Draft
Engineering Evaluation/Cost Analysis
Non-Time-Critical Removal Action
Phillips Asbestos Mine Site
Tonto National Forest, Gila County, Arizona

May 2013

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Prepared for:

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Submitted by:
Engineering/Remediation Resources Group, Inc.

Signature	May 31, 2013 Date
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Executive Summary

Engineering/Remediation Resources Group, Inc. conducted an engineering evaluation/cost analysis (EE/CA) for the Phillips Asbestos Mine Site in the Tonto National Forest, Gila County, Arizona. The purpose of this EE/CA is to develop and analyze removal action alternatives to aid the U.S. Department of Agriculture Forest Service in reclamation of the site.

Based on previous investigations and the results of an additional screening evaluation of risks, asbestos in mine wastes and site soil is likely to pose an unacceptable risk to site visitors or workers. As a result, a removal action is necessary to minimize the risks associated with asbestos in soil and mine waste materials at the site.

The following preliminary removal action objectives (RAOs) were developed for the site to reduce the risks to human health:

- Reduce human exposure to asbestos fibers released from soil, waste material, and building materials at Subareas 1, 2, and 3.
- Reduce the exposure of humans to physical hazards and asbestos at former site features such as open adits.

This EE/CA considered cleanup levels that are protective of human health and the environment based on the site's status as nonresidential, with recreational use or habitat for wildlife. As a result, removal action alternatives were developed and evaluated for soil, waste piles, and building materials at the following subareas: the Mine Camp (Subarea 1), Mill Area (Subarea 2), and Upper Workings (Subarea 3).

The following removal action alternatives were evaluated in the EE/CA to address the RAOs:

- Alternative 1: No Action
- Alternative 2: Institutional and Engineering Controls
- Alternative 3A: Excavation and Onsite Encapsulation of Source Materials from Subareas 1, 2, and 3
- Alternative 3B: Excavation and Onsite Encapsulation of Source Materials from Subarea 1 and Subarea 3, and Consolidation of Soil and Waste Materials and Cap in Place at Subarea 2
- Alternative 4: Excavation and Offsite Disposal of Source Materials from Subareas 1, 2, and 3

Each alternative was analyzed for effectiveness, implementability, and cost. Following the analysis of alternatives, a comparative analysis of all alternatives was conducted and the recommended removal action alternative was selected. Based on the detailed and comparative analyses, **Alternative 3B: Excavation and Onsite Encapsulation of Source Materials from Subareas 1 and 3, and Consolidation of Soil and Waste Materials and Cap in Place at Subarea 2** is recommended as the preferred remedy for the site. Alternative 3B is recommended because (1) it achieves the RAOs; (2) it meets the applicable or relevant and appropriate requirements (ARARs); and (3) is more cost-effective than the other alternatives[1], except for Alternative 1 (no action) and Alternative 2 (institutional and engineering controls), neither of which achieve RAOs.

The recommended removal action alternative has the following primary components:

- Repair roads as needed to gain access to the site areas.
- Remove approximately 800 cubic yards of primary source materials from Subarea 1 and 5,000 cubic yards of source materials from Subarea 3. Waste materials would be loaded into dump trucks, transported to an unlined onsite repository, and covered with 2 feet of clean soil sourced from the repository excavation at Subarea 3.
- Waste at Subarea 2 would be capped in place with 2 feet of clean cover soil sourced from the excavation of the Subarea 3 repository.
- Shape and regrade excavated areas to match natural contours and restore the site to pre-mining conditions to the extent practicable.
- Restore excavated and regraded areas.
- Secure the openings of 16 adits.

The estimated capital cost of the recommended removal action alternative is $1,210,465. This cost represents an order-of-magnitude estimate, in accordance with the U.S. Environmental Protection Agency's guidance for conducting EE/CAs, with an intended accuracy of +50 to -30 percent.

[1] The capital costs for Alternative 3B are less than the capital costs for Alternative 3A, but the long-term cost of Alternative 3A is less than the long-term cost for Alternative 3B. Because the costs are so close, the final decision about the location of encapsulation areas should be finalized during the design process.

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Acronyms and Abbreviations

ARARs	applicable or relevant and appropriate requirements
ATSDR	Agency for Toxic Substances and Disease Registry
ATV	all-terrain vehicle
AZGFD	Arizona Game and Fish Department
BLM	Bureau of Land Management
BMPs	best management practices
CARB	California Air Resources Board
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COCs	chemicals of concern
COPCs	chemicals of potential concern
EE/CA	Engineering Evaluation/Cost Analysis
ELCR	excess lifetime cancer risk
EPA	U.S. Environmental Protection Agency
EPC	exposure point concentration
ERRG	Engineering/Remediation Resources Group, Inc.
Forest Service	U.S. Department of Agriculture Forest Service
FR	Forest Road
IUR	Inhalation Unit Risk
L/min	liters per minute
MCLG	maximum contaminant level goal
MFL	million fibers per liter
mm^2	square millimeters
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NESHAP	National Emission Standards for Hazardous Air Pollutants
NTCRA	non-time-critical removal action
O&M	operations and maintenance

Acronyms and Abbreviations *(continued)*

PLM	polarized light microscopy
PPE	personal protective equipment
PRPs	potentially responsible parties
QC	quality control
RAOs	removal action objectives
RMC	risk management criteria
RPA	Removal Preliminary Assessment
SAIC	Science Applications International Corporation
SCEM	site conceptual exposure model
SRE	screening risk evaluation
str/cc	structures per cubic centimeter
TBC	"to be considered"
TEM	transmission electron microscope
TPH	total petroleum hydrocarbons
TWF	time weighting factor
WHO	World Health Organization
µm	microns (or micrometers)
§	Section

Section 1. Introduction

Engineering/Remediation Resources Group, Inc. (ERRG) has prepared this Engineering Evaluation/Cost Analysis (EE/CA) for a non-time-critical removal action (NTCRA) at the Phillips Asbestos Mine Site located in the Tonto National Forest, Gila County, Arizona. ERRG is conducting this EE/CA on behalf of the U.S. Department of Agriculture Forest Service (Forest Service) under the Regional A/E Indefinite Quantity Contract for Environmental Site Response Activities (AG-91S8-C-11-0001), Order No. AG-8371-D-11-0083. This EE/CA has been prepared in accordance with the Forest Service Statement of Work (Forest Service, 2011) and the U.S. Environmental Protection Agency's (EPA) "Conducting Non-Time-Critical Removal Actions under CERCLA" (EPA, 1993).

The following subsections describe the regulatory framework, the purpose of the EE/CA, and the organization of this report.

1.1. REGULATORY FRAMEWORK

Authority for responding to releases from a hazardous waste site is addressed in Section 104 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). Executive Order 12580 delegates the authority for removal actions at Forest Service sites to the U.S. Department of Agriculture. The Forest Service, under the delegation of the U.S. Department of Agriculture's authority, is the lead federal agency for the environmental investigation and cleanup of the Phillips Asbestos Mine Site, and as such will oversee all project activities. Other federal, state, or local agency representatives may be consulted, at the discretion of the Forest Service's On-Scene Coordinator. The Forest Service will ensure that all removal action tasks comply with CERCLA and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP).

EPA has classified removal actions into three types: emergency, time-critical, and non-time-critical. The classification is based on the type of situation, the urgency to take action, the threat of a release or potential release, and the period of time in which the action must be initiated (EPA, 1993). The removal action at the Phillips Asbestos Mine Site will be non-time-critical because a 6-month period is available before a removal action should be taken at the site and the threat to human and ecological receptors is not immediate. Section 300.415(b)(4)(i) of the NCP requires that an EE/CA is conducted for all NTCRAs to evaluate removal alternatives for the site.

Asbestos is a known carcinogen and respiratory hazard; as a result, it has the potential to pose a serious risk to site visitors and the environment. Mining and milling of asbestos materials at the site may have increased the potential for naturally occurring asbestos to become airborne, thus increasing the likelihood that site visitors could be exposed to asbestos fibers through the inhalation pathway.

For solid asbestos, National Emission Standards for Hazardous Air Pollutants (NESHAP) defines "friable asbestos material" as any material containing more than 1 percent asbestos using the method specified in Title 40 Code of Federal Regulations, Part 763, Subpart E, Appendix E, Section 1, Polarized Light Microscopy (PLM). Additionally, the California Air Resources Board's (CARB) Asbestos Airborne Toxics Control Measure for Surfacing Applications indicates that "restricted material" includes ultramafic rock and any material that has been tested and found to have an asbestos content of 0.25 percent or greater, as measured by PLM[2]. California guidance was reviewed to evaluate the potential hazard associated with asbestos in soil because no federal or Arizona regulations have been established for naturally occurring asbestos or asbestos in soil, particularly at low concentrations (ERRG, 2012; Arizona Department of Air Quality, 2012).

For asbestos in air, no methods are currently available that reliably predict the concentration of asbestos in air based on concentrations in source materials (i.e., soil, waste material, or building materials) (EPA, 2008). However, whenever asbestos is found in soil, some amount of risk is assumed to exist. As indicated by EPA, disturbance of soil or other bulk materials with asbestos concentrations below the level of detection may still result in potentially hazardous airborne exposures (EPA, 2008). EPA considers activity-based sampling the most appropriate method for estimating risk from asbestos. Ongoing investigations by EPA have indicated that airborne exposures associated with the disturbance of contaminated soil depend upon a number of factors such as environmental conditions, soil composition, releasability and friability of the asbestos materials present, and the nature of the disturbance activities (EPA, 2007 and 2008). As a result, activity-based sampling and further data evaluation are required at asbestos-contaminated sites to fully evaluate the potential exposure of site visitors to asbestos via the inhalation pathway.

1.2. PURPOSE

The purpose of the EE/CA is to develop and analyze removal action alternatives in accordance with CERCLA and to recommend a removal action alternative that is protective of human health and the environment, and that complies with applicable or relevant and appropriate requirements (ARARs). In accordance with EPA guidance, the EE/CA is completed to (1) meet the environmental review requirements for removal actions; (2) satisfy administrative record requirements for documentation of the selected removal action alternative; and (3) identify the objectives of a removal action and analyze the

[2] Title 17 California Code of Regulations Section 93106

effectiveness, implementability, and cost of various alternatives that may satisfy these objectives (EPA, 1993).

1.3. REPORT ORGANIZATION

Following Section 1, this EE/CA is organized as follows:

- Section 2, Site Characterization – describes the site location and features, summarizes the site background, and describes the physical setting of the site.
- Section 3, Source, Nature, and Extent of Contamination – summarizes the source, nature, and extent of contamination based on previous investigations at the site.
- Section 4, Streamlined Risk Evaluation – discusses the selection and screening of chemicals of potential concern (COPCs), summarizes the site conceptual exposure model (SCEM), and summarizes the results of the screening evaluation of site risks to human health and the environment.
- Section 5, Identification of Removal Action Goals and Objectives – identifies the removal action goals and removal action objectives (RAOs) that, if met, will result in the protection of human health and the environment, pursuant to CERCLA criteria.
- Section 6, Applicable or Relevant and Appropriate Requirements – describes the chemical-specific, location-specific, and action-specific ARARs that aid in establishing cleanup criteria for the site.
- Section 7, Identification and Analysis of Removal Action Alternatives – describes the removal action alternatives and analyzes each alternative for effectiveness, implementability, and cost.
- Section 8, Comparative Analysis of Removal Action Alternatives – provides a comparative analysis of the removal action alternatives against each other for effectiveness, implementability, and cost to recommend a removal action alternative for the site.
- Section 9, Recommended Removal Action Alternative – presents the recommended removal action alternative based of the findings of the comparative analysis.
- Section 10, References – lists the reports and guidance documents used to prepare the EE/CA.

Figures and tables are presented following Section 10. The following supplemental information is appended to this EE/CA:

- Appendix A. Photographic Log
- Appendix B. Summary of Previous Sample Results
- Appendix C. Laboratory Analytical Results from the Phillips Asbestos Mine Site EE/CA
- Appendix D. Alternative Cost Estimate Summary

Section 2. Site Characterization

This section describes the Phillips Asbestos Mine Site, its background, and its physical characteristics, and summarizes the source, nature, and extent of known contamination based on analytical data from previous environmental investigations conducted at the site. This section provides the basis for understanding the COPCs and media of potential concern at the site.

2.1. SITE DESCRIPTION

The Phillips Asbestos Mine Site is approximately 362 acres in size and is located in the Globe Ranger District of the Tonto National Forest, in Gila County, Arizona, in Sections 28 and 33, Township 5 North, Range 17 East, Gila and Salt River Base Line Meridian. The site is reached by heading north out of the city of Globe, Arizona, on U.S. Highway 60 for approximately 26 miles to Forest Road (FR) 473. Follow FR 473 for approximately 4 miles to the site (Forest Service, 2009). The first 1.25 miles of FR 473 from U.S. Highway 60 are on land under the jurisdiction of the San Carlos Apache Indian Reservation. Figure 1 shows the location and vicinity of the site.

The site is an abandoned chrysotile asbestos mine that consists of numerous adits with three mine workings areas, a mill, and a mine camp (Figure 2). The ground elevation at the site ranges from 4,600 to 5,600 feet above mean sea level. The exact operational dates of the mine are unknown; however, the first mention of the site in the Bureau of Mines Mineral Yearbooks is in 1940, and no references are made to operations at the site after 1970 (Forest Service, 2009). The following four tributaries to the Salt River traverse the site: Upper Tributary, Middle Tributary, Mill Tributary, and Phillips Canyon Tributary (Figure 2).

The site consists of the following five geographic subareas (Figure 2):

- Mine Camp
- Mill Area
- Upper Workings Area located around a knoll above the Mine Camp
- Lower Workings Area in the cliffs of the Mill Tributary below the Mill Area
- Phillips Canyon Workings Area in the cliffs of Phillips Canyon

The following subsections describe the site features in each of the five subareas. Appendix A contains photographs of the site features.

2.1.1. Mine Camp

The Mine Camp was the base of operations for the mine and is bisected by FR 2298. During a site visit in June 2012, the following historical site features were identified at the Mine Camp (Figure 3):

- A former residence, office, a dorm building, a shop building, a generator shed, and an unidentified shed made of either asbestos-containing plaster and concrete or wood (as identified in the Removal Preliminary Assessment [RPA] and confirmed through personal communication with Ms. Anne Fischer of the Forest Service [Forest Service, 2012a]). The shop building contains a barred basement room, which may have been used as a jail (Appendix A, Photographs A-1 through A-11). Additionally, stained soil was observed near the generator shed, indicating a possible release of petroleum hydrocarbons.
- Six foundations, including the former shop building and town mill. A fireplace with a chimney is present on the foundation north of the former residence and may have been part of another residence or kitchen outbuilding (Appendix A, Photographs A-12 through A-16).
- Miscellaneous debris, including an abandoned vehicle, a collapsed shed (around a pit), and a metal tank. General metal debris can be seen in various locations around the Mine Camp, particularly near the buildings (Appendix A, Photographs A-17 through A-22).
- A partially collapsed culvert made of asbestos cement pipe, which was identified during the RPA (Forest Service, 2009), is believed to run through the Mine Camp and is visible above ground in at least one location (Figure 3).

An asbestos processing or fiber storage facility is also believed to have been located in the Mine Camp (Forest Service, 2009), but evidence of a processing or storage facility was not observed at the Mine Camp during the 2012 site visit. Based on field observations, the volume of asbestos-containing building materials potentially requiring removal is estimated to be 200 cubic yards. Additionally, asbestos debris can be seen all around the Mine Camp. White fibrous material, which appears to contain asbestos fibers, was observed in several areas of the camp. These areas are not distinct piles. Figure 3 shows the main areas where significant amounts of white fibrous material were observed. The volume of contaminated soil potentially requiring removal is estimated to be 600 cubic yards. Figure 3 also shows several areas of special concern. These areas have been identified as potential cultural resource areas, where prehistoric artifacts may exist. Table 1 lists the estimated volume of building materials and soil requiring removal from the Mine Camp.

In addition to the historical mine features, the following modern features were also identified at the Mine Camp:

- A makeshift shooting area, which consists of objects found at the site such as cans and metal debris stacked up and used for target practice. The area surrounding the stacked objects had several shell casings and items with holes shot into them. Based on the debris observed, this area appears to be used infrequently and is not a likely source of potential lead contamination (Appendix A, Photograph A-23).
- A plastic water tank, which may be used for drinking water for cattle. Cattle were seen on the road near the Mine Camp but not in the camp area itself, during the 2012 site visit (Appendix A, Photograph A-24).
- A 6-inch-diameter groundwater well was located next to the shed adjacent to the generator building (Forest Service 2012a). During the 2012 site visit, ERRG attempted to measure the well depth and water level using a 100-foot water level sounder, but the depth to water was greater than 100 feet. The well has a cap with a small access hole, but was not sealed. No permanent pump was observed in the well. The Arizona Department of Water Resources well registry[3] was searched, and no record of this well or any other wells at the site was found. This well may be the source of water contained in the plastic tank (Appendix A, Photographs A-25 and A-26).
- Two wood- and wire-fenced corral areas, one in disrepair and one that may currently be in use by range permittees (Appendix A, Photographs A-27 and A-28).

Figure 3 shows the site features of the Mine Camp.

2.1.2. Mill Area

The Mill Area is accessed via FR 2298 (Figure 4). The Mill Area is approximately 1 mile from the Mill Camp, but vehicle access to this area is blocked at about a 0.5 miles by a collapsed culvert, similar to the one visible at the Mine Camp.

Site features present at the Mill Area include one standing cable car pulley tower and the remnants of two cable car pulley towers (Appendix A, Photographs A-29 and A-30), the mill building (Appendix A, Photographs A-31 through A-32), miscellaneous pieces of mill equipment and debris, and waste and tailings from processing of asbestos-containing minerals (Appendix A, Photographs A-33 through A-40). Of the three pulley towers previously identified at the Mill Area, only the lowest tower along the canyon edge was standing during the 2012 site visit; however, it had been partially cut with a cutting torch. The other two pulley towers were missing, with only the stumps of the legs remaining on the foundation pads. Vandals have recently removed metal debris from several areas at the Mill Area, presumably to be sold as scrap. A review of previous site photographs indicated that conspicuous bare areas observed at the site were previously covered with metal (Forest Service, 2012d). It is likely that vandals cut up the two towers and removed them from the site.

