | 4E-01 | 6E-02 | 2E+00 | 3E-01 | No |
| Cadmium | 2.34E+01 | 4.77E+00 | 3.20E-02 | 4.00E+00 | 2.00E+01 | 6.00E+00 | 1.25E+02 | 1E+00 | 2E-01 | 8E-01 | 4E-02 | Yes |
| Copper | 6.98E+02 | 5.21E+01 | NA | 1.00E+02 | 5.00E+01 | 1.90E+02 | 3.90E+02 | 5E-01 | 1E+00 | 3E-01 | 1E-01 | No |
| Iron | 9.73E+04 | 2.78E+04 | NA | 1.00E+01 | 2.00E+02 | No Data | No Data | 2.782E+03 | 1.39E+02 | 0E+00 | 0E+00 | No |
| Lead | 2.43E+03 | 5.95E+02 | NA | 5.00E+01 | 5.00E+02 | 1.60E+01 | 4.00E+03 | 1.2E+01 | 1E+00 | 3.7E+01 | 1E-01 | Yes |
| Manganese | 1.26E+03 | 5.85E+02 | NA | 5.00E+02 | 1.00E+02 | 4.13E+03 | 1.10E+04 | 1E+00 | 6E+00 | 1E-01 | 5E-02 | No |
| Mercury | 7.84E+02 | 6.25E+01 | 2.50E-02 | 3.00E-01 | 1.00E-01 | 1.50E+00 | 7.30E+01 | 2.08E+02 | 6.25E+02 | 4.2E+01 | 9E-01 | Yes |
| Selenium | 3.26E+00 | 7.21E-01 | NA | 1.00E+00 | 7.00E+01 | 2.00E+00 | 2.50E+01 | 7E-01 | 1E-02 | 4E-01 | 3E-02 | Yes |
| Silver | 3.19E+02 | 4.70E+01 | 1.05E-01 | 2.00E+00 | 5.00E+01 | No Data | No Data | 2.3E+01 | 9E-01 | 0E+00 | 0E+00 | No |
| Thallium | 3.30E+00 | 1.52E+00 | 2.30E-01 | 1.00E+00 | 1.00E+00 | No Data | 1.00E+00 | 2E+00 | 2E+00 | 0E+00 | 2E+00 | No |
| Vanadium | 9.61E+01 | 4.49E+01 | NA | 2.00E+00 | No Data | 4.70E+01 | 2.50E+01 | 2.2E+01 | 0E+00 | 1E+00 | 2E+00 | No |
| Zinc | 2.41E+03 | 3.67E+02 | NA | 5.00E+01 | 2.00E+02 | 6.00E+01 | 2.00E+04 | 7E+00 | 2E+00 | 6E+00 | 2E-02 | No |

Abbreviations: **Bold** = indicates chemcials of potential concern that may require further assessment at the site, mg/kg = milligrams per kilogram, NA = not applicable, NC = not calculated, Unknown = chemical was detected but no screening criterial are available.

- b) The chemical of interest is a bioaccumulator.
- c) No SLV or bioaccumulation vaule is available.
- d) Not Calculated = Risk was not calculated for analytes with no screening criteria or bioaccumulation data.

Cascade Earth Sciences - Spokane, WA

PN: 2723018

Doc: App D Level II Ecorisk Tables-Calcs.xlsx (D2 SurfSoil COPECs)

3.168E+03

1.4E+01

7E-02

8.07E+02

1.4E+01

7E-02

1.31E+02

1.4E+01

7E-02

4.6E+01

1.4E+01

7E-02

:Sum of Rij (Rj)

:1/Nij

:Number of COIs (Nij)

¹ Chemicals remaining following the frequency of detection, essential nutrient, and background concentrations screening procedures.

² Upper confidence limit on the mean or maximum (whichever is lower).

³ The risk ratio is the exposure point concentration divided by the Screening Level Values (SLV).

⁴ As listed in the Draft Sediment Evaluation Framework (USACE et al., 2005).

⁵ The chemical of interest is considered a chemical of potential ecological concern if:

a) The risk ratio (Rij) is greater than 5 (non-protected) or 1 (protected).