Two asbestos waste piles were previously identified in the Mill Area; however, the exact extent of the piles was not delineated (Forest Service, 2009). In addition, approximately 5 acres of the Mill Area was

[3] https://gisweb.azwater.gov/waterresourcedata/WellRegistry.aspx

observed to be covered with waste material containing asbestos fibers. During the 2012 site visit, the piles observed on site were not distinct; rather, asbestos fibers were clearly visible mixed with soil over the entire Mill Area. Several small piles (approximately 5 feet in diameter and 3 feet high) were also observed directly adjacent to the mill building. Approximately 1,600 cubic yards of asbestos-contaminated soil and approximately 100 cubic yards of asbestos-containing building debris are estimated to be present in the Mill Area. Figure 4 shows the most concentrated areas of waste material at the Mill Area. Table 1 presents the estimated volumes of waste.

2.1.3. Upper Workings Area

The Upper Workings Area can be accessed from the north via an approximately 0.25-mile two-track road from the Mine Camp that ends at the workings area. All-terrain vehicle (ATV) tracks on a knoll lead from the two-track road to the Upper Workings Area. Fourteen adits and 1 test pit were identified around the knoll at the Upper Workings Area (shown on Figure 5 and Appendix A, Photographs A-41 through A-58). In some cases, the adit openings are large enough to see that they interconnect below ground (Appendix A, Photograph A-49). Adits 1, 2, 2A, 3, and 4 are located on the south, east, northeast, and north sides of the knoll (Figure 5). Adits 1 through 4 are accessible on foot, via a severely degraded roadbed around the perimeter of the knoll. Small waste piles are present near the openings of Adits 1, 2A, and 4 (Appendix A, Photographs A-59 through A-63). Adits 5 through 12 are clustered along the northwest side of the knoll and can be easily accessed on foot or by four-wheel drive vehicle (Figure 5). Approximately 5,000 cubic yards of waste rock material containing asbestos fibers is present at the openings of Adits 5 through 8 (Appendix A, Photographs A-64 through A-66).

2.1.4. Lower Workings Area

The Lower Workings Area is located below the Mill Area, along the Mill Tributary Canyon, and is mostly inaccessible (Figures 2 and 6). The area includes at least nine open adits, only one of which is accessible. Records for the site indicate that the Lower Workings Area consists of a series of adits on both sides of the Mill Tributary's canyon walls (Forest Service, 2009). During the RPA, the Forest Service documented eight adits: four on the north-facing cliff slopes across from the mill and four on the south-facing cliff face below the mill. These eight adits are visible from the Mill Site or Phillips Canyon (Forest Service, 2012d; Attachment 1). Small amounts of waste are present below at least two of the adits, eroding down the steep slopes into the canyon of the Mill Tributary. The volume of waste present in the Lower Workings is unknown but based on photographs it is believed to be minimal relative to other areas of the site (Forest Service, 2012d). Additional adits may exist in inaccessible locations that are not visible from the site. Access to these areas may require specialized training and climbing equipment (e.g., ropes and harnesses).

During the 2012 sampling event, one adit in the Lower Workings Area was found that could be accessed. The adit is identified as the accessible Lower Workings adit in Photographs A-67 and A-68 in Appendix A. No waste pile was associated with this adit.

Figure 6 shows the approximate locations of the eight inaccessible and one accessible adit at the Lower Workings Area.

2.1.5. Phillips Canyon Workings Area

The Phillips Canyon Workings Area is located on the north-facing cliff face of Phillips Canyon and is mostly inaccessible (Figure 2 and Figure 7). Portions of the area may be accessed on foot, although with difficulty, via a severely degraded mining road (FR 2299). Two adits and associated waste piles were identified in the Phillips Canyon Workings Area (Figure 7; Appendix A, Photographs A-69 through A-74). Some mining debris and tower foundations remain near the adits (Appendix A, Photographs A-75 through A-81). One of the adits is collapsed but was identified because a large waste rock pile was present and a collapsed area in the cliff above the pile was observed. In Phillips Canyon, waste rock extends from the adits down toward the Phillip Canyon Tributary on nearly vertical slopes (Figure 7 and Photograph A-82).

Maps and aerial photographs indicated that, at one time, FR 2299 continued farther to the east; however, during the 2012 site visit, boulders and fallen rock prevented access to the road beyond the second waste pile.

2.2. SITE BACKGROUND

The following subsections summarize the operational history of the site, the search for potentially responsible parties (PRPs), the current and future land use of the site, and surrounding land use and populations.

2.2.1. Operational History

The following site history information is taken from "Removal Preliminary Assessment Report, Phillips Asbestos Mine, Mill, and Mine Camp" (Forest Service, 2009).

Chrysotile asbestos was first discovered in Arizona near the Grand Canyon in 1869. The success of mining this deposit led to an intensive search of the nearby area and the Sierra Ancha Mountains. By late 1915, approximately 500 claims were located between Globe and Young, Arizona (Arizona Bureau of Mines, 1928). Development was spurred on by the high prices for Crude No. 1[4] in 1921 (U.S.

[4] From U.S. Department of Interior, Bureau of Mines, 1955: Crude No. 1 is unmilled (or mechanically cobbed crude fiber) asbestos with 3/4 inch or longer fibers. Crude No. 2 is unmilled asbestos with 3/8 to 3/4 inch fibers

Department of Interior, Bureau of Mines, 1955). Early in 1921, legislation allowed for prospecting, locating, and leasing of asbestos claims on the Fort Apache and San Carlos Apache Indian Reservations.

The first mention of the site in the Bureau of Mines Mineral Yearbooks is in 1940. The Phillips Asbestos Mine may have gone by the name of Crosthwaite-Steward prior to this date. The Phillips Asbestos Mine was named after Mr. Guy Phillips. He operated the mine until he was shot to death at the Mine Camp in 1962. After his death, ownership of the mine passed to his wife but it was operated by Western Asbestos Manufacturing Group. No reference is made to operations at the site after 1970. New regulations governing asbestos began to appear that year.

2.2.2. Potentially Responsible Party Search, 2010

Science Applications International Corporation (SAIC) conducted a PRP search in 2010. The intent of the search was to identify any parties who may bear some financial responsibility for site investigation and cleanup. The PRP search consisted of research into the various companies and individuals who held mining claims over the years and who conducted mining operations at the site. The PRP Report concluded that no viable PRPs were identified for the site. The companies that operated the mine and mill are no longer in business, and the individuals who held mining claims and conducted mining operations at the site were either impossible to locate or deceased (SAIC, 2010).

2.2.3. Current and Future Land Use

The Phillips Asbestos Mine Site is currently not in operation; however, many areas of the site are frequently used by the public for recreational purposes. Common recreational activities at the site are ATV riding and hiking.

Evidence of recreational activities at the site was observed during a site visit in 2012. Two quad-style ATV riders passed through the Mine Camp during the 2012 site visit. The ATV riders said that they had previously witnessed vandals removing scrap metal and cutting down pulley towers in the Mill Area. Parts of the Mine Camp and areas directly adjacent to the Mine Camp are used for grazing cattle. Modern features associated with ranching (a plastic water tank and a corral) and a groundwater well (presumed to be supplying the water tank) were observed at the Mine Camp. It is anticipated that the site will continue to be used in a similar capacity in the future.

2.2.4. Surrounding Land Use and Populations

The site is within the Tonto National Forest, which is bordered on the north and west by the Fort Apache Indian Reservation and on the east by the San Carlos Apache Indian Reservation, with populations of approximately 13,400 and 10,050, respectively (based on data from the 2010 census[5]). The nearest

[5] http://edrp.arid.arizona.edu/tribes.html

highway is U.S. Highway 60 between the cities of Globe and Show Low, Arizona, with populations of approximately 7,500 and 10,600, respectively (based on data from the 2010 census[6]).

The Salt River is below and downstream of the site and is a popular recreational river for whitewater rafting. The area is popular with hunters, and recreational ATV use appears to be increasing (Forest Service, 2009).

2.3. PHYSICAL SETTING

This section summarizes the physical setting, including geology and soil, hydrology and hydrogeology, climate, vegetation and sensitive ecosystems, and cultural resources, of the Phillips Asbestos Mine Site.

2.3.1. Geology and Soil

The site is located in the Arizona Transition Zone, which is a northwest-to-southeast trending metamorphic region across central Arizona. The area is characterized by rugged mountain ranges and valleys formed primarily from sediments that have undergone metamorphism and erosion (Arizona Geological Survey, 2012). The lithologic unit of concern at the site is the Mescal Limestone that contains chrysotile-bearing serpentinite zones. The Mescal Limestone normally consists of up to 300 feet of medium- to thin-bedded, hard, cherty, dolomitic limestone. In the Sierra Ancha/Chrysotile region, the middle part of the Mescal is often a pure, crystalline, magnesian limestone. Metamorphism of the Mescal Limestone resulted in the development of chrysotile asbestos. Veins of asbestos within the serpentinite range from microscopic to 14 inches thick, with an average thickness of 2 inches (Wilson and Butler, 1928).

The chrysotile-bearing serpentinite zones in Arizona are described as soft and weakly resistant to weathering. The zones are commonly exposed in cliffs and steep slopes, protected by the more resistant, overlying metamorphic limestone, which reduces the exposure of serpentinite and chrysotile to erosion (U.S. Geological Survey, 1986).

2.3.2. Hydrology and Hydrogeology

The site is on the edge of the Salt River Canyon gorge and is approximately 1 mile from the Salt River. No perennial drainages are present in the Mine Camp, Mill Area, or Upper Workings Area. Any surface water drainages in these areas are either ephemeral or intermittent, responding to rain or snowmelt conditions. Four tributaries of the Salt River run through the canyons of the Lower and Phillips Canyon Workings Areas (Forest Service, 2009). These four tributaries are referred to as the Upper Tributary, the Middle Tributary, the Mill Tributary, and the Phillips Canyon Tributary, as shown on Figure 2. The Phillips Spring is located adjacent to the Mine Camp area in the Mill Tributary (Figure 2). Depth to

[6] http://quickfacts.census.gov/qfd/states/04000.html

groundwater at the Mine Camp, as measured during the 2012 site visit, was estimated to be greater than 100 feet below ground surface.

2.3.3. Climate

Monthly climate data collected from August 1, 1975, through December 31, 2008, at a meteorological data station (#023500) in nearby Globe, Arizona, were reviewed to characterize the climate at the site. Winter temperatures in Globe range from 32°F to 69°F, with an average daily high temperature of 61°F. Summer temperatures ranged from 60°F to 99°F, with an average daily high temperature of 92°F. Average annual precipitation is 15.28 inches, with most precipitation occurring during July, August, and the winter months (Western Regional Climate Center, 2011).

Thunderstorms are common in the afternoons during July and August. These storms can be sudden, causing flash floods. Gentle rains and some snow may occur from December through March. The winter weather can result in road closures because of snow or the conditions becoming too slippery to drive safely (Forest Service, 2009).

2.3.4. Vegetation and Sensitive Ecosystems

The site contains a diverse mixture of vegetation. The following species of common vegetation are found at the Phillips Asbestos Mine Site: pinyon pine (*Pinus monophylla*), alligator juniper (*Juniperus deppeana*), One-seed juniper (*Juniperus monosperma*), Emory oak (*Quercus emoryi*), Arizona white oak (*Quercus arizonica*), Sonoran scrub oak (*Quercus turbinella*), pointleaf manzanita (*Arctostaphylos pungens*), deerbrush (*Ceanothus integerrimus*), catclaw (*Acacia greggii*), wait-a-minute-bush (*Mimosa biuncifera*), banna yucca (*Yucca baccata*), agave (*Agave* spp.), and sideoats grama (*Bouteloua curtipendula*) (Forest Service, 2009).

The Salt River is located about 1 mile from the site and is the nearest and largest sensitive ecosystem. A query was submitted to the Arizona Game and Fish Department (AZGFD)[7] to identify state-listed and federally listed species that may occur near the site. Table 2 presents the query results obtained from the AZGFD. Query results indicated three fish species—Desert Sucker (*Catostomus clarki),* Sonora Sucker (*Catostomus insignis),* and Roundtail Chub (*Gila robusta)*—are present within a 3-mile radius of the site. No fish or associated habitat is present at the site (Forest Service, 2012b); however, fish are present in the Salt River, downstream of the site and were retained as a species of concern. However, designated critical habitat for the federally endangered Razorback Sucker (*Xyrauchen Texanus*) is present downstream of the site, along the Salt River. Results also indicated three bird species—Golden Eagle (*Aquila chrysaetos),* Bald Eagle (*Haliaeetus leucocephalus)* and Common Black-Hawk (*Buteogallus anthracinus)*—are present within a 3-mile radius of the site, thus these bird species were retained as species of concern at the site.

[7] AZGFD Environmental Review On-Line Tool at <http://www.azgfd.gov/hgis/>.

2.3.5. Cultural Resources

The Mine Camp and Mill Area are historical sites with structures dating to the early 1940s that were associated with the production of asbestos during World War II and later. Prehistoric artifacts are present; mitigations and avoidance measures for this project will be addressed during the design and fieldwork periods (Forest Service, 2009). Further investigation of the archaeological resources in the area is needed to ensure that any removal action on the site does not damage historical features.

Section 3. Source, Nature, and Extent of Contamination

This section summarizes the source, nature, and extent of contamination based on analytical data collected during the 2012 site visit and previous investigations conducted at the Phillips Asbestos Mine Site. This section summarizes the results of these investigations and relevant data from primary areas that are further evaluated in the streamlined risk evaluation (SRE) (Section 4).

3.1. REMOVAL PRELIMINARY ASSESSMENT REPORT, 2009

In 2008, the Forest Service performed an RPA of the Phillips Asbestos Mine Site (Forest Service, 2009). The objective the RPA was to identify any releases or threats of release of asbestos at the site. Samples were collected from buildings, soil, and tailings in the Mine Camp and Mill Area to evaluate (1) the size range of onsite asbestos fibers, (2) whether building materials contained asbestos, and (3) the potential for onsite asbestos fibers to move. Sample results were compared against the 1 percent threshold established by the NESHAP. Sample results ranged from 0 percent to 80 percent asbestos; therefore, material at the site was classified as asbestos-containing. Asbestos in building materials in each structure was consistently found to be both friable and present in excess of 30 percent, with a maximum concentration of 80 percent. The high percentage and friable nature of asbestos in building materials indicate that asbestos in building materials is a potential site hazard. Tailings samples were collected from the Mill Area where asbestos was detected at concentrations ranging from less than 1 percent to 40 percent. Appendix B summarizes the RPA results.

In addition to identifying potential environmental and human health hazards, the RPA identified several types of cultural resources at the Mine Camp and Mill Area. Remaining structures at the site may date to the early 1940s and are associated with World War II production of asbestos (Forest Service, 2009). Prehistoric artifacts, consisting of ceramic shards and chipped stone artifacts dating between 750 and 1,000 years ago, have also been found at the Mine Camp (Forest Service, 2009). It is likely that additional artifacts are present in the subsurface of the Mine Camp.

3.2. 2012 SITE VISIT AND SAMPLING EVENT

In July 2012, ERRG, on behalf of the Forest Service, visited the site to document site features and collect additional samples to supplement data obtained during the RPA (Forest Service, 2009) and to evaluate the nature and extent of asbestos and metals and total petroleum hydrocarbons (TPH) at the site. The following samples were collected:

- Air Samples
  - Ambient air samples
  - Activity-based air samples
  - Background activity-based samples and ambient air samples
- Solid Matrix and Water Samples
  - Soil and waste material samples
  - Sediment samples
  - Surface water samples
  - Groundwater samples
  - Background soil and sediment samples

All background samples were collected in areas unimpacted by mining activities (see Figure 8) and in the same manner as their corresponding air, solid matrix, and water samples. The following sections describe the sample collection methods; laboratory analysis of the air, solid matrix, and water samples; deviations from the work plan; and the sample results.

3.2.1. Sample Collection

This section describes the collection of air and solid matrix and water samples during the 2012 site visit. Appendix A presents a photographic log of field activities including sampling locations.

3.2.1.1. Air Samples

Ambient air samples were collected concurrently with all other sampling activities to evaluate the ambient air quality each day that samples were collected. Initially, the ambient sampling stations were placed upwind and downwind and far enough away from the active work areas (hiking and ATV activity-based sampling) to ensure that the upwind sample represented a true undisturbed ambient sample. However, because the wind direction fluctuated throughout the day, the stations were subsequently placed in accessible locations on either side of the site, where ambient conditions were most likely. The ambient sampling equipment consisted of a stationary pump with a preloaded asbestos filter cassette that was fixed to an immobile object such as a tree, signpost, or stake.

As discussed in Section 1.1, collection of activity-based samples is the most appropriate method for evaluating the risk to humans from asbestos in air. Activity-based air samples were collected under the following two scenarios, which represent the likely recreational uses at the site: hiking (modified jogger scenario) and ATV riding. The hiking activity-based samples were collected from the Mine Camp, Mill Area, and Upper Workings Area (Figures 3, 4, and 5). At each area, two samplers, one 5 feet in front of the other, walked the subarea and collected the sample. The ATV activity-based samples were collected while riding an ATV along specified routes at the site (see Figure 9). Two ATVs were used, with one driven in front of the other. The distances between the riders varied based on speed and surface

conditions; the trailing rider made sure to stay within the dust cloud generated by the lead rider. Equipment for activity-based sampling consisted of a personal air sample pump with a preloaded asbestos filter cassette. Activity-based samples were collected in accordance with EPA's SOP-2084 (EPA, 2007) and the EE/CA Work Plan (ERRG, 2012).

3.2.1.2. Solid Matrix and Water Samples

Soil, Waste Material, and Sediment

Soil and waste material samples were collected from across the Mine Camp, the Mill Area, the Upper Workings Area, and the Phillip Canyon Workings Area and along two ATV routes (Figure 9). All soil samples were collected from along the activity-based air sampling routes. Figures 3, 4, 5, and 7 show the locations where samples were collected. Sediment samples were collected from the upstream locations at the Upper Tributary, Mill Tributary, and Phillips Canyon Tributary. Samples were collected from as close to the center of the tributary as possible. No water was present in the tributaries at the locations where sediment samples were collected. Sediment samples could not be collected from below the cliffs downstream of the site because the terrain was steep and impassable.