Appendix D2. Ecological Risk-Based Screening for Surface Soil/Waste Rock (continued)

Upper Granite Creek Mines Human Health and Ecological Risk Assessment, Wallowa-Whitman National Forest, Oregon

| | | Risked Posed to | Non-Protecte | d | | Risks Posed t | to Protected | | | Risks Posed to | Non-Protected | | | Risks Posed to Protected | | | |
|---|------------------|-------------------------|-------------------------------|-------------------|-----------------------------|-------------------------|-------------------------------|-------------------|--------|-----------------|---------------|---------|--------|--------------------------|---------------|---------|--|
| Chemical of Interest ¹ | Plants (Rij>5) 5 | Invertebrates (Rij>5) 5 | Birds (Rij>5) ⁵ | Mammals (Rij>5) 5 | Plants (Rij>1) ⁵ | Invertebrates (Rij>1) 5 | Birds (Rij>1) ⁵ | Mammals (Rij>1) 5 | Plants | Invertebrates | Birds | Mammals | Plants | Invertebrates | Birds | Mammals | |
| | | | | | | | | |] | Due to Elevated | Reporting Lin | nit | I | Due to Elevated I | Reporting Lin | nit | |
| Metals | | | | | | | | | | | | | | | | | |
| Antimony | Yes | No | NC | No | Yes | No | NC | Yes | No | No | No | No | No | | | | |
| Arsenic, Total | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | No | No | No | No | No | No | | | |
| Barium | No | No | No | No | No | No | Yes | No | No | No | No | No | No | No | No | No | |
| Cadmium | No | No | Yes | Yes | No | No | Yes | Yes | No | No | No | No | No | No | No | No | |
| Copper | No | No | No | No | No | No | No | No | No | No | No | No | No | No | No | No | |
| Iron | Yes | Yes | NC | NC | Yes | Yes | NC | NC | No | No | No | No | No | No | No | No | |
| Lead | Yes | No | Yes | Yes | Yes | No | Yes | Yes | No | No | No | No | No | No | No | No | |
| Manganese | No | Yes | No | No | No | Yes | No | No | No | No | No | No | No | No | No | No | |
| Mercury | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | No | No | No | No | No | No | No | No | |
| Selenium | No | No | Yes | Yes | No | No | Yes | Yes | No | No | No | No | No | No | No | No | |
| Silver | Yes | No | NC | NC | Yes | No | NC | NC | No | No | No | No | No | No | No | No | |
| Thallium | No | No | NC | No | Yes | Yes | NC | Yes | No | No | No | No | No | No | No | No | |
| Vanadium | Yes | NC | No | No | Yes | NC | No | Yes | No | No | No | No | No | No | No | No | |
| Zinc | Yes | No | Yes | No | Yes | Yes | Yes | No | No | No | No | No | No | No | No | No | |

Abbreviations: **Bold** = indicates chemcials of potential concern that may require further assessment at the site, mg/kg = milligrams per kilogram, NA = not applicable, NC = not calculated, Unknown = chemical was detected but no screening criterial are available.

- 1 Chemicals remaining following the frequency of detection, essential nutrient, and background concentrations screening procedures.
- 2 Upper confidence limit on the mean or maximum (whichever is lower).
- 3 The risk ratio is the exposure point concentration divided by the Screening Level Values (SLV).
- 4 As listed in the Draft Sediment Evaluation Framework (USACE et al., 2005).
- 5 The chemical of interest is considered a chemical of potential ecological concern if:
- a) The risk ratio (Rij) is greater than 5 (non-protected) or 1 (protected).
- b) The chemical of interest is a bioaccumulator.
- c) No SLV or bioaccumulation vaule is available.
- d) Not Calculated = Risk was not calculated for analytes with no screening criteria or bioaccumulation data.

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PN: 2723018

Doc: App D Level II Ecorisk Tables-Calcs.xlsx (D2 SurfSoil COPECs)

Appendix D2. Ecological Risk-Based Screening for Surface Soil/Waste Rock (continued)

Upper Granite Creek Mines Human Health and Ecological Risk Assessment, Wallowa-Whitman National Forest, Oregon