Soil, waste, and sediment samples were collected using a disposable trowel into a zip-top plastic bag or a laboratory-provided sample jar. Three aliquots were collected within a 10-foot radius of the sample location and composited for laboratory analysis. Soil, waste, and sediment samples were packed, labeled, and transported in accordance with the EE/CA Work Plan (ERRG, 2012). Samples for asbestos analysis were transported to EMSL Analytical, Inc., and samples for analysis of metals and TPH were transported to TestAmerica; both laboratories are located in Phoenix, Arizona.

Surface Water and Groundwater

A surface water sample was collected from the Mill Tributary upstream of the Mill Area. No water was flowing in the tributary when the sample was collected. However, a sample was collected of stagnant water present in the creek bed by dipping a plastic bottle into the water. Figure 9 shows the location where the surface water sample was collected. A groundwater sample was collected from the well at the Mine Camp. The groundwater sample was collected using a Teflon-lined disposable bailer and placed in laboratory-provided containers (plastic bottles and an amber glass bottle). Figure 3 shows the well location where the groundwater sample was collected.

The surface water and groundwater samples were also filtered in the field using a disposable syringe and 0.45-micron (µm) filter to remove any metals suspended in the water, so that dissolved metals concentrations could be evaluated. Samples were collected in plastic bottles pre-preserved with nitric acid.

Surface water and groundwater samples were packed, labeled, and transported in accordance with the EE/CA Work Plan (ERRG, 2012). Samples for asbestos analysis were transported to EMSL Analytical,

Inc., and samples for analysis of metals and TPH were transported to TestAmerica; both laboratories are located in Phoenix, Arizona.

3.2.2. Laboratory Analysis

This section summarizes the laboratory analysis of the air and solid matrix and water samples.

3.2.2.1. Air Samples

Air Sample Analysis

Air samples were analyzed using a transmission electron microscope (TEM) to distinguish between asbestos fibers and non-asbestos fibers in accordance with the work plan (ERRG, 2012). Consistent with EPA's recommendations for activity-based sampling (EPA, 2008), the TEM analysis was performed in accordance with the International Organization for Standardization Method 10312. Asbestos concentrations were reported in terms of Phase Contrast Microscopy Equivalent fibers, which are defined as fibers greater than 5 µm long, with a width between 0.25 and 3.0 µm and a length-to-width ratio of greater than 3:1. Fibers of this size form the basis for the EPA inhalation unit risk for asbestos and have been most closely linked to asbestos-related diseases (EPA, 2008).

TEM analysis was conducted by visual analysis of the samples. Following sample preparation and equipment calibration, each grid opening in a given sample was visually analyzed under magnification. The analyst conducted a systematic visual observation of the grid opening, looking for suspect asbestos fibers and fiber structures. The asbestos concentration in the sample was then extrapolated from the number of observed structures based on the number of grid openings evaluated, the volume of the air sample, and the size of the air filter evaluated. The achieved analytical sensitivity varies slightly from sample to sample as discussed in Section 3.2.4.1.

Air Data Sensitivity

As outlined in the EE/CA Work Plan (ERRG, 2012), an analytical sensitivity of 0.0004 structures per cubic centimeter (str/cc) was proposed for the ambient air samples and an analytical sensitivity of 0.004 str/cc was proposed for the activity-based air samples for both hikers and ATV riders. The analytical sensitivity is defined as the smallest value that can be counted, or the smallest number of str/cc that can be analyzed. A complete discussion of sensitivities achieved is presented in Section 3.2.3.1.

3.2.2.2. Solid Matrix and Water Samples

The laboratory analyzed the solid matrix and water samples for the following analytical groups:

- Asbestos
  - By PLM CARB Method 435 for solid matrix samples
  - Asbestos by EPA 100.2 (TEM) for water

- Metals (i.e., arsenic, barium, cadmium, chromium [total], cobalt, copper, lead, magnesium, manganese, nickel, selenium, silver, uranium, and zinc) by EPA Method 6010/6020 and 7471 (for mercury) for both solid matrix and water samples
- TPH as diesel-range range organics by EPA Method 8015 in soil and groundwater only

3.2.3. Deviations from the Work Plan

During the sampling event, several deviations from the work plan occurred. The details of each deviation and the potential impact on the data are discussed below.

3.2.3.1. Air Data Sensitivity

During development of the EE/CA Work Plan, ERRG evaluated equipment available for sampling asbestos that would be able to obtain the necessary flow rates (between 2 to 5 liters per minute (L/min]) to achieve the desired analytical sensitivities. Available sample pumps were only able to achieve a rate of 1.9 L/min to 2.9 L/min, with an average flow rate of 2.3 L/min. During the 2012 sampling event, the battery life on the pumps was anticipated to last a full day; however, the average battery life was about 4 hours. Because the flow rate was low and the sampling duration was shorter than anticipated, the sample volume was lower than anticipated. To accommodate for the lower sample volume, the laboratory increased the number of grid openings counted under the microscope to achieve the analytical sensitivities identified in the EE/CA Work Plan (ERRG, 2012)[8].

Increasing the grid openings during analysis of asbestos is a standard approach to ensure that sensitivities are met. Using this approach, the proposed analytical sensitivity of 0.004 str/cc was achieved for the hiking and ATV riding activity-based samples. However, the analytical sensitivity of 0.0004 str/cc for the ambient air samples could not be achieved. As a result, an alternative analytical sensitivity of 0.002 str/cc was developed for the ambient air samples based on the highest sensitivity, which would allow the data to be used to evaluate risk (i.e., would still achieve the target cancer risk values needed). The methods used to develop the alternate sensitivity are presented in Section 4.3.1.1.

3.2.3.2. Water Data Sensitivity

One surface water sample was collected from the Mill Tributary above the mill. Asbestos was not detected at concentrations greater than the laboratory reporting limit of 24 million fibers per liter (MFL) in the sample. The analytical sensitivity of 7 MFL was not achieved because excessive particulate matter was present in the sample. These data are not usable to determine if asbestos is present in surface water at the site. In addition, the sample was collected from the mill tributary above the Mill Area, so it would not

[8] The following equation was used to determine the number of grid openings required to meet the analytical sensitivities established in the Work Plan (ERRG, 2012): $S = At/(K \times Ag \times V \times CF)$, where: S = analytical sensitivity, in structures per cubic centimeter (str/cc); At = active area, in mm^2 of the collection media; K = number of grid openings examined; Ag = mean area, in mm^2, of the grid openings examined; V = volume of air in liters (L); CF = conversion factor, cubic centimeters per liter (1,000 cc/L)

reflect asbestos concentrations downstream of the site. Further discussion of asbestos in surface water is presented in Section 3.2.3.3.

3.2.3.3. Inaccessible Sample Areas

The EE/CA Work Plan included documenting site features (such as adits) and collecting sediment and surface water samples from the Lower Workings Area and at five downstream locations on four tributaries at the site, if accessible. Because of the steep terrain, most of the Lower Workings Area and all of the downstream sampling locations could not be accessed during the site visit. Additionally, while a sample was collected from the waste rock piles at Phillips Canyon, only a small portion of the piles were accessible. Figure 2 outlines the approximate extent of the inaccessible area of the site.

Lower Workings Area and Phillips Canyon Workings Area

Most of the Lower Workings Area could not be accessed because of the steep terrain. As a result, the exact locations of eight adits in the Lower Workings Area were not recorded and no samples of waste material in the Lower Workings Area could be collected. Some parts of the Lower Workings Area have been documented visually from the Mill Area and the Phillips Canyon Workings, as discussed in Section 2.1.4. Figures 2 and 6 show the approximate location of adits and waste piles in the Lower Workings Area; the adits and waste material are also shown in Appendix A.

As specified in the Work Plan, one soil sample was collected from the Phillips Canyon Workings Area. However, except for the portions of piles that intersected with the access trail, the waste piles were inaccessible to sampling personnel. Because hiking on the piles to collect additional material was considered unsafe, the sample that was collected consists of material from the top of the piles only.

Downstream Surface Water and Sediment Sampling

All five downstream surface water and sediment sampling locations identified in the EE/CA Work Plan were inaccessible during the 2012 sampling event. As a result, no data could be collected to evaluate the downstream erosion or transport of asbestos material from the waste piles or workings areas and a data gap exists for surface water and sediment at the site. To address this data gap, these areas would need to be accessed, by either hiking up to the locations from downstream (requiring permission to cross the San Carlos Apache Indian Reservation), hiking or rafting down to the locations from upstream, climbing down to the locations from the site (requiring technical climbing gear), or flying in to the locations via helicopter. However, if sediment samples were collected from the tributaries, they are unlikely to provide data that could be used to quantify risk because (1) no screening criteria are available for asbestos in sediment and (2) literature on quantifying risks from ingestion of asbestos in sediment is not available. Section 4.3.1.1 presents the qualitative discussion of possible risks associated with the surface water pathway.

Waste rock from the Lower Workings and Phillips Canyon Workings Areas are most likely to enter the surface water pathway in the Mill Tributary and Phillips Canyon Tributary, respectively. If surface water samples were collected from the tributaries during high flow, sample results could be compared with available surface water criteria (Agency for Toxic Substances and Disease Control [ATSDR], 2001). However, collecting surface water samples would be logistically challenging for the same reasons as discussed in Section 3.2.3.3. The Salt River is the nearest perennial water source that is easily accessible for sampling. However, results for surface water samples from the Salt River could not be used to quantify risks from the site because the Salt River receives water from many other upstream sources and asbestos occurs naturally at many points along the river. Based on these limitations, it is not recommended that this data gap be addressed at this time.

3.2.4. Analytical Results

This section summarizes the asbestos and metals and TPH results for the samples collected during the 2012 site visit. The results are used in this EE/CA in conjunction with sampling results from previous investigations to (1) perform the human and ecological SRE (Section 4) and (2) further evaluate physical characteristics of the site to support the preparation of cost estimates for the EE/CA. Tables 3 through 7 summarize the results of the 2012 sampling event. Figures 3 through 9 show the sampling locations and routes. Appendix A presents a photographic log of field activities, including sampling locations, and Appendix C presents the complete analytical results of the 2012 sampling event.

3.2.4.1. Asbestos Results

Asbestos was not detected in ambient air samples collected at the site. The achieved analytical sensitivities for the ambient samples ranged from 0.0018 to 0.0019 str/cc, which is more sensitive than revised sensitivity target of 0.002 str/cc presented in Section 3.2.3.1.

Asbestos fibers (which are referred to as “structures” during laboratory analysis) were detected in four activity-based air samples at concentrations ranging from 0.0175 str/cc to 0.0385 str/cc (Table 3). Results of the TEM analysis are statistical. Because of the extreme magnification of TEM, analysis of the entire 385 square millimeters (mm^2) area of a filter is impractical. As previously noted in Section 3.2.2.1, the calculated asbestos concentration was extrapolated from a relatively small area, which was then applied to the entire sample. As a result, some asbestos fibers are likely present in samples, but the results may indicate that asbestos is not present in a quantifiable amount or is present at concentrations lower than the analytical sensitivity. In some activity-based samples from the site, asbestos structures were observed, but not in amounts that could be quantified below the selected sensitivity. In these instances, asbestos is assumed to be present at concentrations lower than the selected analytical sensitivities. Because the analytical sensitivities used in the analysis were selected based on the lower end of the risk management range, asbestos concentrations lower than the analytical sensitivities do not present a risk to potential future receptors.

Asbestos fibers were detected in 15 out of 20 source area soil or waste samples at concentrations ranging from 0.25 percent to 13.75 percent. Asbestos was not detected in the upstream sediment, surface water, or groundwater samples (Table 4).

3.2.4.2. Metals and TPH Results

Arsenic, barium, cadmium, chromium, cobalt, copper, lead, magnesium, manganese, nickel, mercury, uranium, and zinc were detected in one or more soil or waste samples. Barium, magnesium, manganese, dissolved barium, and dissolved magnesium were detected in both surface water and groundwater samples. Copper was detected in surface water only. TPH was detected in one soil sample collected at the Mine Camp. Tables 5, 6, and 7 summarize the results for metals and TPH in soil and waste, sediment, and water samples.

3.3. EE/CA AREAS OF CONCERN

Based on the results of the RPA and 2012 site visit, the following five subareas were identified at the Phillips Asbestos Mine Site (Figure 2):

- Mine Camp (Subarea 1)
- Mill Area (Subarea 2)
- Upper Workings Area (Subarea 3)
- Lower Workings Area (Subarea 4)
- Phillips Canyon Workings (Subarea 5)

In total, 24 open or partially open adits were identified at the site. Because asbestos is present within the adits and the adits are open and unsupported, they may pose a risk or safety hazard to site visitors who enter them. Of the 24 adits, 16 are considered accessible to site visitors. Closure of the 16 accessible adits is required to ensure the safety of site visitors. Open adits requiring closure are present in all three of the workings areas (Subareas 3, 4, and 5). Eight of the adits (all located in Subarea 4) are not accessible without specialized equipment and will not require closure (Forest Service, 2012c). Because adits may also provide suitable habitat for bats, bat surveys should be conducted to evaluate whether the adits currently serve as bat habitat and ensure appropriate bat-friendly closure methods are employed.

Section 4. Streamlined Risk Evaluation

This section summarizes the SRE of potential risks to human health and the environment from exposure to asbestos, metals, and TPH at the Phillips Asbestos Mine Site. Potential risks were evaluated for exposure to air, soil and waste materials, sediment, surface water, and groundwater. The SRE is typically used to qualitatively evaluate rather than quantify potential risks to justify a removal action and develop appropriate removal action alternatives to reduce risk. Accordingly, the potential risks to human and ecological receptors from exposure to asbestos, metals, and TPH were evaluated in a qualitative manner by comparing COPCs to appropriate benchmarks, as discussed below. The SRE only evaluates potential exposure of human and ecological receptors to potential chemical hazards and does not evaluate the potential risks from physical hazards such as open adits or steep hillsides.

The SRE for asbestos was performed in accordance with EPA's "Framework for Investigating Asbestos-Contaminated Superfund Sites" (EPA, 2008). The EPA framework outlines a methodology to calculate quantitatively the excess lifetime cancer risk (ELCR) to human receptors at a given site. Cancer risk is the estimated probability that a person will develop cancer from exposure to site contaminants, and is generally expressed as an upper-bound probability. For example, a 1 in 10,000 (1×10^{-4}) chance is a risk that for every 10,000 people, one additional cancer case may occur as a result of exposure to asbestos at the site. A 1 in 1,000,000 chance (1×10^{-6}) is a risk that for every 1,000,000 people, one additional cancer case may occur as a result of exposure to asbestos at the site. This EE/CA adopted a conservative approach and used the cancer risk of 1×10^{-6}, which meets the most conservative end of the risk management range established by EPA (1×10^{-4} to 1×10^{-6}).

Although ingestion of asbestos can contribute to an increased cancer risk, EPA has not established a dose-response relationship for these endpoints (EPA, 2008). In addition, EPA has not established a dose-response relationship for noncancer health effects. As a result, the risk from asbestos to human receptors from other pathways such as ingestion of asbestos in soil or drinking water was evaluated qualitatively.

The following sections summarize the SRE, including the selection and screening of COPCs, the SCEM, and the SRE results.

4.1. SELECTION AND SCREENING OF CHEMICALS OF POTENTIAL CONCERN

All analytical data collected during the 2012 sampling event were initially tabulated (Tables 3 and 4 for asbestos, and Tables 5, 6, and 7 for metals and TPH). Based on EPA guidance (EPA, 2008), asbestos was selected as a COPC because it was detected in samples collected at the site.

Metals data were screened against site-specific background concentrations. Metals concentrations that exceeded their respective background concentrations were retained as COPCs and further evaluated in the SRE, whereas metals not detected in any sample for a given medium or detected at concentrations less than the background concentrations, were removed from the risk evaluation as a COPC.

One background soil sample (sample PA-BG-SS-01) was collected as part of the 2012 sampling event to establish background concentrations for metals at the site. The background sample was not used to screen for asbestos at the site because asbestos had been previously established as present at the site. Results of soil, waste rock and tailings samples were screened against the site-specific background concentrations for 13 metals (arsenic, barium, cadmium, chromium, cobalt, copper, lead, magnesium, manganese, mercury, nickel, selenium, uranium, and zinc) (Table 5). Based on the background screening results, arsenic, cadmium, chromium, cobalt, copper, lead, manganese, nickel, uranium, and zinc were retained as COPCs in soil and waste for further analysis in the SRE. Although magnesium was detected in soil and waste samples at concentrations exceeding background, it was eliminated for further assessment in the SRE because it is an essential nutrient[9]. Table 5 compares the data for soil and waste samples against the background concentrations.

Three background sediment samples (samples PA-UT-SD-01, PA-MT-SD-01, and PA-PT-SD-01) were collected to establish background concentrations for metals at the site. As discussed in Section 3.2.3.2, downstream sediment samples were not collected because the downstream areas could not be accessed; therefore, metals results for upstream background samples and downstream samples could not be compared. However, metals that were detected in the upstream samples were carried forward for further evaluation in the SRE. Metals detected in sediment included barium, chromium, cobalt, copper, lead, manganese, nickel, and zinc. Although magnesium was detected in sediment, it was eliminated for further assessment in the SRE because it is an essential nutrient. Table 6 summarizes the metals results for sediment.

Background concentrations were not established for metals in surface water and groundwater. As a result, all detected metals were selected as COPCs for further evaluation in the SRE for surface water and groundwater. Metals detected in surface water and groundwater included barium, copper, and manganese. Table 7 summarizes the metals results for surface water and groundwater.

Background concentrations do not exist for TPH, so TPH was selected as a COPC and further evaluated in the SRE. Tables 5 and 7 summarize the TPH results for soil and water, respectively.

[9] Removing magnesium from consideration as a COPC because it is an essential nutrient is standard risk assessment practice and is consistent with EPA guidance (EPA, 2000a), which states: "… chemicals which may be eliminated based on essential nutrients are calcium, chloride, iodine, magnesium, phosphorus, potassium, and sodium."

4.2. SITE CONCEPTUAL EXPOSURE MODEL

The SCEM is a descriptive and graphical presentation of the physical, chemical, and biological relationships between sources of contaminants and potentially exposed populations. Figures 10 and 11 present the SCEM for asbestos and metals and TPH at the Phillips Asbestos Mine Site. As shown on Figure 10, the primary source of asbestos contamination is from buildings and waste rock at the site. As shown on Figure 11, the primary source of metals and TPH contamination is from waste rock and generator use. The primary release mechanisms asbestos and metals and TPH are weathering and demolition of building materials, handling and crushing of rock during mining operations, erosion, and spills and leaks from the site generator.

The transport mechanisms are the physical means by which the source materials are transported to the potential exposure media. Potential transport mechanisms at the site include airborne dust, leaching and infiltration, erosion and runoff, and deposition of source materials. Potential exposure media at the site include particulates in air, surface and subsurface soil, groundwater, surface water, and sediment.

The potential routes of exposure to asbestos, as well as metals and TPH, are inhalation of particulates; ingestion and direct contact with surface and subsurface soil, surface water, and sediment; and ingestion of groundwater. The only complete pathway at the site to human and ecological receptors is inhalation of asbestos fibers in air.

All other exposure pathways are insignificant or incomplete. Inhalation of metals and TPH is considered a potentially complete but insignificant pathway because human receptors are unlikely to disturb surface soil at the site for long durations of time. Although inhalation is a possible exposure route for ecological receptors, under most exposure conditions, inhalation pathways do not contribute significantly to risk to ecological receptors (EPA, 2005). Incidental ingestion of asbestos or metals and TPH in surface soil is potentially complete but considered insignificant and not to be quantified because human and ecological receptors are unlikely to ingest site soil. Additionally, EPA has not established a dose-response relationship for ingestion of asbestos and increased cancer risk or a dose-response relationship for noncancer health effects. Ingestion and dermal exposure to asbestos and metals and TPH in subsurface soil is considered an incomplete pathway because site visitors and ecological receptors are unlikely to come in contact with subsurface soil and controls would be implemented to protect future construction workers during a removal action. Ingestion and direct contact of site visitors with groundwater, surface water, and sediment are considered potentially complete but insignificant pathways because groundwater is more than 100 feet below the ground surface and the site is dry most of the year. The potential exposure route of asbestos to humans or wildlife via surface water is considered insignificant. However, as a conservative measure, risks to human health from asbestos in surface water are qualitatively evaluated to assess the data gaps discussed in Section 3.2.3.3.

Based on the current and future land use at the site, the potential human receptors include recreational visitors (i.e., hikers and ATV riders on site and possibly river rafters downstream), future construction workers, and Forest Service personnel. Because the site is in a remote location, residential development is unlikely; therefore, the risk of long-term exposure of humans to contaminants at the site is considered low. Potential ecological receptors at the site include terrestrial wildlife (birds, invertebrates, reptiles, and mammals). Species identified within the vicinity of the project area are presented in Section 2.3.4 and Table 2.

4.3. RISK SCREENING

Potential risks to human receptors from asbestos were evaluated by quantifying risks based on asbestos concentrations in air samples collected during activity-based sampling. Potential risks to human and ecological receptors to metals and TPH were evaluated by comparing concentrations in each medium (soil, waste material, and water) with appropriate screening benchmarks developed for protection of human health and the environment. COPC results that exceeded screening benchmarks were retained as chemicals of concern (COCs).

The following sections summarize the results of the SRE for human and ecological receptors.

4.3.1. Human Receptors

This section describes the SRE of potential risks to human receptors from asbestos and metals and TPH in soil, waste materials, and surface water at the Phillips Asbestos Mine Site.

4.3.1.1. Asbestos

Ambient air and activity-based air samples were collected at the Phillips Asbestos Mine Site to evaluate the potential risk to site visitors during various activities that could occur on the site (as presented in Section 3.2.1.1). As discussed previously, only the air pathway is quantitatively evaluated in the SRE for asbestos in soil and waste materials. In addition, a qualitative risk evaluation was conducted to evaluate the potential risk from asbestos fibers from the Philips Asbestos Mine Site entering the Salt River through erosion.

Air Pathway

EPA's "Framework for Investigating Asbestos-Contaminated Superfund Sites" identifies procedures to calculate the time weighting factor (TWF) for various exposure scenarios and the inhalation unit risk (IUR) for less-than-lifetime exposure scenarios (EPA, 2008). The TWF is calculated as the percentage of time a receptor would spend on site within a year. The basic equation for calculating the ELCR from exposure to asbestos is:

$$Risk\ (ELCR) = EPC \times TWF \times IUR \qquad \text{(Equation 4-1)}$$

where:

ELCR	=	excess lifetime cancer risk, which is the risk of developing cancer as a result of site-related exposure
EPC	=	exposure point concentration, the concentration of asbestos in air (str/cc) for the specific activity being assessed
TWF	=	time weighting factor for the scenario being assessed
IUR	=	inhalation unit risk $(str/cc)^{-1}$, corresponding to the age at first exposure and exposure duration for the exposure scenario

To ensure that data quality (i.e., sensitivity) met the requirements of the SRE, equation 4-1 was rearranged to calculate an exposure point concentration (EPC) equivalent to the desired sensitivity as follows:

$$EPC\ (str/cc) = Target\ Risk\ /\ (TWF \times IUR) \qquad \text{(Equation 4-2)}$$

Based upon recreational use of the site, it is likely that a recreational receptor (hikers or ATV riders) would use the site for 2.5 hours per day, 20 days per year (a total of 50 hours per year). As a conservative measure, the risk calculations assumed that a recreational receptor would use the site for a total of 156 hours per year, resulting in a TWF of 0.018, consistent with EPA guidance (Table 1 in EPA, 2008). It was further assumed that the age of first exposure for recreational receptor is 10 years, with the exposure duration being 20 years, resulting in an IUR of 0.094 (str/cc)-1 (Table 2 in EPA, 2008). Using an ELCR of 1×10^{-6}, which is the lower end of EPA's risk management range, the required sensitivity was calculated to be 0.002 str/cc. All data from the activity-based sampling met the recalculated sensitivity and are considered usable.

Using the data presented in Table 3, the risks from exposure of human receptors to asbestos were quantitatively assessed. Equation 4-1 was used to calculate the estimated ELCR from exposure to asbestos for likely receptors at the Phillips Asbestos Mine Site. Table 8 summarizes the results of the evaluation of risk to human health from exposure to asbestos.

As presented in Table 8, asbestos was detected in three activity-based air samples collected in Subarea 2, and one sample collected in Subarea 3. Asbestos concentrations in the activity-based air samples in Subarea 2 ranged from 0.0180 str/cc in sample PA-MA-AM-05 to 0.0385 str/cc in sample PA-MA-AM-02, with the estimated ELCR ranging from 3.0×10^{-7} to 6.5×10^{-7}. Asbestos was detected at a concentration of 0.0175 str/cc in sample PA-UW-AM-04 in Subarea 3, with an estimated ELCR of 3.2×10^{-7}. Additionally, the laboratory analyst found asbestos structures (one to three fibers) in eight other samples. As discussed in Section 3.2.4.1, because the results of the TEM analysis are statistical and a relatively small area of the sample is observed for asbestos, a certain number of asbestos fibers must be observed to reliably extrapolate the concentration across the entire sample. Additionally, the sample results with observed asbestos structures with nonreportable concentrations of asbestos were compared to

a calculated risk-based EPC. Using Equation 4-2 an EPC of 0.06 str/cc correlates to a cancer risk of 1×10^{-4}, the upper end of the risk management range. Conservatively assuming that the reporting limit is equal to the actual concentration of asbestos, results for all eight samples are less than the risk management range.

As discussed in Section 3.2.2.2, soil samples were also analyzed directly for asbestos. Table 4 summarizes the soil sample results. Currently, no available methods can reliably predict the concentration of asbestos in air based on concentrations in soil (EPA, 2008). However, some amount of risk is assumed to exist wherever asbestos is present in soil. As indicated by EPA, disturbance of contaminated soil and other bulk materials at concentrations less than the detection level of currently available methods may still result in potentially hazardous airborne exposures (EPA, 2008).

While activity-based sample results can be used to identify a quantitative level of risk associated with asbestos at Subarea 2 and Subarea 3, a qualitative assessment of risk associated with other areas of the site can be conducted in areas where asbestos was identified in soil and could potentially contribute to asbestos concentrations in air. Asbestos was detected at concentrations of at least 0.25 percent in all four accessible site areas and along ATV Route 1. Two of the seven soil samples collected along ATV Route 1 contained asbestos. Those two samples, however, coincide with parts of the route that crossed Subareas 1 and 2, so the results were considered indicative of asbestos detections within Subareas 1 and2 rather than along the portions of the road connecting the two areas. Asbestos was not detected in soil samples collected along ATV route 2. Figure 9 shows the sample locations for ATV Routes 1 and 2. Concentrations in excess of 0.25 percent were detected at Subarea 1 (in the sample collected as part of ATV route 1), Subareas 2 and 3. Concentrations did not exceed 1 percent at Subarea 5 or in the background sampling area. Sample locations are presented on Figures 3, 4, 5, 7, 8, and 9. No samples were collected in Subarea 4, due to the inaccessible nature of the area.

Surface Water Pathway

To evaluate the potential risk to human health from asbestos fibers in surface water at the Philips Asbestos Mine Site, concentrations of asbestos in surface water were compared with existing regulatory benchmarks. As discussed in Section 3.2.2.2, one surface water sample (PA-MT-SW-01) was collected from the Mill Tributary above the Mill Area and analyzed for asbestos. No additional surface water samples were collected because water was not present or the tributaries were not accessible. Asbestos was not detected at concentrations greater than the laboratory reporting limit of 24 MFL in the sample (further discussion of the reporting limit for this sample are presented in Section 3.2.3.3).

Subareas 4 and 5 are the primary contributors of asbestos to downstream or downgradient areas where humans may be exposed via the surface water pathway. As a result, concentrations of asbestos fibers in

surface water were qualitatively evaluated to assess the potential risk to humans. The qualitative[10] evaluation consisted of the following steps:

- Review existing literature to identify available surface water or sediment benchmarks for comparison purposes
- Review existing literature for toxicological information on ingestion of asbestos in water and likely risks
- Review regional data from other sources of asbestos similar to those at the Phillips Asbestos Mines Site to approximate the concentrations of asbestos that could migrate from waste piles at the site to surface water

Identification of Surface Water and Sediment Benchmarks

Based on a review of available literature, no surface water or sediment benchmarks exist for asbestos. The only water benchmark identified for asbestos is the EPA's maximum contaminant level goal (MCLG) for asbestos in drinking water, which is 7 MFL for fibers greater than 10 µm in length (ATSDR, 2001). As defined by EPA, MCLGs are the "level of a contaminant in drinking water below which there is no known or expected risk to health. MCLGs allow for a margin of safety and are non-enforceable public health goals" (EPA, 2013a). Specifically, the potential health effects from long-term exposure to asbestos above the MCLG include "increased risk of developing benign intestinal polyps" (EPA, 2013b). Based on the equation used to derive the MCLG, a person is assumed to consume 2 liters of water every day over the course of 1 year for a lifetime. However, it is unlikely that recreational users (e.g., river rafters, swimmers, or boaters) of the Salt River would ingest 2 liters of unfiltered river water per day because (1) they would be using the river seasonally and not 12 months of the year, (2) they would not be using unfiltered river water as their drinking water source, and (3) ingestion of river water would be incidental (e.g., swallowing water while swimming in the river)[11]. It is more likely that recreational visitors would ingest 0.2 liters or fewer per day. Because the MCLG is considered a safe exposure level and is based on the amount of water consumed, no adverse health effects are expected if less than 2 liters of water per day is consumed, even if the concentration of asbestos in the water is higher. For example, if water

[10] Because no data are available for surface water or sediment downstream of the site, this qualitative evaluation makes conservative assumptions to evaluate a worst-case scenario. It is standard practice to make worst-case assumptions in the absence of data. If future data become available, the conclusions of this qualitative assessment may be revised.

[11] Although the Salt River is not designated as a drinking water source, it is possible that some recreational users (e.g., river rafters) drink water from the Salt River that they filter themselves through portable filtration systems such as the Platypus Gravity Works filter system produced by Cascade Designs, Inc. These personal-use filters are typically capable of filtering particulates to 0.2 µm. The MCLG for asbestos drinking water is based on particles that are 10 µm in diameter or greater (ATSDR, 2001). Because asbestos fibers are elongate, they are further defined by their aspect ratio. Asbestos fibers are defined as having aspect ratios of between 3:1 and 5:1 (ASTDR, 2001). Thus, the minimum asbestos particle size of concern in drinking water is assumed to be 3 µm, an order of magnitude larger than the typical filtration capability (0.2 µm) of a standard backcountry water filter. Although this EE/CA does not evaluate potential risks to recreational users who choose to consume non-potable water from the Salt River, it is assumed that any such users would use a portable filtration device that would eliminate asbestos fibers larger than 0.2 µm, thereby eliminating potential exposure to harmful asbestos fibers (fibers that fall within the range identified by EPA in developing the MCLG).

consumption was 0.2 liters per day rather than 2 liters per day, a human receptor would be able to consume water with a concentration of 70 MFL with no significant adverse health effects (i.e., a risk corresponding to 1×10^{-6}). Based on the concentrations of asbestos present at the site and the distance from the site to the Salt River, it is very unlikely that the site is contributing asbestos to the Salt River at concentrations in excess of 70 MFL.

For sediment, the possibility exists that asbestos from the site could travel downstream and be deposited as beach sand along the banks of the Salt River, where recreational users (e.g., river rafters or hikers) could come into contact with it. The primary exposure route of concern at these locations would be inhalation of asbestos fibers present in beach sands. While it is not possible to quantify the amount of asbestos likely to be transported and deposited in this manner, it is very unlikely that concentrations downstream would exceed those in waste piles (source materials) present on site. It is conservative to assume that concentrations downstream equal those at the site. No detections of asbestos in activity-based air samples from the site exceeded the risk management range (see Air Pathway discussion above). Therefore, no risk from site-derived asbestos[12] is likely to be present downstream from these locations, in areas where material sourced from the piles is being redeposited.

Toxicological Information on Ingestion of Asbestos in Water

While the health hazards associated with the inhalation of asbestos have been widely publicized and are well known, a link between ingestion of asbestos in drinking water and adverse health effects has not been established. The World Health Organization (WHO) has stated that "although asbestos is a known human carcinogen by the inhalation route, available epidemiological studies do not support the hypothesis that an increased cancer risk is associated with the ingestion of asbestos in drinking water. Moreover, in extensive feeding studies in animals, asbestos has not consistently increased the incidence of tumors of the gastrointestinal tract. There is therefore no consistent, convincing evidence that ingested asbestos is hazardous to human health…" (WHO, 2003). This conclusion is consistent with conclusions from the Arizona Geological Survey that the risk from ingestion of water is negligible compared to the risk from inhalation (Arizona Geological Survey, 2003).

Review of Regional Asbestos Data

Based on the lack of available site-specific data for surface water, additional research was conducted to qualitatively evaluate the potential for asbestos to erode from waste piles to the Salt River, which is located approximately 1 mile downstream of the site. The purpose of the evaluation was to establish a range of concentrations of asbestos in regional surface water that could be used to qualitatively identify the typical concentration of asbestos in surface water downstream of the site. Based on a review of available data, concentrations of asbestos fibers in waters of the U.S. vary widely, with most areas having

[12] This does not mean no risk from asbestos inhalation exists downstream. Other sources of asbestos may contribute fibers to the Salt River and its beaches. The scope of this EE/CA does not include evaluating all potential upgradient sources of asbestos to the Salt River.

concentrations less than 1 MFL (ATSDR, 2001). However, higher concentrations have been reported at sites contaminated by erosion from natural asbestos deposits or from mining operations. At such sites, asbestos fibers in water ranged from 1 to 100 MFL or higher (ATSDR, 2001). Similar to those sites, the area of the Philips Asbestos Mine Site has higher known concentrations of asbestos that are likely to erode to surface water. The primary areas of the site where asbestos is likely to enter surface water are the Phillips Canyon Tributary and the Mill Tributary. At the Phillips Canyon Tributary, waste piles were observed to be in direct contact with the canyon floor (i.e., the surface water pathway). At the Mill Tributary, waste piles from the Lower Workings Area are eroding down the cliff face. Asbestos in water may be further transported from these tributaries downstream to the Salt River. Because the canyons draining the Phillips Canyon Workings Area are dry much of the year, it is likely that elevated asbestos concentrations in surface water only occur during the wet season (January through March) or the monsoon season (July through September), when water is more likely to flow in the canyons.

Although some asbestos-containing sediment may be transported to the canyons draining the site and eventually to the Salt River, it is not likely that human receptors in these canyons would be exposed to asbestos at concentrations that would pose a health concern, as discussed above.

Qualitative Evaluation of Risk from Ingestion of Surface Water

Asbestos fibers are insoluble and tend to settle out of water and deposit in soil or sediment (ATSDR, 2001). Longer asbestos fibers (greater than 10 µm long), which are heavy, would settle out in soil or sediment more readily and travel over shorter distances. Shorter fibers (less than 10 µm in length), which are light, would stay suspended in the water and travel over farther distances. The MCLG for asbestos is based on fibers longer than 10 µm, because shorter fibers are not linked to adverse health effects in water (ATSDR, 2001; EPA, 2013c).

Assuming a worst-case scenario, if a concentration of 100 MFL or more is released from wastes piles along the Phillips Canyon Tributary in contact with the canyon floor, the concentration is likely to be much lower at the point where the tributary converges with the Salt River (about 1 mile downstream). Asbestos concentrations would be even lower once they reach the nearest surface water intake (i.e., Lake Roosevelt Reservoir, approximately 50 miles downstream), which is where the MCGL would be an appropriate benchmark. In addition, any asbestos still suspended in water by the time it reaches the drinking water intake would be highly diluted by other sources of water contributing to the Salt River and the Lake Roosevelt Reservoir. For these reasons, as well as the conclusion that recreational users would ingest less than 0.2 liters of unfiltered river water per day, it is unlikely for asbestos from the site to be present in excess of 70 MFL in downstream surface water. The results of this qualitative assessment, based on worst-case assumptions, indicate that asbestos from the site is not migrating downstream at harmful concentrations either in water or in sediment (beach deposits).