| Chemical of Interest ¹ | | Inordinate Cor Overall R Protected (R _{ij} /R _j > | lisk for Species | | | Inordinate Cor Overall $(R_{ij}/R_j >$ | Risks | | Risks Posed to Protected Species | | | | Risks Posed to Non-Protected Species | | | | |
|---|--------|--|---------------------|---------|--------|---|--------|---------|--|---------------|-------|---------|--|---------------|-------|---------|--|
| | Plants | Invertebrates | Birds | Mammals | Plants | Invertebrates | Birds | Mammals | Plants | Invertebrates | Birds | Mammals | Plants | Invertebrates | Birds | Mammals | |
| Metals | | | | | | | | | | | | | | | | | |
| Antimony | No | No | Unkown | No | No | No | Unkown | No | Yes | No | No | Yes | Yes | No | No | No | |
| Arsenic, Total | No | No | Yes | Yes | No | No | No | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | |
| Barium | No | No | No | No | No | No | No | No | No | No | Yes | No | No | No | No | No | |
| Cadmium | No | No | No | No | No | No | No | No | No | No | Yes | Yes | No | No | Yes | Yes | |
| Copper | No | No | No | No | No | No | No | No | No | No | No | No | No | No | No | No | |
| Iron | Yes | Yes | Unkown | Unkown | Yes | No | Unkown | Unkown | Yes | Yes | No | No | Yes | Yes | No | Yes | |
| Lead | No | No | Yes | No | No | No | No | No | Yes | No | Yes | Yes | Yes | No | Yes | Yes | |
| Manganese | No | No | No | No | No | No | No | No | No | Yes | No | No | No | Yes | No | No | |
| Mercury | No | Yes | Yes | No | No | Yes | No | No | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | |
| Selenium | No | No | No | No | No | No | No | No | No | No | Yes | Yes | No | No | Yes | Yes | |
| Silver | No | No | Unkown | Unkown | No | No | Unkown | Unkown | Yes | No | No | No | Yes | No | No | No | |
| Thallium | No | No | Unkown | No | No | No | Unkown | No | Yes | Yes | No | Yes | No | No | No | No | |
| Vanadium | No | Unkown | No | No | No | Unkown | No | No | Yes | Unknown | No | Yes | Yes | Unknown | No | No | |
| Zinc | No | No | No | No | No | No | No | No | Yes | Yes | Yes | No | Yes | No | Yes | No | |

Abbreviations: **Bold** = indicates chemcials of potential concern that may require further assessment at the site, mg/kg = milligrams per kilogram, NA = not applicable, NC = not calculated, Unknown = chemical was detected but no screening criterial are available.

- 1 Chemicals remaining following the frequency of detection, essential nutrient, and background concentrations screening procedures.
- 2 Upper confidence limit on the mean or maximum (whichever is lower).
- 3 The risk ratio is the exposure point concentration divided by the Screening Level Values (SLV).
- 4 As listed in the Draft Sediment Evaluation Framework (USACE et al., 2005).
- 5 The chemical of interest is considered a chemical of potential ecological concern if:
- a) The risk ratio (Rij) is greater than 5 (non-protected) or 1 (protected).
- b) The chemical of interest is a bioaccumulator.
- c) No SLV or bioaccumulation vaule is available.
- d) Not Calculated = Risk was not calculated for analytes with no screening criteria or bioaccumulation data.

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PN: 2723018

Doc: App D Level II Ecorisk Tables-Calcs.xlsx (D2 SurfSoil COPECs)

Appendix D3. **Ecological Risk-Based Screening for Surface Wate** Upper Granite Creek Mines Human Health and Ecological Risk Assessment, Wallowa-Whitman National Forest, Oregon