4.3.1.2. Metals and TPH

Because the primary human receptors at the site are recreational users (i.e., hikers and ATV riders), the following benchmarks were selected as the most appropriate to screen risk to human health from exposure to metals and TPH in soil and waste, sediment, surface water, and groundwater at the Phillips Asbestos Mine Site:

- *Primary soil and sediment screening criteria:* Arizona non-residential soil remediation levels[13]. These criteria were selected because the site is not residential.
- *Secondary soil and sediment screening criteria:* Bureau of Land Management (BLM) risk management criteria (RMC) for campers and ATV riders (BLM, 2004). These criteria were selected because the site is used for recreational purposes. BLM RMC are not available for hikers, and the camper RMC is the most conservative (i.e., protective) nonresidential criteria. ATV riders are included because they are known to use the area.
- *Primary surface and groundwater screening criteria:* EPA Region 9 regional screening levels for tap water (EPA, 2012b). These criteria were selected because no Arizona specific criteria have been developed.
- *Secondary surface and groundwater screening criteria:* BLM RMC for surface water and groundwater for campers and workers (BLM, 2004). These criteria were selected because the site is used for recreational purposes. BLM RMC are not available for hikers, and the camper RMC is the most conservative (i.e., protective) nonresidential criteria. Screening criteria for workers was included as an additional point of comparison for risk screening.

As a conservative approach, the lowest available screening criteria were used to screen risk to human health. When a chemical concentration exceeded the lowest screening criterion, then it was identified as a COC. Based on the SRE results, metals (except for magnesium and manganese) and TPH were less than their respective screening criteria, thus they were not identified as site COCs. Magnesium does not have any published risk-based criteria because it is considered an essential nutrient.

Manganese concentrations in groundwater exceeded the BLM RMC but were less than the EPA's RSL for tap water, thus manganese is not considered a COC. Manganese concentrations in surface water from Subarea 2 exceeded the BLM RMC and EPA's RSL for tap water in the unfiltered surface water sample collected from Subarea 2. The filtered sample did not contain elevated concentrations of manganese. It is likely that manganese detected in surface water at this location is sorbed to particulates present in the unfiltered sample. Because humans are unlikely to ingest unfiltered water at this location, manganese is not considered a COC. Tables 5, 6, and 7 present the results of the screening evaluation for risk to human health from exposure to metals and TPH in soil and waste, sediment, and surface water and groundwater.

[13] http://www.azsos.gov/public_services/Title_18/18-07.htm

4.3.2. Ecological Receptors

Asbestos screening criteria for ecological receptors have not yet been developed; therefore, a SRE was not performed for exposure of ecological receptors to asbestos. Based on the ecological receptors (birds, invertebrates, reptiles, and mammals) identified in the SCEM, the following screening criteria were selected as the most appropriate to screen risk to ecological receptors from metals and TPH at the Phillips Asbestos Mine Site:

- BLM RMC for protection of wildlife (specifically the deer mouse and median wildlife) (BLM, 2004)
- EPA's ecological soil screening levels for invertebrates, birds, and mammals (EPA, 2012a)

The lowest available ecological screening criteria were used for screening purposes. Based on the SRE results, metals (except for copper) and TPH concentrations were less than their respective screening benchmarks in soil or waste material, sediment, surface water, or groundwater (Tables 5, 6 and 7). Copper was detected in one unfiltered surface water sample at a concentration exceeding the EPA freshwater aquatic life exposure for chronic exposure, but not for acute exposure. The concentration of copper detected was 0.011 mg/L, while the chronic exposure benchmark is 0.009 mg/L. Based on the low magnitude of this exceedance, and the fact that wildlife are likely to use this tributary intermittently (i.e., the tributary does not provide year-round habitat to fish, birds, or mammals), copper is not considered a COC at the site.

4.3.3. Streamlined Risk Evaluation Conclusions

The following sections present the conclusions of the SRE for asbestos and metals and TPH at the Phillips Asbestos Mine Site.

4.3.3.1. Asbestos

Based on the results of the SRE, asbestos fibers in air in Subareas 2 and 3 are likely to pose unacceptable risk to human receptors. The risk to human receptors is highest in Subarea 2, where asbestos was detected in three of the five activity-based samples. In addition, asbestos was detected in soil samples in Subarea 2 at concentrations of 0.50 to 9.50 percent. It is likely that disturbing soil in these areas has the potential to release more asbestos fibers than activities in other areas of the site.

At Subarea 3, asbestos was detected in one of five activity-based air samples. Asbestos was detected in two soil samples at Subarea 3 at low concentrations of 0.25 to 0.50 percent. Three waste rock samples were collected from the largest and most accessible waste pile at Subarea 3. Asbestos was detected in all three waste rock samples at concentrations ranging from 2.25 to 13.75 percent. Samples were not collected from the three small waste rock piles in Subarea 3. These piles are not considered to be a

significant risk at the site because they are difficult to access and were not observed to be eroding into waterways.

No waste or activity-based samples were collected from Subarea 4 because most of the area was inaccessible and no waste piles were identified in the accessible portion of the AOC. Additionally, asbestos was detected at low concentrations in waste material at Subarea 5 (0.25 percent), but no activity-based samples were collected in this area because it could not be safely accessed. Because field personnel could not access these areas, it is also unlikely they would be accessible to recreational visitors. Additionally, the likelihood that asbestos fibers would be released to the air in either of these areas is very low. As presented in Section 4.3.1.1, asbestos in these areas is not likely to be transported via the surface water pathway at concentrations that would pose a threat to recreational visitors using the Salt River or negatively affect drinking water supplies at Lake Roosevelt (50 miles downstream).

Although no asbestos was detected in air samples at Subarea 1, low concentrations of asbestos were found in soil. The absence of measurable concentrations of asbestos in air could indicate that no risk is associated with this AOC. However, risk may still be associated with this area because there is no reliable way to fully assess the direct exposure risk where low concentrations of asbestos are found in soil. In addition, asbestos has been identified in buildings at Subarea 1 that pose risk to site visitors. Subarea 1 is also one of the most accessible areas of the site, which may increase the risk of exposure to asbestos.

Based on the results of the SRE, an unacceptable risk is posed to humans in Subareas 1, 2, and 3. Therefore, these areas are retained in this EE/CA for evaluation of removal action alternatives. Subareas 4 and 5 are eliminated from analysis for removal action alternatives because risk to human health in these AOCs is minimal, while the cost to access and remove the waste materials in these areas and danger caused by the steep cliff sides are high (Section 4.3.1.1).

4.3.3.2. Metals and TPH

The SRE concluded that metals and TPH in soil and waste material, sediment, and surface water and groundwater at the Phillips Asbestos Mine Site do not pose an unacceptable risk to human and ecological receptors. Sediment samples downstream from the site could not be collected because of the steep terrain, so the risk to human and ecological receptors in downstream sediments could not be evaluated. However, given the terrain and the lack of access, it is not likely that human and ecological receptors would be directly exposed to sediment or surface water immediately downstream of the site. No action is required to address metals and TPH in soil and waste material, sediment, and surface water and groundwater.

Section 5. Identification of Removal Action Goals and Objectives

The purpose of this EE/CA is to develop and analyze removal action alternatives in accordance with CERCLA and to recommend a removal action alternative that is protective of human health and the environment and compliant with ARARs. The removal action alternative will be selected in an Action Memorandum, which is to be prepared by the lead federal agency (i.e., the Forest Service). The following sections describe the removal action goals and RAOs for the Phillips Asbestos Mine Site, as well as the removal action schedule. The goals for the site may be altered following the submittal of this EE/CA, if additional information becomes available from stakeholders or other interested parties that requires reevaluation of the RAOs. As such, the final removal action goals and RAOs will reflect the alterations and refinements, if any, and will be defined in the Action Memorandum.

5.1. REMOVAL ACTION GOALS AND OBJECTIVES

Based on the results of the SRE, the overall goal of the removal action is to minimize risks posed to human health from asbestos in soil, waste material, and building materials at the Phillips Asbestos Mine Site. In addition, open adits identified at the site pose a risk to site visitors. The following preliminary RAOs were developed to reduce the risks to human receptors at the site:

- Reduce exposure of humans to asbestos fibers released from soil, waste material, and building materials at Subareas 1, 2, and 3.
- Reduce the exposure of humans to physical hazards and asbestos at former site features such as open adits.

These objectives will be achieved through attainment of the ARAR-based and risk-based goals. The NTCRA in this EE/CA would cleanup asbestos to a level that is protective of human health based on the nonresidential and recreational use of the site. The primary source materials (i.e., soil, waste material, and building materials) contain the highest concentrations of asbestos at the site. Therefore, the scope of the removal action focuses on the removal of primary source materials.

5.2. CLEANUP ACTION LEVELS

Based on results of the SRE, asbestos in waste material, soil, and building materials pose a potential risk to human receptors at Subareas 1, 2, and 3. Asbestos was detected at other areas of the site in soil but was not detected in activity-based air samples. Regulatory standards and risk-based screening concentrations, along with site use considerations, were used to develop the cleanup action levels. The cleanup action

levels deemed most appropriate for the site were based on reducing risks to acceptable levels for humans that could potentially use the site.

Asbestos was detected in soil samples collected from Subareas 1, 2, and 3 and ATV Route 1. However, reportable concentrations of asbestos were only detected in activity-based air samples collected within Subareas 2 and 3, which are also the only areas where asbestos in soil was detected at concentrations greater than 1 percent. The results of the risk evaluation indicate that, although asbestos may be present in soil, no significant risk is posed to potential receptors from asbestos at low concentrations (less than or equal to 1 percent). In addition, the site is an area of naturally occurring asbestos, and asbestos fibers were reported in background samples. To eliminate risk to human receptors, a cleanup level of 1 percent detected asbestos fibers in soil has been selected for use at this site. The only asbestos detected in the background area was in background sample PA-AM-BG-02 at a concentration below the detection limit (of less than 0.0175 str/cc). This value was selected as a concentration that reflects site background conditions and was deemed appropriate for use as the cleanup action level for air.

No cleanup action levels for ecological receptors have been selected because insufficient data exist to evaluate at what concentrations ecological communities may be exposed to asbestos or how asbestos may affect ecological receptors. However, compliance with the cleanup action levels for human health (less than 1 percent asbestos in soil and less than 0.0175 str/cc in air) is considered sufficient for protection of ecological receptors.

5.3. REMOVAL SCHEDULE

The Forest Service has determined that an NTCRA is appropriate at the site. The NTCRA process could begin within 3 months following approval of this EE/CA. Based on past experience with implementation of removal actions similar to those proposed in this EE/CA and the volume of material to be removed, it is estimated that the removal action will require up to approximately 5 months to implement. Actual duration of the removal action will depend on the final project requirements and scope of work.

Section 6. Applicable or Relevant and Appropriate Requirements

Section 300.415(j) of the NCP provides that removal actions must attain ARARs to the extent practical, considering the exigencies of the situation.

Applicable requirements are those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that specifically address the situation at a CERCLA site. The requirement is applicable if the jurisdictional prerequisites of the law or regulation directly address the circumstances at the site. An applicable federal requirement is considered an ARAR. An applicable state requirement is an ARAR only if it is more stringent than federal ARARs.

If the requirement is not legally applicable, then the requirement is evaluated to determine whether it is relevant and appropriate. Relevant and appropriate requirements are those cleanup criteria or limitations promulgated under federal or state law that, while not applicable, address problems or situations similar to the circumstances of the proposed removal action and are well suited to the conditions of the site (EPA, 1988). A requirement must be determined to be both relevant and appropriate to be considered an ARAR.

To qualify as a state ARAR under CERCLA and the NCP, a state requirement must be a promulgated law, substantive, consistently applied, and more stringent than a federal requirement. Provisions of generally relevant federal and state statutes and regulations that were determined to be procedural or non-environmental, including permit requirements, are not considered to be ARARs. Non-promulgated advisories or guidance issued by federal or state governments are not legally binding and do not have the status of ARARs. However, such requirements may be useful and are "to be considered" (TBC) for guiding decisions regarding cleanup levels or methods when regulatory standards are not available.

EPA has developed the following three categories of ARARs to assist in the identification of site requirements: (1) chemical-specific, (2) location-specific, (3) and action-specific. EPA guidance recognizes that some requirements do not fall neatly into this classification; however, the following definitions provide a general guideline for each of these categories:

- Chemical-Specific ARARs are usually health- or risk-based numerical values or methodologies that, when applied to site-specific conditions, result in the establishment of numeric values (i.e., cleanup levels). These values establish the acceptable amount or concentration of a chemical that may be found in or discharged to the ambient environment.
- Location-Specific ARARs are restrictions placed on the concentration of hazardous substances or the conduct of activities solely because they occur in special locations. Location-specific ARARs relate to the geographical or physical position of the site (e.g., presence of wetlands, sensitive species, floodplains, etc.).
- Action-Specific ARARs are activity-based requirements or limitations on actions taken with respect to hazardous substances.

The federal and state ARARs that are presented in this document are considered to be preliminary. Other federal and state advisories, criteria, or guidance may, as appropriate, be considered in formulating the removal action. Tables 9 through 12 summarize the preliminary potential ARARs for this project.

Section 7. Identification and Analysis of Removal Action Alternatives

To identify removal action alternatives for the Phillips Asbestos Mine Site, potential response actions were selected based on the RAOs, ARARs, and EPA guidance (EPA, 1993). The technologies and process options specific to the response actions are screened, and the retained technologies and process options of each general response action are assembled into removal action alternatives. The selected removal action alternatives are then evaluated with respect to their effectiveness, implementability, and cost.

Based on the guidelines presented in the "Guidance on Conducting Non-Time-Critical Removal Actions Under CERCLA" (EPA, 1993), only the most qualified technologies that apply to the media or source of contamination should be discussed in the EE/CA. Limiting the number of alternatives to those that have been selected in the past at similar sites or for similar contaminants provides an immediate focus to the discussion and selection of alternatives.

The remainder of this section summarizes the general response actions, presents the evaluation criteria, identifies the removal action alternatives, and summarizes the analysis of alternatives with respect to the evaluation criteria.

7.1. GENERAL RESPONSE ACTIONS

General response actions applicable to the site were identified based on a review of the alternatives used at similar mine sites. Preliminary response actions considered, included no action, institutional controls, in-situ treatment, engineering controls, and offsite disposal. Of these response actions, in-situ treatment was not considered a viable response action because no published studies were found where large-scale asbestos contamination had successfully been treated on site. Several published studies documented some success at binding asbestos through small-batch in-drum-mixing using binders (e.g., Environment Agency, 2004) or through biologic treatment (or "bioweathering") using a fungi or lichen to enhance asbestos breakdown (Daghino et al., 2008; Daghino et al., 2009), although the latter were laboratory-scale studies only. The in-drum-mixing approach was not considered for this site because large quantities of asbestos would need to be batched and treated. The biological treatments were also not deemed appropriate because (1) additional study (e.g., treatability studies) would be required to determine whether organisms that were studied in the laboratory could be used at full-scale; (2) the fungi and lichen that have been shown to break down asbestos at the laboratory-scale are not native to the region of the site, thus

these biological treatments would need to be carefully contained and controlled throughout the duration of treatment; and (3) the likely duration needed to treat the volume of asbestos present on site in containers is considered excessive (tens of years).

As a result four general response actions were considered for this EE/CA:

1. No Action
2. Institutional Controls
3. Engineering Controls
4. Offsite Disposal of Source Materials

The no-action category is retained throughout the evaluation process as required by the NCP to provide a baseline for comparison with other alternatives. Table 13 summarizes the screening of technologies and processes associated with the general response actions. The removal action alternatives were identified based on the general response actions and are discussed in Section 7.3.

7.2. REMOVAL ACTION ALTERNATIVES EVALUATION CRITERIA

The analysis of removal action alternatives is qualitative in nature and is based on the following three evaluation criteria, as recommended by EPA (1993): effectiveness, implementability, and relative cost. The following subsections summarize each criterion.

7.2.1. Effectiveness

Alternatives are evaluated for effectiveness based on the following criteria:

- Overall Protection of Human Health and the Environment: This criterion assesses the ability of the alternative to be protective of human health and the environment under present and future land use conditions.
- Compliance with ARARs: Identifies whether or not implementation of the alternative would comply with all chemical-specific, action-specific, and location-specific ARARs.
- Long-Term Effectiveness: This criterion addresses the magnitude of residual risk remaining at the conclusion of removal activities. It addresses the adequacy and reliability of controls established by a removal action alternative to maintain reliable protection of human health and the environment over time.
- Reduction of Toxicity, Mobility, or Volume through Treatment: Identifies whether or not implementation of the alternative would reduce contaminant toxicity (e.g., reduction of metals), mobility, or actual volume of the hazardous substances.
- Short-Term Effectiveness: This criterion addresses the effects of an alternative during the construction and implementation phase until the RAOs are met. This criterion includes the time with which the remedy achieves protectiveness and the potential to create adverse impacts on human health and the environment during construction and implementation of the remedy.

7.2.2. Implementability

Alternatives are evaluated for implementability based on the following criteria:

- Technical Feasibility: Evaluates constructability and operational considerations, as well as demonstrated performance/useful life.
- Administrative Feasibility: Evaluates those activities such as statutory limits, permitting requirements, easements and rights of way, and impacts on adjoining property
- Availability of Services and Materials: Evaluates the availability of qualified contractors to provide the necessary services, materials, and equipment (with the preferred technologies being those that are commercially developed and readily available, or innovative technologies that have been field-tested with documented results). Also evaluates the availability of disposal facilities that are licensed to accept solid and liquid waste classified as hazardous and nonhazardous.
- State Acceptance: The concurrence of the State of Arizona with the proposed alternatives.
- Community Acceptance: The acceptance of the proposed alternatives by the community.

7.2.3. Cost

Technologies were evaluated based on qualitative costs. Alternatives with lower costs were preferred if the effectiveness and implementability criteria were judged to be similar. Cost estimates were prepared to aid in the evaluation of alternatives using information that is currently available. These costs are order-of-magnitude estimates with an intended accuracy of +50 to -30 percent (EPA, 2000b). These costs are not construction bid costs, nor are they final project costs. Final project costs will depend on actual labor and material costs, actual engineering design costs, actual site conditions (including the actual quantities of mine waste excavated and the amount of material that may be classified as hazardous waste), competitive market conditions, the final project scope, the final project schedule, and other variables. As a result, the final project costs will vary from these estimates.