| | | | Freshwater I | Risk-Based Scr | eening Value | | Risk Ratio | | | Risks Posed | | | | |
|---|--|--|-----------------|----------------|--------------|---------------------------------------|-----------------------------|-------------------------------|------------------------------|------------------------------|---------------------------------|---|-----------------------------------|---|
| Chemical of Interest (COI) ¹ | Exposure Point Concentration ² | Half of Maximum Sample Reporting Limit | Aquatic Life | Birds | Mammals | Aquatic Life (Rij) ² | Birds (Rij) ² | Mammals (Rij) ² | Bioaccumulator? ³ | Aquatic Life (Rij>1) 4 | Protected Birds (Rij>1) 4 | Non- Protected Birds (Rij>5) 4 | Protected Mammals (Rij>1) 4 | Non- Protected Mammals (Rij>5) 4 |
| 7.5 | | m | g/L | | | | | | | | | | | |
| Metals | T | T | T | | | | T | ľ | | | | ľ | • | |
| Aluminum | 4.87E-02 | 3.16E-02 | 8.70E-02 | 7.97E+02 | 8.00E+00 | 6E-01 | 6E-05 | 6E-03 | No | No | No | No | No | No |
| Antimony | 9.00E-04 | 2.50E-03 | 1.60E+00 | No Data | 1.00E+00 | 6E-04 | 0E+00 | 9E-04 | No | No | NC | NC | No | No |
| Arsenic, Total | 1.78E-02 | 3.00E-03 | 1.50E-01 | 1.80E+01 | 6.00E+00 | 1E-01 | 1E-03 | 3E-03 | Yes | No | Yes | Yes | Yes | Yes |
| Barium | 6.22E-02 | NA | 4.00E-03 | 1.50E+02 | 3.90E+01 | 1.6E+01 | 4E-04 | 2E-03 | No | Yes | No | No | No | No |
| Cadmium | 4.47E-04 | 6.00E-04 | 2.20E-03 | 1.00E+01 | 8.00E+00 | 2E-01 | 4E-05 | 6E-05 | Yes | No | Yes | Yes | Yes | Yes |
| Chromium, Total | 7.40E-04 | 5.00E-03 | 1.10E-02 | 7.20E+00 | 2.50E+01 | 7E-02 | 1E-04 | 3E-05 | No | No | No | No | No | No |
| Copper | 1.56E-03 | 1.65E-03 | 9.00E-03 | 3.41E+02 | 5.30E+01 | 2E-01 | 5E-06 | 3E-05 | No | No | No | No | No | No |
| Iron | 6.43E-01 | 3.34E-02 | 1.00E+00 | No Data | No Data | 6E-01 | 0E+00 | 0E+00 | No | No | NC | NC | NC | NC |
| Lead | 2.13E-03 | 7.50E-04 | 2.50E-03 | 2.80E+01 | 3.23E+02 | 9E-01 | 8E-05 | 7E-06 | Yes | No | Yes | Yes | Yes | Yes |
| Manganese | 1.01E-01 | 9.50E-04 | 1.20E-01 | 7.24E+03 | 6.76E+02 | 8E-01 | 1E-05 | 1E-04 | No | No | No | No | No | No |
| Mercury | 7.57E-05 | 5.00E-05 | 7.70E-04 | 3.30E+00 | 1.00E+01 | 1E-01 | 2E-05 | 8E-06 | Yes | No | Yes | Yes | Yes | Yes |
| Selenium | 1.26E-03 | 1.70E-03 | 5.00E-03 | 3.60E+00 | 1.50E+00 | 3E-01 | 3E-04 | 8E-04 | Yes | No | Yes | Yes | Yes | Yes |
| Silver | 9.00E-05 | 1.45E-03 | 1.20E-04 | No Data | No Data | 8E-01 | 0E+00 | 0E+00 | No | No | NC | NC | NC | NC |
| Zinc | 2.31E-01 | 5.00E-03 | 1.20E-01 | 1.05E+02 | 1.23E+03 | 2E+00 | 2E-03 | 2E-04 | No | Yes | No | No | No | No |

Abbreviations: **Bold** = indicates chemicals of potential ecological concern that may require further assessment at the site was detected but no screening criteria are available, mg/L = milligrams per liter, NA = not applicable, Unknown = Chemical was detected but no screening criteria are available.

² The risk ratio is the exposure point concentration divided by the Screening Level Values (SLV).

| 3 As listed in the Draft Sediment Evaluation Framework (USACE et al., 2005). | 2.2E+01 | 4E-03 | 1E-02 | :Sum of Rij (Rj) |
|---|---------|-------|---------|-----------------------|
| 4 The chemical of interest is considered a chemical of potential ecological concern if: | 14 | 14 | 14 | :Number of COIs (Nij) |
| a) The risk ratio (Rij) is greater than 1 for protected species and aquatic life. | 7E-02 | 7E-02 | 7.1E-02 | :1/Nij |

b) The risk ratio (Rij) is greater than 5 for other species.

¹ Chemicals remaining following the frequency of detection, essential nutrient, and background concentrations screening procedures.

² Upper confidence limit on the mean or maximum (whichever is lower).

c) The chemical of interest is a bioaccumulator.

d) The chemical of interest has an elevated detection limit.

e) No risk-based screening or bioaccumulation vaule is available.

f) Inordinate contribution to overall risk (Rj).

Appendix D3. Ecological Risk-Based Screening for Surface Water (continued Upper Granite Creek Mines Human Health and Ecological Risk Assessment, Wallowa-Whitman National Forest, Oregon

| | | | Risks Posed to |) | | T 1' | 4 0 4 1 | 4. | T 1' 4 | G 4 7 | 4. | | | | | | |
|------------------------------------|-----------------|--------------------|----------------------------|----------------------|------------------------------|-----------------|--|-----------|----------------|---|-------------|-------------------------------------|---------|---------|---|---------|---------|
| Chemical of Interest (COI) 1 | Aquatic Life | Protected Birds | Non- Protected Birds | Protected Mammals | Non- Protected Mammals | to Ove Prote | te Contrib erall Risk f ected Speci /R _j > 1/N _{ij}) | for es | Over Non-Pr | ee Contribucall Risks for otected Spendor, p. 5/N _{ij}) | or ecies | Risks Posed to Protected Species | | | Risks Posed to Non-Protected Species | | |
| | | Due to E | levated Report | ting Limit | | Aquatic Life | Birds | Mammals | Aquatic Life | Birds | Mammals | Aquatic Life | Birds | Mammals | Aquatic Life | Birds | Mammals |
| Metals | | | | | | | | | | | | | | | | | |
| Aluminum | No | No | No | No | No | No | No | No | No | No | No | No | No | No | No | No | No |
| Antimony | No | No | No | No | No | No | No | No | No | No | No | No | Unknown | No | No | Unknown | No |
| Arsenic, Total | No | No | No | No | No | No | No | No | No | No | No | No | Yes | Yes | No | Yes | Yes |
| Barium | No | No | No | No | No | Yes | No | No | Yes | No | No | Yes | No | No | Yes | No | No |
| Cadmium | No | No | No | No | No | No | No | No | No | No | No | No | Yes | Yes | No | Yes | Yes |
| Chromium, Total | No | No | No | No | No | No | No | No | No | No | No | No | No | No | No | No | No |
| Copper | No | No | No | No | No | No | No | No | No | No | No | No | No | No | No | No | No |
| Iron | No | No | No | No | No | No | No | No | No | No | No | No | Unknown | Unknown | No | Unknown | Unknown |
| Lead | No | No | No | No | No | No | No | No | No | No | No | No | Yes | Yes | No | Yes | Yes |
| Manganese | No | No | No | No | No | No | No | No | No | No | No | No | No | No | No | No | No |
| Mercury | No | No | No | No | No | No | No | No | No | No | No | No | Yes | Yes | No | Yes | Yes |
| Selenium | No | No | No | No | No | No | No | No | No | No | No | No | Yes | Yes | No | Yes | Yes |
| Silver | Yes | No | No | No | No | No | No | No | No | No | No | Yes | Unknown | Unknown | Yes | Unknown | Unknown |
| Zinc | No | No | No | No | No | No | No | No | No | No | No | Yes | No | No | Yes | No | No |

Abbreviations: **Bold** = indicates chemicals of potential ecological concern that may require further assessment at the site was detected but no screening criteria are available, mg/L = milligrams per liter, NA = not applicable, Unknown = Chemical was detected but no screening criteria are available.

- 1 Chemicals remaining following the frequency of detection, essential nutrient, and background concentrations screening procedures.
- 2 Upper confidence limit on the mean or maximum (whichever is lower).
- 2 The risk ratio is the exposure point concentration divided by the Screening Level Values (SLV).
- 3 As listed in the Draft Sediment Evaluation Framework (USACE et al., 2005).
- 4 The chemical of interest is considered a chemical of potential ecological concern if:
- a) The risk ratio (Rij) is greater than 1 for protected species and aquatic life.
- b) The risk ratio (Rij) is greater than 5 for other species.
- c) The chemical of interest is a bioaccumulator.
- d) The chemical of interest has an elevated detection limit.
- e) No risk-based screening or bioaccumulation vaule is available.
- f) Inordinate contribution to overall risk (Rj).

Doc: App D Level II Ecorisk Tables-Calcs.xlsx (D3 SWTotal COPECs)

Appendix D4. Ecological Risk-Based Screening for Pore Water
Upper Granite Creek Mines Human Health and Ecological Risk Assessment, Wallowa-Whitman National Forest, Oregon