7.3. ANALYSIS OF REMOVAL ACTION ALTERNATIVES

The following removal action alternatives were developed for the Phillips Asbestos Mine Site based on the screening of technologies and process options described in Section 7.1:

- Alternative 1: No action (required under CERCLA).
- Alternative 2: Institutional and Engineering Controls
- Alternative 3A: Excavation and Onsite Encapsulation of Source Materials from Subareas 1, 2, and 3
- Alternative 3B: Excavation and Onsite Encapsulation of Source Materials from Subarea 1 and Subarea 3, and Consolidation of Soil and Waste Materials and Cap in Place at Subarea 2
- Alternative 4: Excavation and Offsite Disposal of Source Materials from Subareas 1, 2, and 3

Each alternative was analyzed for its capability to reduce the risks detailed in Section 4. Specifically, the alternatives are analyzed for effectiveness, implementability, and cost. Following the individual analysis of alternatives, each removal action alternative was compared against the others (Section 8) to select the recommended removal action (Section 9).

7.3.1. Alternative 1: No Action

Under Alternative 1, no removal action would be taken at the site under current or future land use scenarios. As such, the human health risks relating to the site would remain unchanged. The no-action alternative is evaluated as required by the NCP to provide a baseline for comparison with other alternatives.

7.3.1.1. Effectiveness

Alternative 1 would not provide short-term or long-term protection of public health. This alternative would not comply with ARARs. The time required to achieve the RAOs is indefinite, and risks to current and future receptors would remain indefinitely. The toxicity, mobility, and volume of contamination at the site would not be reduced through treatment and potential receptor exposure pathways would remain for current and future receptors

7.3.1.2. Implementability

Alternative 1 would be readily technically and administratively feasible, and no services or materials are needed for implementation

7.3.1.3. Cost

No costs are associated with this alternative.

7.3.2. Alternative 2: Institutional and Engineering Controls

Under Alternative 2, no direct removal action would be taken at the site. Institutional controls consisting of road closures and signage would be used to discourage recreational users from accessing the site. Engineering controls such as fences and roadblocks to prevent access to hazardous areas would be constructed.

The road connecting Subarea 3 to Subarea 2 (FR 2298), which passes through Subarea 1, would be blocked or obliterated using onsite materials. Because no asbestos contamination was detected on the road, except where it passes through Subareas 1, 2, and 3, only sections of the road that access or cross those areas would be blocked. The section of road immediately to the west of Subarea 2 is in severe disrepair and would be fully obliterated by regrading the roadbed to blend with the natural topography and placing boulders across the remaining portions of the road. Similarly, the section of road that allows

access to Subarea 3 would be returned to a natural hillslope at a point downslope from all adits and mine waste.

Unlike the other AOCs, Subarea 1 is in a flat area and access to this area is much more difficult to restrict through physical means. This area, which did not have unacceptable levels of airborne asbestos and asbestos in soil, would be controlled by closing the road through the Mine Camp with gates at either end of the camp and installing fencing around the entire area. Camp structures would be secured from entry by boarding up doorways and windows to prevent unauthorized entry. Signs illustrating the dangers of entry to the site and to site buildings would be placed at access points to this AOC. Annual inspections would be required to ensure that all closures and signage are in place.

All adits that may be accessed on foot would be secured, either with a foam plug closure or an appropriate bat-friendly closure. Bat surveys should be conducted prior to adit closures to evaluate whether the adits currently serve as bat habitat and ensure appropriate bat-friendly closure methods are employed.

7.3.2.1. Effectiveness

Institutional and engineering controls would provide overall protection to humans if the controls are sufficiently maintained to ensure site visitors do not disturb asbestos-containing materials. However, waste material would remain on site and could be accessed by people climbing over fences and bypassing road closures. Exposure to visitors would not be reduced if site closure measures are breached. This alternative would comply with all chemical-, location-and action-specific ARARs but would not comply with the following TBC criterion: "Framework for Evaluating Asbestos Contaminated CERCLA Sites" (EPA, 2008). The toxicity, mobility, or volume of contamination at site would not be reduced through treatment. Risks to current and future receptors would not be reduced to levels considered protective of human health. This alternative is not considered to be reliable based on accepted industry standards for similar projects. This alternative would not meet the RAO for effectively reducing the exposure of humans to asbestos-containing materials at the site.

Long-term risks to current and future receptors related to asbestos at the site would not be minimized because waste would remain in place. Long-term periodic inspection and maintenance of the site closure measures would be required to ensure the long-term integrity of the closures. Removal activities associated with this alternative are not anticipated to have severe or lasting harmful effects on the sensitive species at and downstream of the site. Institutional and engineering controls would not be a durable or long-term solution, exposed waste materials would remain on site, and it is likely that site visitors would breach the closure measures.

Construction activities (such as road closures and fence installation) would be implemented using best management practices (BMPs) such that short-term impacts to humans (including site construction workers) and the environment would be minimized. Worker protection would be provided during

implementation of the remedy through strict adherence to a site-specific safety and health plan. An exclusion zone, a decontamination zone, and a staging zone would be established at the site to reduce potential migration of contamination to adjacent areas. The exclusion zone would encompass the contaminated areas, and any persons entering this zone would be required to don the appropriate personal protective equipment (PPE). The decontamination zone would be used to remove contamination from equipment and PPE before it is cleared to leave the exclusion zone. The staging zone is where decontaminated equipment would be stored when not in use in the exclusion zone.

To meet action-specific ARARs, dust generation would be suppressed by applying water and performing real-time dust monitoring. Airborne asbestos is a potential hazard to human health at the site and strict controls must be implemented to ensure worker safety during construction. Real-time dust monitoring instrumentation would detect particulate concentrations greater than applicable dust action levels. Respiratory protection would be required for all site workers; however, use of water trucks is generally highly effective and may eliminate the need to use respiratory protection. Air monitoring to establish daily airborne asbestos levels for various work types may be conducted to establish the effectiveness of dust suppression techniques and down grade the level of respiratory protection if warranted. Airborne dust monitoring would be completed using portable hand-held dust monitors to verify and document daily dust-suppression efforts. These dust control methods would also reduce the migration of dust onto adjacent properties.

7.3.2.2. Implementability

This alternative would be technically feasible and services and materials are readily available in the vicinity of the site. This alternative could be implemented in a way that would minimize environmental impacts and could be performed within one construction season. The site access road is in fair condition and would likely not require major reconditioning to allow the small-scale equipment required to implement the site closure measures identified for Alternative 2. The services, equipment, and materials to implement this alternative are common and would be readily available in the site vicinity within the community of Globe, Arizona. This alternative would also be administratively feasible. Access agreements to cross the adjacent private property may be required, but based on the small scale of the removal action, a minimum of equipment and supplies would need to be transported to the site. Other permits, access agreements, and easements are either not required or would be granted by the Forest Service, which is both the property owner and is acting as the lead agency in this removal action. A Work Plan, with an associated site-specific health and safety plan, would be required prior to the start of work. No impacts to adjacent property are anticipated for this action.

It is unlikely this alternative would be acceptable to the state and the community because it would limit recreational use of a popular recreational area. In addition, it may not meet the RAOs, if site control measures are breached and site visitors are exposed to asbestos.

7.3.2.3. Cost

The estimated total capital cost for implementing this alternative is $797,852. The long-term total cost for implementing this alternative is $1,222,052, with a present value cost of $1,110,932. Appendix D provides the detailed cost estimate. The following major assumptions were used in developing the cost for Alternative 2:

- Site personnel would consist of a site superintendent, a site quality control (QC) engineer who would also provide health and safety oversight, and up to two operators and one laborer.
- A bulldozer, tracked skidsteer with grapple bucket, and backhoe would be required to disturb roads to block access, install road closure gates, and install perimeter fencing and signage. Other necessary equipment would include a water truck and hand tools.
- Four road closure gates would be installed
- Five post-mounted signs would be installed
- A total of 2,500 feet of fence would be installed around Subarea 1
- A total of 16 accessible adits would be secured (8 adits would be sealed, and 8 adits would be secured with appropriate bat-friendly closures). Bat surveys would be conducted for each adit to evaluate whether the adits currently serve as bat habitat and ensure appropriate bat-friendly closure methods are employed.
- The estimated duration of field activities is 40 days.
- Biannual inspections of site closure features would be conducted.

7.3.3. Alternative 3A: Excavation and Onsite Encapsulation of Source Materials from Subareas 1, 2, and 3

Alternative 3A includes removal and relocation of primary source materials (i.e., soil, waste materials, and building materials) and site debris from Subareas 1, 2, and 3 to a designated onsite repository located in a flat area west of Subarea 3, between roads FR 382, FR 2290, and FR 473. Approximately 11,500 cubic yards of primary source material and site debris would be relocated. A soil cap would be placed to encapsulate the materials to reduce future exposure of humans or wildlife to asbestos in soil and airborne asbestos. Figure 12 shows the proposed repository area in blue.

In Subarea 1, up to 3 feet of soil would be removed from areas that have been identified as containing contaminated asbestos waste (Figure 3), for a total of approximately 600 cubic yards. The soil would be hauled to the repository for encapsulation. Approximately 200 cubic yards of asbestos-containing building materials would be removed from structures and hauled to the repository. In total, 800 cubic yards of source materials would be relocated from Subarea 1 for encapsulation. Concrete foundations would remain in place. Archaeological surveys would be required prior to site work, and archaeological oversight would be required during implementation of the removal action to ensure the protection of any archaeological resources identified at the site.

In Subarea 2, up to 3 feet of soil would be removed from areas that have been identified as containing contaminated asbestos waste (Figure 4), for a total of approximately 5,600 cubic yards. Archaeological surveys would be required prior to site work, and archaeological oversight would be required during implementation of the removal action to ensure the protection of any archaeological resources identified at the site. The soil would be hauled to the repository for encapsulation. Approximately 100 cubic yards of asbestos-containing building materials would be removed from the former mill building and hauled to the repository. In total, 5,700 cubic yards of source materials would be relocated for encapsulation. Concrete foundations would remain in place.

In Subarea 3, approximately 5,000 cubic yards of waste material would be removed and hauled to the repository for encapsulation.

All source materials would be removed using an excavator. Material would be loaded into off-road dump trucks and transported to the repository location. Repairs to the access road (FR 2290) would be required to ensure that the waste piles at Subareas 2 and 3 could be accessed. Road repairs would be completed using an excavator and a bulldozer.

A repository would be constructed at an appropriate location as determined in consultation with the Forest Service (Figure 12 shows one possible location for the repository). An excavator would be used to excavate a repository that could receive up to 12,000 cubic yards of source materials. Because asbestos is nonsoluble and nonleachable, no lining, drainage, or leachate collection system would be required for the repository. A brightly colored fabric demarcation layer would be placed between the top of the waste and the bottom of the clean cover material to mark the depth of the cap and discourage future site workers from exposing the waste material during maintenance activities. The clean soil removed during excavation of the repository would be stockpiled and used as backfill for road repairs (up to approximately 12,000 cubic yards) and clean cover material for the repository cap (approximately 2,000 cubic yards). The soil cap would consist of at least 2 feet of clean onsite native soil and would be graded to closely match natural topography

Minimal backfilling of the excavated areas would be required to restore, to the degree practicable, the natural contours of the areas where material has been removed. Restoration would be completed using an excavator and a bulldozer. Backfilled material would be compacted with an excavator and covered with biodegradable erosion control mat. Roads that are improved to facilitate the removal of waste material would be scarified, water-barred, and seeded after the removal action is completed.

This alternative would require a final engineering study and design to establish site requirements for the onsite repository and to ensure appropriate requirements are met in terms of waste placement and capping. The selection of the exact repository site would consider current drainage patterns, and the effect of construction activities on drainage patterns at the site would be evaluated. Engineering controls

such as grading, drainage ditches, and culverts would be used where needed to divert water away from the repository and ensure that the repository is not impacted by drainage across the site.

Future institutional controls may be required to accompany the engineering control design, such as placing signs, natural barriers, or fencing around the onsite repository to reduce the potential for erosion of the cap by site visitors until permanent vegetation is established. In addition, annual inspections and site operations and maintenance (O&M) of the cap would be conducted in the long-term.

All adits that could be accessed on foot would be secured, either with a foam plug closure or an appropriate bat-friendly closure. Bat surveys would be conducted for each adit, prior to closure, to evaluate whether the adits currently serve as bat habitat and ensure appropriate bat-friendly closure methods are employed.

7.3.3.1. Effectiveness

Onsite encapsulation of excavated materials would provide overall protection of humans and the environment. Source materials would be encapsulated such that exposure of humans to asbestos would be reduced. This alternative would comply with all chemical-, location-, and action-specific ARARs and TBC criteria. However, detailed planning, as described below, is needed to comply with location-specific and action-specific ARARs. The toxicity, mobility, or volume of contamination at site would not be reduced through treatment. Risks to current and future receptors would be reduced by removing asbestos to levels considered protective of human health. This alternative would be reliable based on accepted industry standards for similar projects.

Long-term risks to current and future receptors related to asbestos at the site would be minimized by encapsulating waste and covering it with a 2-foot-thick soil cap. The finished surface would be smooth, compacted, and free from irregular surface changes. The final grades would provide positive drainage of surface water to minimize erosion. Long-term periodic inspection and maintenance of the soil cap would be required to ensure the long-term integrity of the cap (i.e., to ensure that it is not compromised by natural erosion or human activities) to provide long-term protection of human health. Removal activities associated with this alternative are not anticipated to have severe or lasting harmful effects on the sensitive species at and downstream of the site. While a soil cover is considered a durable and long-term solution, waste materials would remain on site and the risk of a breach of the soil cover would still exist.

Measures would be implemented to minimize the short-term impacts to waterways at the site. Construction activities would be implemented using BMPs such that short-term impacts to humans (including site construction workers) and the environment would be minimized. Worker protection would be provided during implementation of the remedy through strict adherence to a site-specific safety and health plan. An exclusion zone, a decontamination zone, and a staging zone would be established at the site to reduce potential migration of contamination to adjacent areas. The exclusion zone would encompass the

contaminated areas, and any persons entering this zone would be required to don the appropriate PPE. The decontamination zone would be used to remove contamination from equipment and PPE before it is cleared to leave the exclusion zone. The staging zone is where decontaminated equipment would be stored when not in use in the exclusion zone.

To meet action-specific ARARs, dust generation would be suppressed by applying water and performing real-time dust monitoring. Airborne asbestos is a potential hazard to human health at the site and strict controls must be implemented to ensure worker safety during construction. Real-time dust monitoring instrumentation would detect particulate concentrations greater than applicable dust action levels. Respiratory protection would be required for all site workers; however, use of water trucks is generally highly effective and may eliminate the need to use respiratory protection. Air monitoring to establish daily airborne asbestos levels for various work types may be conducted to establish the effectiveness of dust suppression techniques and down grade the level of respiratory protection if warranted. Airborne dust monitoring would be completed using portable hand-held dust monitors to verify and document daily dust-suppression efforts. These dust control methods would also reduce the migration of dust onto otherwise undisturbed areas.

7.3.3.2. Implementability

This alternative would be technically feasible, and services and materials are readily available in the vicinity of the site. Excavation and onsite encapsulation is a proven method for removing the exposure pathway to site receptors and reducing the risk posed to human health and the environment. This alternative could be implemented in a way that would minimize environmental impacts and could be performed within one construction season. Some road repairs would be required to allow heavy equipment transported to the site and for import materials to be transported across the site. The services, equipment, and materials to implement this alternative are common and readily available in the site vicinity from the community of Globe, Arizona. This alternative would also be administratively feasible. Access agreements to cross the adjacent tribal lands may be required, but neither waste material nor backfill material would need to be transported on this section of road so the use of the road would be minimal, except for mobilization and demobilization of earthmoving equipment, water trucks, and passenger vehicles; if needed, this section of road would be repaired prior to completion of the NTCRA. Other permits, access agreements, and easements are either not required or would be granted by the Forest Service, which is both the property owner and is acting as the lead agency in this removal action. A Remedial Design and a Work Plan, with an associated sampling and analysis plan and site-specific health and safety plan, would be required prior to the start of work. No impacts to adjacent property are anticipated for this action.

Because mine waste is exempt from waste disposal criteria provided in the Resource Conservation and Recovery Act while it is located within a mining area [Title 40 Code of Federal Regulations (CFR) Section (§) 261.4(b)(7)], onsite encapsulation of waste materials would not be regulated under hazardous

waste disposal and landfill regulations. However, other federal or state requirements regarding appropriate siting, construction, and long-term inspection and maintenance may apply [e.g., regulations for corrective action management units at Title 40 CFR Part 264, Subpart S, and § 264.552(c)].

The open area west of Subarea 1 would be a suitable location for a repository, with enough capacity to accept the estimated volume of waste material (11,500 cubic yards; Figure 12). This location is relatively open with gradual slopes, virtually no vegetation, and includes approximately 1.5 acres.

This alternative would likely be acceptable to the state and the community because it would meet the RAOs, would improve the site for recreational use, and would require minimal long-term maintenance.

The final decision regarding the location for the encapsulation unit would be made during the design phase of the project; however, it is unlikely that another location within the site would be as suitable for consolidating all removed materials.

7.3.3.3. Cost

The estimated total capital cost for implementing this alternative is $1,289,593. The long-term total cost for implementing this alternative is $2,002,393, with a present value cost of $1,896,628. Appendix D provides the detailed cost estimate. The following major assumptions were used in developing the cost for Alternative 3A:

- Site personnel would consist of a site superintendent, a site QC engineer who would also provide health and safety oversight, and up to three operators, two laborers, and three truck drivers.
- An excavator, bulldozer, and backhoe would be required to grade roads, excavate, and build the repository. Other necessary equipment would include a water truck and hand tools.
- The estimated quantity of waste material to be encapsulated in the repository is 11,500 cubic yards. The repository would have a surface area of approximately 27,000 square feet and depth of 14 feet, including 2 feet of clean cover. Material excavated while constructing the repository would be stockpiled and used as clean cover for the repository site (2,000 cubic yards) and borrow materials for roadwork and restoration (12,000 cubic yards).
- Loading and hauling of waste to the repository would be done with a tracked loader and 20-cubic yard dump trucks. The steepness of the slopes at Subarea 3 was used to estimate costs and rates. Estimated quantities of waste loaded and hauled are 800 cubic yards from Subarea 1 (600 cubic yards of soil and waste and 200 cubic yards of asbestos-containing building materials), 5,700 cubic yards from Subarea 2 (5,600 cubic yards of soil and waste and 100 cubic yards of asbestos-containing building materials), and 5,000 cubic yards of waste from Subarea 3.
- No liner is necessary for encapsulation, but demarcation fabric would be placed between the top of the waste and the bottom of the clean cover. A bulldozer and vibrating roller would be used to place and compact clean cover.