| | | | Freshwater I | Risk-Based Scr | eening Value | | Risk Ratio | | | | | Risks Posed | | |
|---|--|--|------------------------|----------------|--------------|---------------------------------------|-----------------------------|-------------------------------|------------------------------|------------------------------|---------------------------------|---|-----------------------------------|---|
| Chemical of Interest (COI) ¹ | Exposure Point Concentration ² | Half of Maximum Sample Reporting Limit | Aquatic Life g/L | Birds | Mammals | Aquatic Life (Rij) ² | Birds (Rij) ² | Mammals (Rij) ² | Bioaccumulator? ³ | Aquatic Life (Rij>1) 4 | Protected Birds (Rij>1) 4 | Non- Protected Birds (Rij>5) 4 | Protected Mammals (Rij>1) 4 | Non- Protected Mammals (Rij>5) 4 |
| Metals | | |) | | | | | | | | · | | | |
| Aluminum | 3.17E-02 | 3.16E-02 | 8.70E-02 | 7.97E+02 | 8.00E+00 | 4E-01 | 4E-05 | 4E-03 | No | No | No | No | No | No |
| Arsenic, Total | 6.49E-03 | 3.00E-03 | 1.50E-01 | 1.80E+01 | 6.00E+00 | 4E-02 | 4E-04 | 1E-03 | Yes | No | Yes | Yes | Yes | Yes |
| Barium | 4.85E-02 | NA | 4.00E-03 | 1.50E+02 | 3.90E+01 | 1.2E+01 | 3E-04 | 1E-03 | No | Yes | No | No | No | No |
| Lead | 1.16E-03 | 6.50E-04 | 2.50E-03 | 2.80E+01 | 3.23E+02 | 5E-01 | 4E-05 | 4E-06 | Yes | No | Yes | Yes | Yes | Yes |
| Mercury | 5.74E-05 | 5.00E-05 | 7.70E-04 | 3.30E+00 | 1.00E+01 | 7E-02 | 2E-05 | 6E-06 | Yes | No | Yes | Yes | Yes | Yes |
| Selenium | 1.47E-03 | 1.70E-03 | 5.00E-03 | 3.60E+00 | 1.50E+00 | 3E-01 | 4E-04 | 1E-03 | Yes | No | Yes | Yes | Yes | Yes |
| Silver | 0.00E+00 | 1.45E-03 | 1.20E-04 | No Data | No Data | 0E+00 | 0E+00 | 0E+00 | No | No | No | NC | NC | NC |
| Thallium | 2.76E-03 | 2.85E-03 | 4.00E-02 | No Data | 6.00E-02 | 7E-02 | 0E+00 | 5E-02 | No | No | No | NC | NC | No |
| Zinc | 4.52E-03 | 5.00E-03 | 1.20E-01 | 1.05E+02 | 1.23E+03 | 4E-02 | 4E-05 | 4E-06 | No | No | No | No | No | No |

Abbreviations: **Bold** = indicates chemicals of potential ecological concern that may require further assessment at the site was detected but no screening criteria are available, mg/L = milligrams per liter, NA = not applicable, NC = not calculated, Unknown = Chemical was detected but no screening criteria are available.

² The risk ratio is the exposure point concentration divided by the Screening Level Values (SLV).

| 3 As listed in the Draft Sediment Evaluation Framework (USACE et al., 2005). | 1.3E+01 | 1E-03 | 5E-02 | :Sum of Rij (Rj) |
|---|----------|----------|----------|-----------------------|
| 4 The chemical of interest is considered a chemical of potential ecological concern if: | 9.0.E+00 | 9.0.E+00 | 9.0.E+00 | :Number of COIs (Nij) |
| a) The risk ratio (Rij) is greater than 1 for protected species and aquatic life. | 1.1.E-01 | 1.1.E-01 | 1.1.E-01 | :1/Nij |

- b) The risk ratio (Rij) is greater than 5 for other species.
- c) The chemical of interest is a bioaccumulator.
- d) The chemical of interest has an elevated detection limit.
- e) No risk-based screening or bioaccumulation vaule is available.
- f) Inordinate contribution to overall risk (Rj).

Doc: App D Level II Ecorisk Tables-Calcs.xlsx (D4 PoreWat COPECs)

¹ Chemicals remaining following the frequency of detection, essential nutrient, and background concentrations screening procedures.

² Upper confidence limit on the mean or maximum (whichever is lower).

Appendix D4. Ecological Risk-Based Screening for Pore Water (continued Upper Granite Creek Mines Human Health and Ecological Risk Assessment, Wallowa-Whitman National Forest, Oregon

| | |) | Inordinate Contribution | | | Inordinate Contribution to | | | | | | | | | | | |
|---|-----------------|--------------------|----------------------------|----------------------|------------------------------|--|--------------|-------|---|--------------|-------|--|--------------|---------|--|---------|---------|
| Chemical of Interest (COI) ¹ | Aquatic Life | Protected Birds | Non- Protected Birds | Protected Mammals | Non- Protected Mammals | to Overall Risk for Protected Species | | | Overall Risks for Non-Protected Species $(R_{ij}/R_j > 5/N_{ij})$ | | | Risks Posed to Protected Species | | | Risks Posed to Non-Protected Species | | |
| | | Due to E | ting Limit | Aquatic Life | Birds | Mammals | Aquatic Life | Birds | Mammals | Aquatic Life | Birds | Mammals | Aquatic Life | Birds | Mammals | | |
| Metals | | | | | | | | | | | | | | | | | |
| Aluminum | No | No | No | No | No | No | No | No | No | No | No | No | No | No | No | No | No |
| Arsenic, Total | No | No | No | No | No | No | No | No | No | No | No | No | Yes | Yes | No | Yes | Yes |
| Barium | No | No | No | No | No | Yes | No | No | Yes | No | No | Yes | No | No | Yes | No | No |
| Lead | No | No | No | No | No | No | No | No | No | No | No | No | Yes | Yes | No | Yes | Yes |
| Mercury | No | No | No | No | No | No | No | No | No | No | No | No | Yes | Yes | No | Yes | Yes |
| Selenium | No | No | No | No | No | No | No | No | No | No | No | No | Yes | Yes | No | Yes | Yes |
| Silver | Yes | No | No | No | No | Unknown | No | No | Unknown | No | No | Yes | No | Unknown | Yes | Unknown | Unknown |
| Thallium | No | No | No | No | No | No | No | No | No | No | No | No | No | Unknown | No | Unknown | No |
| Zinc | No | No | No | No | No | No | No | No | No | No | No | No | No | No | No | No | No |

Abbreviations: **Bold** = indicates chemicals of potential ecological concern that may require further assessment at the site was detected but no screening criteria are available,

mg/L = milligrams per liter, NA = not applicable, NC = not calculated, Unknown = Chemical was detected but no screening criteria are available.

- 1 Chemicals remaining following the frequency of detection, essential nutrient, and background concentrations screening procedures.
- 2 Upper confidence limit on the mean or maximum (whichever is lower).
- 2 The risk ratio is the exposure point concentration divided by the Screening Level Values (SLV).
- 3 As listed in the Draft Sediment Evaluation Framework (USACE et al., 2005).
- 4 The chemical of interest is considered a chemical of potential ecological concern if:
- a) The risk ratio (Rij) is greater than 1 for protected species and aquatic life.
- b) The risk ratio (Rij) is greater than 5 for other species.
- c) The chemical of interest is a bioaccumulator.
- d) The chemical of interest has an elevated detection limit.
- e) No risk-based screening or bioaccumulation vaule is available.
- f) Inordinate contribution to overall risk (Rj).

Doc: App D Level II Ecorisk Tables-Calcs.xlsx (D4 PoreWat COPECs)

Appendix D5. Ecological Risk-Based Screening for Sediment
Upper Granite Creek Mines Human Health and Ecological Risk Assessment, Wallowa-Whitman National Forest, Oregon