- Disturbed waste removal areas (approximately 24,000 square feet) would be restored to natural grade, seeded with native plants, and covered with erosion control blankets where effective.
- The soil cover (approximately 27,000 square feet) would be seeded with native plants and covered with erosion control blankets where effective.
- A total of 16 accessible adits would be secured (8 adits would be sealed, and 8 adits would be secured with appropriate bat-friendly closures). Bat surveys would be conducted for each adit, prior to closure, to evaluate whether the adits currently serve as bat habitat and ensure appropriate bat-friendly closure methods are employed.
- Archaeological surveys would be required prior to the start of site work. Archaeological oversight would be required during site work to ensure the protection of any archaeological resources identified.
- The estimated duration of field activities is 70 days.
- Regular inspections and site O&M of the cap would be conducted to evaluate the integrity of all cover elements and erosion control measures would be conducted.

7.3.4. Alternative 3B: Excavation and Onsite Encapsulation of Source Materials from Subarea 1 and Subarea 3, and Consolidation of Soil and Waste Materials and Cap in Place at Subarea 2

Alternative 3B includes removal and relocation of primary source materials (soil, waste material, and building material) and site debris from Subarea 1 and Subarea 3 to a designated onsite repository located in a flat area west of Subarea 3, between roads FR 382, FR 2290, and FR 473 (shown in blue on Figure 12). Soil and waste material at Subarea 2 would be consolidated and encapsulated in place with a soil cover (see area shown in green on Figure 12), and building materials would be hauled to the main repository and encapsulated. Archaeological surveys would be required prior to site work, and archaeological oversight would be required during implementation of the removal action to ensure the protection of any archaeological resources identified at the site.

The removal action at Subarea 1 and Subarea 3 would take place as outlined in Alternative 3A, with appropriate changes in the scale of the repository. The repository capacity would be approximately 6,500 cubic yards. The clean soil removed during excavation of the repository would be stockpiled and used as clean cover material for both soil covers (approximately 1,500 cubic yards for the Subarea 1 and Subarea 3 repository cap and 4,000 cubic yards for the Subarea 2 soil cover); approximately 2,000 cubic yards of material would be available for road repairs.

At Subarea 2, the primary area of contaminated soil and waste material would be capped in place (Figure 12). Small waste piles near the mill building (approximately 400 cubic yards) would also be excavated and consolidated in the primary waste area. Clean soil removed during excavation of the Subarea 1 and Subarea 3 repository would be transported to Subarea 2 and used to construct a clean soil cover. A brightly colored fabric demarcation layer would be placed between the top of the waste and the

bottom of the clean cover material to mark the depth of the cap and discourage future site workers from exposing the waste material during maintenance activities. As discussed for Alternative 3A, because asbestos is nonsoluble and nonleachable, no lining, drainage or leachate collection system would be required for the repository. Road improvements would be required to access removal areas at Subarea 2.

Site restoration and O&M activities for both caps would be conducted in the same manner as discussed for Alternative 3A.

All adits that may be accessed on foot would be secured, either with a foam plug closure or an appropriate bat-friendly closure. Bat surveys would be conducted for each adit, prior to closure, to evaluate whether the adits currently serve as bat habitat and ensure appropriate bat-friendly closure methods are employed.

7.3.4.1. Effectiveness

The effectiveness of Alternative 3B is the same as for Alternative 3A (see Section 7.3.3.1).

7.3.4.2. Implementability

For the most part, Alternative 3B has the same technical and administrative implementability as Alternative 3A (see Section 7.3.3.2). The major difference is that two repositories would be constructed. The second repository would be a cap-in-place repository at Subarea 2. Subarea 2 would be a suitable location for a cap-in-place repository because it is relatively open, mostly flat, with virtually no vegetation, and covers an area of approximately 1.5 acres. Consolidation and encapsulation in place at Subarea 2 would eliminate excavation and hauling of 5,600 cubic yards of waste material; however, clean cover soil would need to be hauled from Subareas 1, 2, and 3. Additionally, long-term inspection and maintenance would need to be performed for both repositories.

This alternative would likely be acceptable to the state and the community because it would meet the RAOs, would improve the site for recreational use, and would require minimal long-term maintenance. The final decision regarding the location of the onsite repositories would be made during the design phase of the project.

7.3.4.3. Cost

The estimated total capital cost for implementing this alternative is $1,210,465. The long-term total cost for implementing this alternative is $2,036,665, with a present value cost of $1,817,501. Appendix D provides the detailed cost estimate. The following major assumptions were used in developing the cost for this alternative:

- Site personnel would consist of a site superintendent, a site QC engineer who also provides health and safety oversight, and up to three operators, two laborers, and three truck drivers.
- An excavator, bulldozer, and backhoe would be required to grade roads and excavate and build the repositories. Other necessary equipment would include a water truck and hand tools.
- Approximately 5,800 cubic yards of waste material would be encapsulated in the repository near Subarea 3. The repository would have a surface area of approximately 20,000 square feet and depth of 10 feet, including 2 feet of clean cover. Material excavated in constructing the repository at Subarea 3 would be stockpiled and used as clean cover for the repository cap (1,500 cubic yards), the cap-in-place repository at Subarea 2 (4,000 cubic yards), and borrow materials for road work and restoration (up to 2,000 cubic yards).
- Loading and hauling of waste to the repository at Subarea 3 and of clean fill to the cap-in-place repository at Subarea 2 would be done with a tracked loader and 20-cubic yard dump trucks. The steepness of Subarea 3 was used to estimate costs and rates. Estimated quantities of waste loaded and hauled are 800 cubic yards from Subarea 1 (600 cubic yards of soil and waste and 200 cubic yards of asbestos-containing building materials) and 5,000 cubic yards from Subarea 3; 400 cubic yards would be excavated and consolidated with the approximately 5,200 cubic yards of waste to remain in place at Subarea 2. In total, 100 cubic yards of asbestos-containing building materials would be hauled from Subarea 2 to the Subarea 3 repository.
- Soil cover area at Subarea 2 is approximately 54,000 square feet. The thickness of the cap is assumed to be 2 feet.
- No liner is necessary for encapsulation, but demarcation fabric would be placed between the top of the waste and the bottom of the clean cover. A bulldozer and vibrating roller would be used to place and compact the clean cover.
- Approximately 7,200 square feet of disturbed waste removal areas would be restored to a natural grade and covered with erosion control blanket.
- The repository soil cover (approximately 20,000 square feet) and in-place soil cover (approximately 54,000 square feet) would be seeded with native plants and covered with erosion control blankets where effective.
- A total of 16 accessible adits would be secured (8 adits would be sealed, and 8 adits would be secured with appropriate bat-friendly closures). Bat surveys would be conducted for each adit, prior to closure, to evaluate whether the adits currently serve as bat habitat and ensure appropriate bat-friendly closure methods are employed.
- Archaeological surveys would be required prior to the start of site work. Archaeological oversight would be required during site work to ensure the protection of any archaeological resources identified.
- The estimated duration of field activities is 55 days.
- Regular inspections and site O&M of the cap would be conducted, and biannual inspections would be conducted to evaluate the integrity of all cover elements and erosion control measures.

7.3.5. Alternative 4: Excavation and Offsite Disposal of Source Materials from Subareas 1, 2, and 3

Alternative 4 includes removal and relocation of primary source materials (i.e., soil, waste material, and building materials) and site debris from Subareas 1, 2, and 3 to an offsite disposal facility. Approximately 11,500 cubic yards of primary source material would be disposed of off site. Archaeological surveys would be required prior to site work, and archaeological oversight would be required during implementation of the removal action to ensure the protection of any archaeological resources identified at the site. Source materials would be removed as described in Alternative 3A (Section 7.3.3). Following removal, the source materials would be placed in haul trucks and trucked to an appropriate offsite disposal facility. Where possible, source materials would be directly loaded into haul trucks; however, soil may need to be shuttled using smaller-scale trucks prior to being loaded into haul trucks for highway travel. The source materials would be hauled on FR 473 to U.S. Highway 60 and then to a disposal facility, such as Apache Junction Landfill in Apache Junction, Arizona. To support the heavy truck traffic anticipated during this removal action alternative, FR 473 would require some repairs and reinforcement. Materials for these repairs would be sourced from an onsite borrow source. Because this alternative would involve hauling source material across non-federal land, access arrangements would be required prior to implementation. Special handling procedures, including double bagging and sealing, would be implemented for source materials that are removed from the site by truck.

Site restoration would be conducted as presented in Alternative 3A. No O&M activities would be required under this alternative.

All adits that may be accessed on foot would be secured, either with a foam plug closure or an appropriate bat-friendly closure. Bat surveys would be conducted for each adit, prior to closure, to evaluate whether the adits currently serve as bat habitat and ensure appropriate bat-friendly closure methods are employed.

7.3.5.1. Effectiveness

Alternative 4 would provide the most overall protection of human health because contaminated source materials would be removed from the site, thus completely removing the long-term risk to human health. In all other respects, Alternative 4 has the same effectiveness as Alternatives 3A and 3B (see Sections 7.3.3.1 and 7.3.4.1).

7.3.5.2. Implementability

Alternative 4 would be technically feasible, and equipment and materials, except for the disposal facility, are readily available in the vicinity of the site from the community of Globe, Arizona. The closest landfill that would accept waste materials with asbestos is located in Apache Junction, Arizona, which is 95 miles away from the site. Excavation and offsite disposal is a proven method for removing the exposure pathway to site receptors and the risk posed to human health. This alternative could be implemented in a

way that would minimize environmental impacts; however, the project duration of construction may require that work be performed during two construction seasons (depending on the project schedule). Off-hauling of waste from the site is estimated to take 153 days because space at the site for loading trucks is limited and the distance to the nearest appropriately permitted disposal facility is approximately 95 miles. The daily rate for the export of waste material would also be slowed down by handling requirements for asbestos-containing material, which will impact loading rates. The site access road would require significant repairs to accommodate heavy use by large haul trucks. Because waste material would be hauled across private land between the site location and the public highway, permits, access agreements, and easements may be required. A Remedial Design and a Work Plan, with an associated sampling and analysis plan and site-specific health and safety plan, would be required prior to the start of work. Road repairs may be required on sections of road crossing adjacent tribal lands.

This alternative would likely be acceptable to the state because it would meet the RAOs, would improve the site for recreational use and would require minimal long-term maintenance; however, it may not be acceptable to the local community because large volumes of hazardous materials would be hauled across private property.

7.3.5.3. Cost

The estimated total capital cost for implementing this alternative is $13,580,792. The long-term total cost for implementing this alternative is $14,269,592, with a present value cost of $14,088,016. Appendix D provides the detailed cost estimate. The following major assumptions were used in developing the cost for Alternative 4:

- Site personnel would consist of a site superintendent, a site QC engineer who provides health and safety oversight, and up to three operators, two laborers, and three truck drivers.
- An excavator, bulldozer, and backhoe would be required to grade roads to access Subarea 1, Subarea 2, and Subarea 3. Other necessary equipment would include a water truck and hand tools.
- Loading and hauling of waste from Subareas 1, 2, and 3 would be done with a tracked loader and 20-cubic yard dump trucks. The steepness of Subarea 3 was used to estimate costs and rates. Estimated quantities of waste loaded and hauled are 800 cubic yards (600 cubic yards of soil and waste and 200 cubic yards of asbestos-containing building materials) from Subarea 1; 5,700 cubic yards from Subarea 2 (5,600 cubic yards of soil and waste and 100 cubic yards of asbestos-containing building materials); and 5,000 cubic yards of waste from Subarea 3.
- Approximately 11,500 cubic yards of waste material would be hauled, stockpiled, and loaded for transport and disposal. Waste would be treated as asbestos-containing material, and would be double wrapped in plastic and sealed shut. Waste would be exported at a rate of 10 22-ton loads per day.

- Approximately 24,000 square feet of disturbed waste removal areas would be restored to natural grade and covered with erosion control blankets.
- A total of 16 accessible adits would be secured (8 adits would be sealed, and 8 adits would be secured with appropriate bat-friendly closures). Bat surveys would be conducted for each adit, prior to closure, to evaluate whether the adits currently serve as bat habitat and ensure appropriate bat-friendly closure methods are employed.
- The estimated duration of field activities is 910 days.
- Regular inspections and site O&M of the cap would be conducted to evaluate the integrity of all cover elements and erosion control measures would be conducted.

Section 8. Comparative Analysis of Removal Action Alternatives

The removal action alternatives identified in Section 7.3 were compared with one another using the evaluation criteria presented Section 7.2. This section describes the results of the comparative evaluation; the recommended removal action is discussed in Section 9. Table 14 summarizes the ranking of each alternative compared with the evaluation criteria and in relation to one another.

8.1. EFFECTIVENESS

Alternative 1 is considered the least effective alternative to protect public health and the environment because risks to current and future receptors would remain indefinitely and the toxicity, mobility, and volume of contamination would not be reduced through either treatment or removal.

Alternative 2 is the second least effective alternative because site visitors may bypass institutional and engineering controls (such as road closures and fences) and disturb asbestos-containing materials, thus being exposed to airborne asbestos. Under Alternative 2 risks to current and future receptors would remain indefinitely and the toxicity, mobility, and volume of contamination would not be reduced through either treatment or removal. Alternative 2 does not meet the RAOs.

Alternatives 3A and 3B are considered equally effective alternatives to protect public health and the environment because risks to current and future receptors would be reduced by removal and onsite encapsulation of source materials. Alternative 4 would be the most effective alternative because source materials would be completely removed from the site, thus the risk to current and future receptors would be eliminated. Alternatives 3A, 3B, and 4 would not reduce the toxicity, mobility, and volume of contamination through treatment.

8.2. IMPLEMENTABILITY

All alternatives would be technically and administratively feasible, and the services and materials necessary to implement the alternatives are readily available. Alternative 1 is the most implementable because no administration, services, or materials are required. Alternative 2 is technically feasible but is not likely to be accepted by the community or regulatory agencies. Alternatives 3A and 3B are very implementable and could be conducted within one construction season. Alternative 4 is moderately implementable. Although it is technically and administratively feasible, the required disposal services are not readily available (i.e., nearest waste disposal facility is 95 miles from the site). Special handling is

also required for asbestos-containing waste material when transported across public roadways. Because of the remote location of the site and the distance to the nearest landfill, as well as the special handling requirements, Alternative 4 would require more time than Alternatives 2, 3A and 3B and may need to be conducted during two construction seasons.

8.3. COST

The estimated cost for Alternative 1 is $0. The estimated capital cost for Alternative 2 is $797,852, and the total cost with ongoing maintenance is $1,222,052. The estimated capital cost for Alternative 3A is $1,289,593, and the total cost with ongoing maintenance is $2,002,393. The estimated capital cost for Alternative 3B is $1,210,465, and the total cost with ongoing maintenance is $2,036,665. The estimated capital cost for Alternative 4 is $13,580,792, and the total cost with ongoing maintenance is $14,269,592. Costs for Alternatives 3A and 3B are very similar, Alternative 3A has a slightly greater capital cost, where Alternative 3B has a slightly greater long-term cost.

Section 9. Recommended Removal Action Alternative

The recommended removal action alternative for the Phillips Asbestos Mine Site is **Alternative 3B: Excavation and Onsite Encapsulation of Source Materials from Subarea 1 and Subarea 3, and Consolidation of Soil and Waste Materials and Cap in Place at Subarea 2.** Alternative 3B would meet the RAOs at the site and is preferable to Alternative 3A because the work could be conducted over a shorter time period.[14] The cost difference between Alternatives 3A and 3B is minimal. Alternative 2 is significantly less effective than Alternatives 3A, 3B, and 4 and does not meet the ROAs. The level of protection under Alternatives 3A and 3B is slightly less than afforded by Alternative 4, although all three meet the RAOs, but the cost for Alternative 4 is significantly more expensive than Alternatives 3A and 3B.

The primary components of the recommended alternative are as follows:

- Repair roads as needed to gain access to the site areas.
- Remove approximately 800 cubic yards of primary source materials from Subarea 1 and 5,000 cubic yards of source materials from Subarea 3. Waste materials would be loaded into dump trucks, transported to an unlined onsite repository, and covered with 2 feet of clean soil sourced from the repository excavation at Subarea 3.
- Waste at Subarea 2 would be capped in place with 2 feet of clean cover soil sourced from the excavation of the Subarea 3 repository.
- Shape and regrade excavated areas to match natural contours and restore the site to pre-mining conditions to the extent practicable.
- Restore excavated and regraded areas.
- Secure the openings of 16 adits.

The estimated capital cost of the recommended removal action alternative is $1,210,465. As discussed in Section 8.3, this cost represents an order-of-magnitude estimate with an intended accuracy of +50 to -30 percent (EPA, 2000b). Final project costs will depend on actual labor and material costs, actual engineering design costs, actual site conditions (including the actual quantities of mine waste excavated and the amount of material that may be classified as hazardous waste), competitive market conditions, the final project scope, the final project schedule, and other variables.

[14] Because the costs for Alternatives 3A and 3B are so similar, the design should consider both alternatives as appropriate.