| Chemical of Interest (COI) 1 | Maximum Detected Concentration | Sediment Exposure Point Concentration ² | Maximum Sample Reporting Limit | Freshwater Sediment Risk-Based Screening Value | | Risk Ratio | | | Risks Posed to | | R | isks Posed | Inordinate Contribution to Overall Risks | | Risks Posed? | |
|------------------------------------|--------------------------------------|---|---|--|---------------------------------------|--------------------------|----------------------|------------------------------|---------------------------------|----------------------------|--------------------------|------------------------------------|---|----------------------|--------------|-----|
| | | | | Benthic Invertebrates | Bioaccumulation | Benthic Invertebrates | Birds and Mammals | Bioaccumulator? ⁴ | Invertebrates | Non-Protected Birds and | Invertebrates | Non-Protected Birds and Mammals | $(\mathbf{R_{ij}/R_{j}} > 5/\mathbf{N_{ij}})$ | | | |
| | | mg/kg | | | (Rij) ³ (Rij) ³ | | (Rij>1) ⁵ | Mammals (Rij>5) ⁵ | Due to Elevated Reporting Limit | | Benthic Invertebrates | Birds, and Mammals | Benthic Invertebrates | Birds and Mammals | | |
| Metals | | | | | | | | | | | | | | | | |
| Aluminum | 1.17E+04 | 7.89E+03 | NA | No Data | No Data | 0.E+00 | 0.E+00 | No | NC | No | No | No | Unknown | Unknown | Unknown | No |
| Antimony | 5.10E+00 | 1.43E+00 | 2.75E-01 | 3.00E+00 | 1.00E+01 | 5E-01 | 1E-01 | Not Required | No | No | No | No | No | No | No | No |
| Arsenic, Total | 3.03E+02 | 7.71E+01 | NA | 6.00E+00 | 4.00E+00 | 1.3E+01 | 1.9E+01 | Not Required | Yes | Yes | No | No | No | No | Yes | Yes |
| Barium | 2.17E+02 | 1.35E+02 | NA | No Data | No Data | 0E+00 | 0E+00 | No | NC | No | No | No | No | No | Unknown | No |
| Cadmium | 2.80E+00 | 6.47E-01 | 4.30E-02 | 6.00E-01 | 3.00E-03 | 1E+00 | 2.16E+02 | Not Required | No | Yes | No | Yes | No | No | No | Yes |
| Chromium, Total | 4.56E+01 | 1.71E+01 | NA | 3.70E+01 | 4.20E+03 | 5E-01 | 4.1E-03 | Not Required | No | No | No | No | No | No | No | No |
| Cobalt | 9.60E+00 | 6.72E+00 | NA | No Data | No Data | 0E+00 | 0E+00 | No | NC | No | No | No | No | No | Unknown | No |
| Copper | 3.00E+01 | 9.92E+00 | NA | 3.60E+01 | 1.00E+01 | 3E-01 | 9.9E-01 | Not Required | No | No | No | No | No | No | No | No |
| Iron | 5.46E+04 | 2.46E+04 | NA | No Data | No Data | 0E+00 | 0.00E+00 | No | NC | No | No | No | No | No | Unknown | No |
| Lead | 1.48E+02 | 3.39E+01 | NA | 3.50E+01 | 1.28E+02 | 1E+00 | 3E-01 | Not Required | No | No | No | No | No | No | No | No |
| Manganese | 6.11E+02 | 3.03E+02 | NA | 1.10E+03 | No Data | 3E-01 | 0E+00 | No | No | No | No | No | No | No | No | No |
| Mercury | 3.20E-01 | 1.14E-01 | 2.50E-02 | 2.00E-01 | No Data | 6E-01 | 0E+00 | Yes | No | Yes | No | No | No | No | No | Yes |
| Nickel | 7.60E+00 | 4.43E+00 | 5.00E-01 | 1.80E+01 | 3.16E+02 | 2E-01 | 1E-02 | Not Required | No | No | No | No | No | No | No | No |
| Selenium | 8.80E-01 | 5.06E-01 | NA | No Data | 1.00E-01 | 0E+00 | 5E+00 | Not Required | NC | No | No | No | No | No | Unknown | No |
| Silver | 7.90E+00 | 2.02E+00 | 5.00E-02 | 4.50E+00 | No Data | 4E-01 | 0E+00 | No | No | No | No | No | No | No | No | No |
| Thallium | 1.80E+00 | 7.89E-01 | 3.35E-01 | No Data | 7.00E-01 | 0E+00 | 1E+00 | Not Required | NC | No | No | No | No | No | Unknown | No |
| Vanadium | 1.54E+02 | 7.10E+01 | NA | No Data | No Data | 0E+00 | 0E+00 | No | NC | No | No | No | No | No | Unknown | No |
| Zinc | 1.86E+02 | 8.28E+01 | NA | 1.23E+02 | 3.00E+00 | 7E-01 | 2.8E+01 | No | No | Yes | No | No | No | No | No | Yes |

Abbreviations: **Bold** = indicates chemcials of potential concern that may require further assessment at the site, mg/kg = milligrams per kilogram, NA = not applicable, NC = not calculated, Unknown = chemical was detected but no screening criterial are available.

- 1 Chemicals remaining following the frequency of detection, essential nutrient, and background concentrations screening procedures.
- 2 Upper confidence limit on the mean or maximum (whichever is lower)
- $3 \ The \ risk \ ratio \ is \ the \ exposure \ point \ concentration \ \ divided \ by \ the \ Screening \ Level \ Values \ (SLV).$
- 4 As listed in the Draft Sediment Evaluation Framework (USACE et al., 2005).

 Bioaccumulation screening not required when a bioaccumulation screening value is available.

 18 18 :Number of COIs (Nij)

 5 The chemical of interest is considered a chemical of potential ecological concern if:

 0.1 :1/Nij
- a) The risk ratio (Rij) is greater than 1 for protected species and benthic invertebrates.
- b) The risk ratio (Rij) is greater than 5 for other species.
- c) The chemical of interest is a bioaccumulator.
- d) The chemical of interest has an elevated detection limit.
- e) No risk-based screening or bioaccumulation vaule is available.
- f) Inordinate contribution to overall risk (Rj).