Section 10. References

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Figures

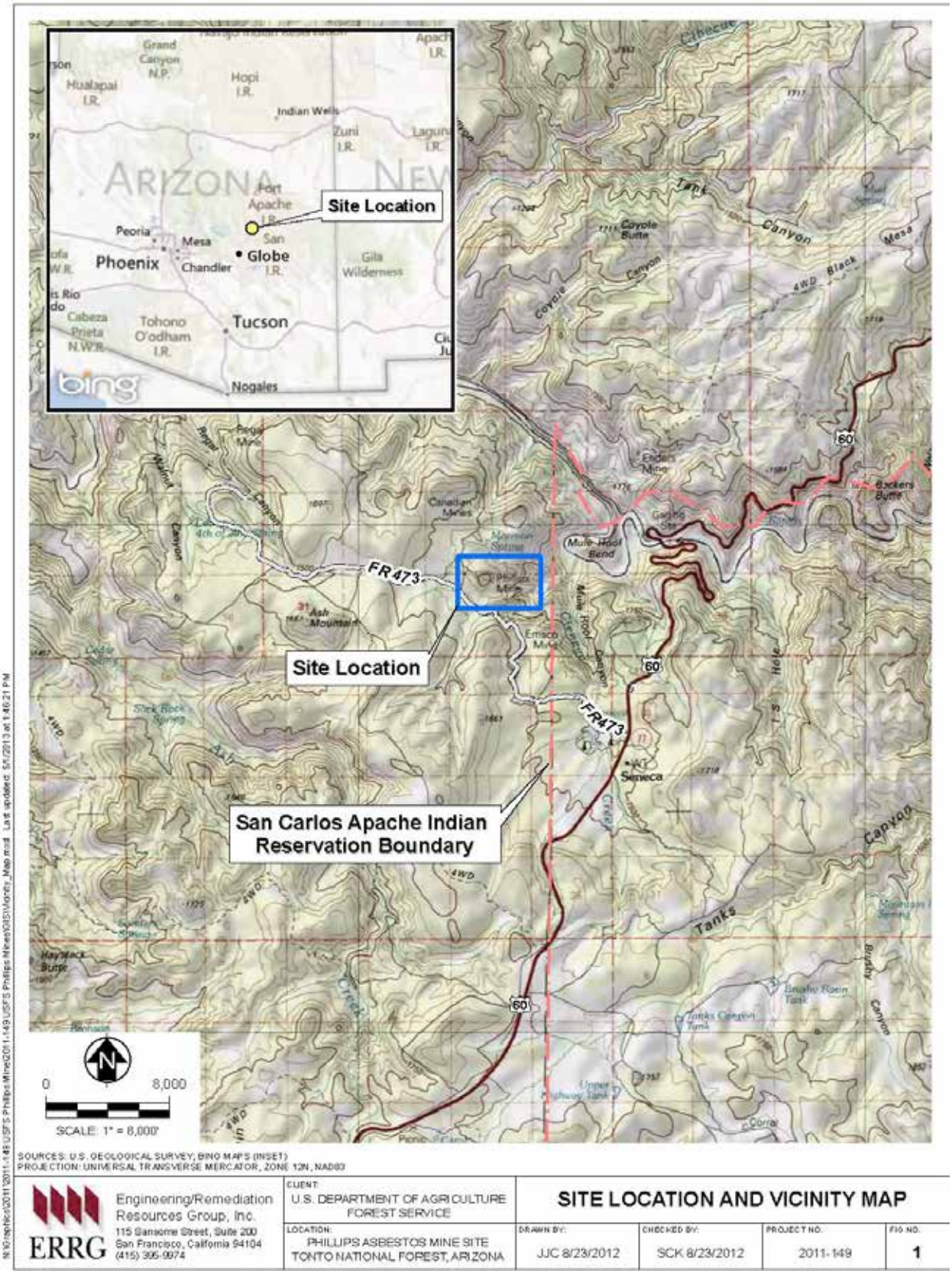

Figure 1. Site Location and Vicinity Map

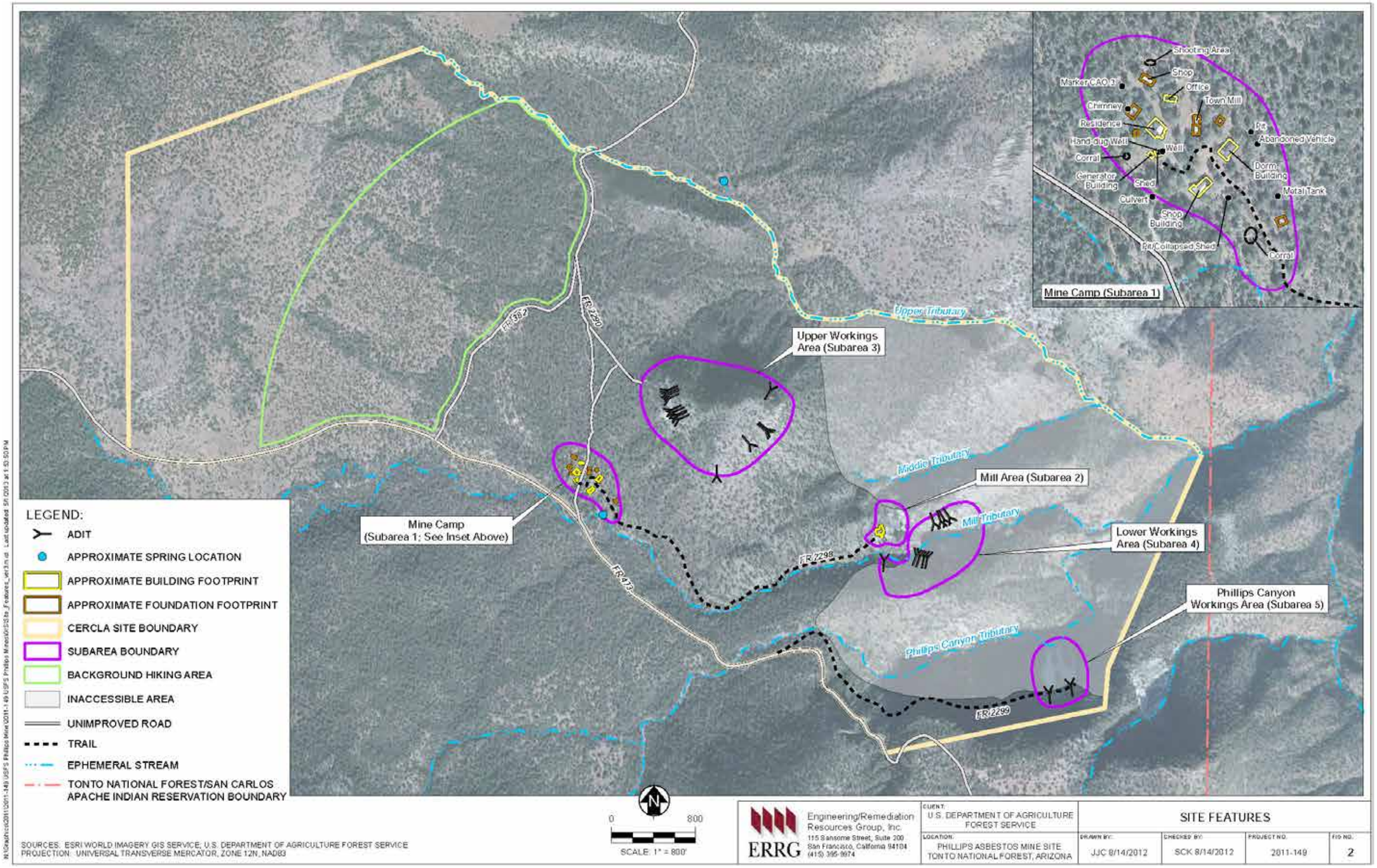

Figure 2. Site Features

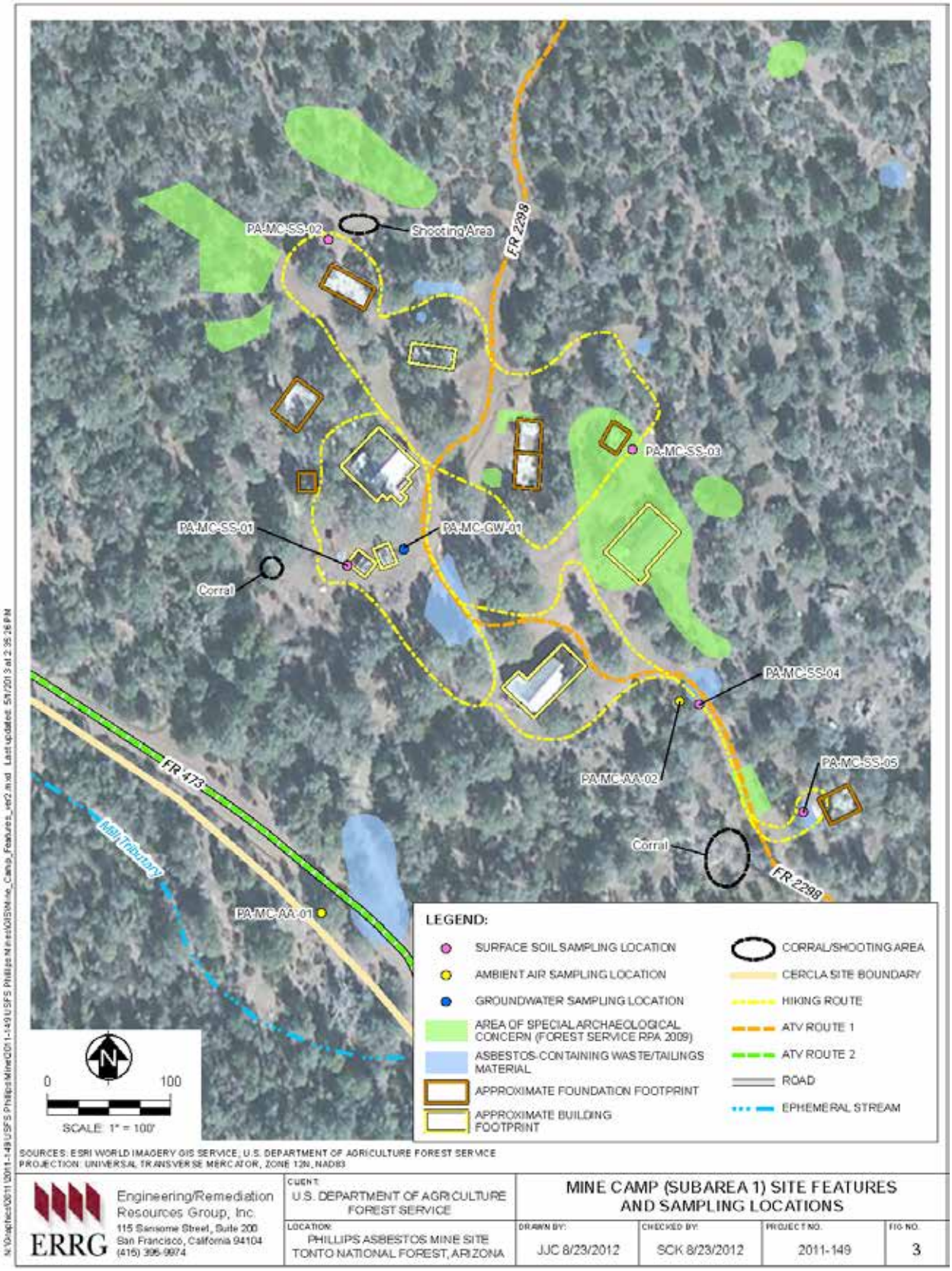

Figure 3. Mine Camp (Subarea 1) Site Features and Sampling Locations

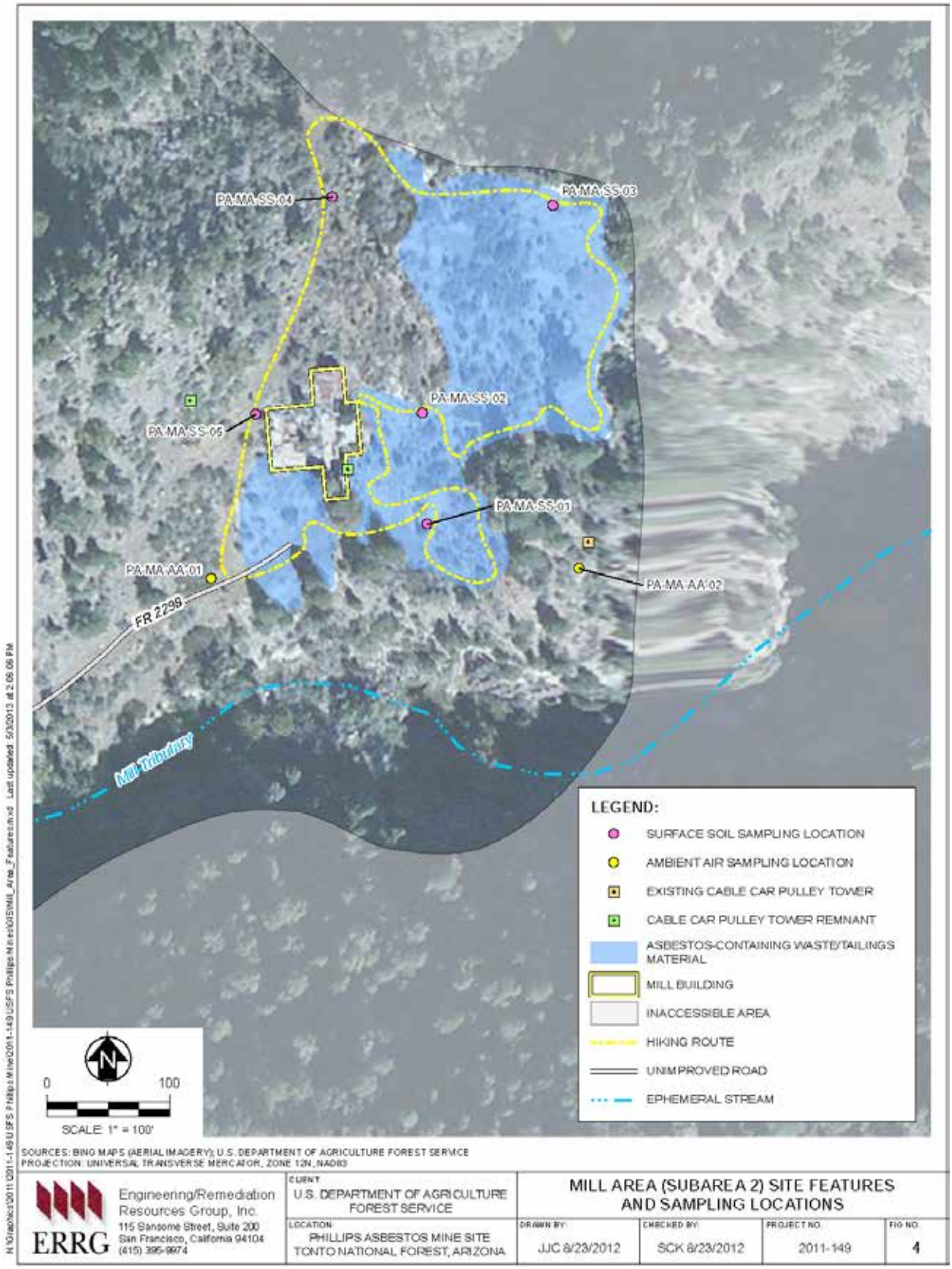

Figure 4. Mill Area (Subarea 2) Site Features and Sampling Locations

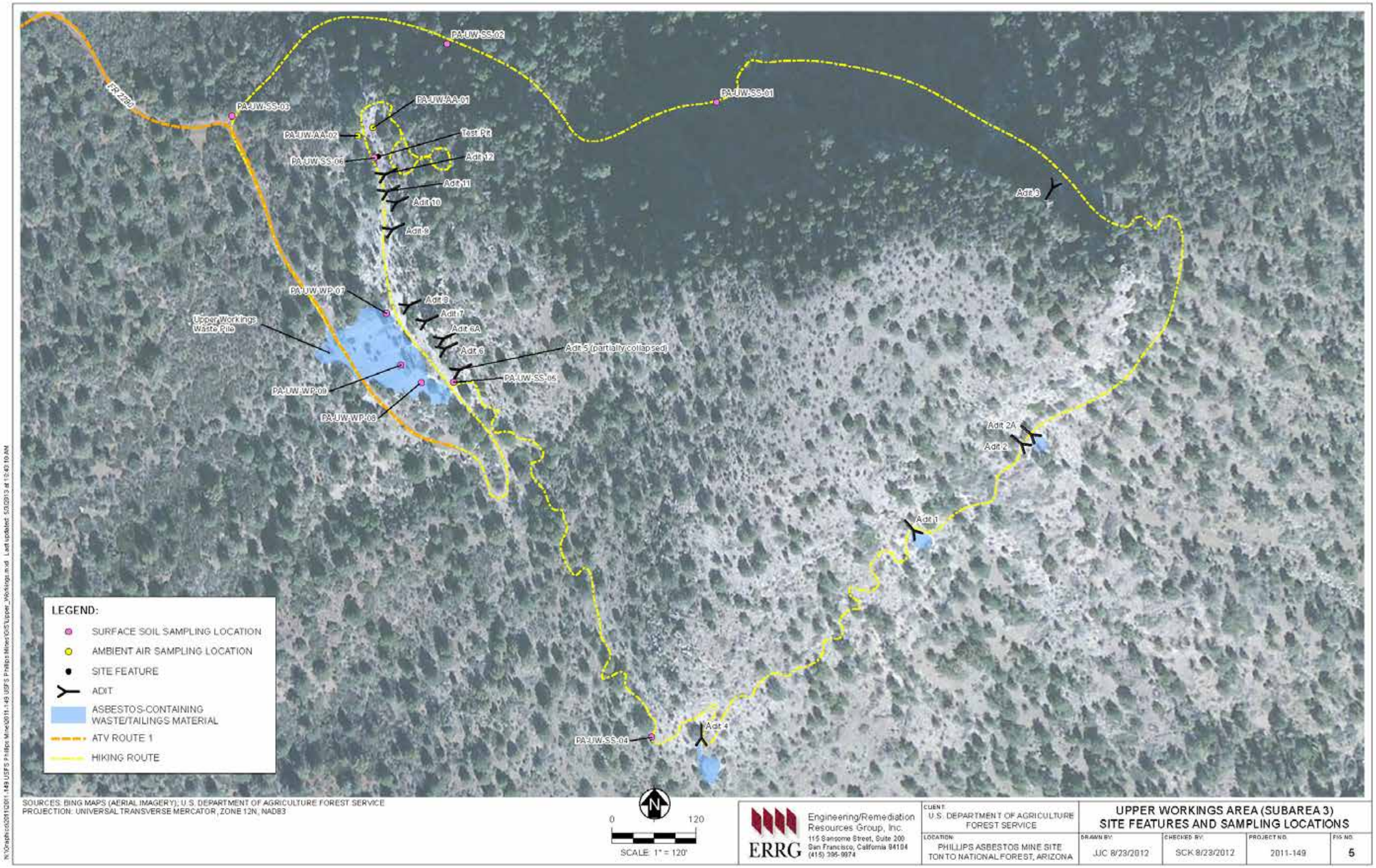

Figure 5. Upper Workings Area (Subarea 3) Site Features and Sampling Locations

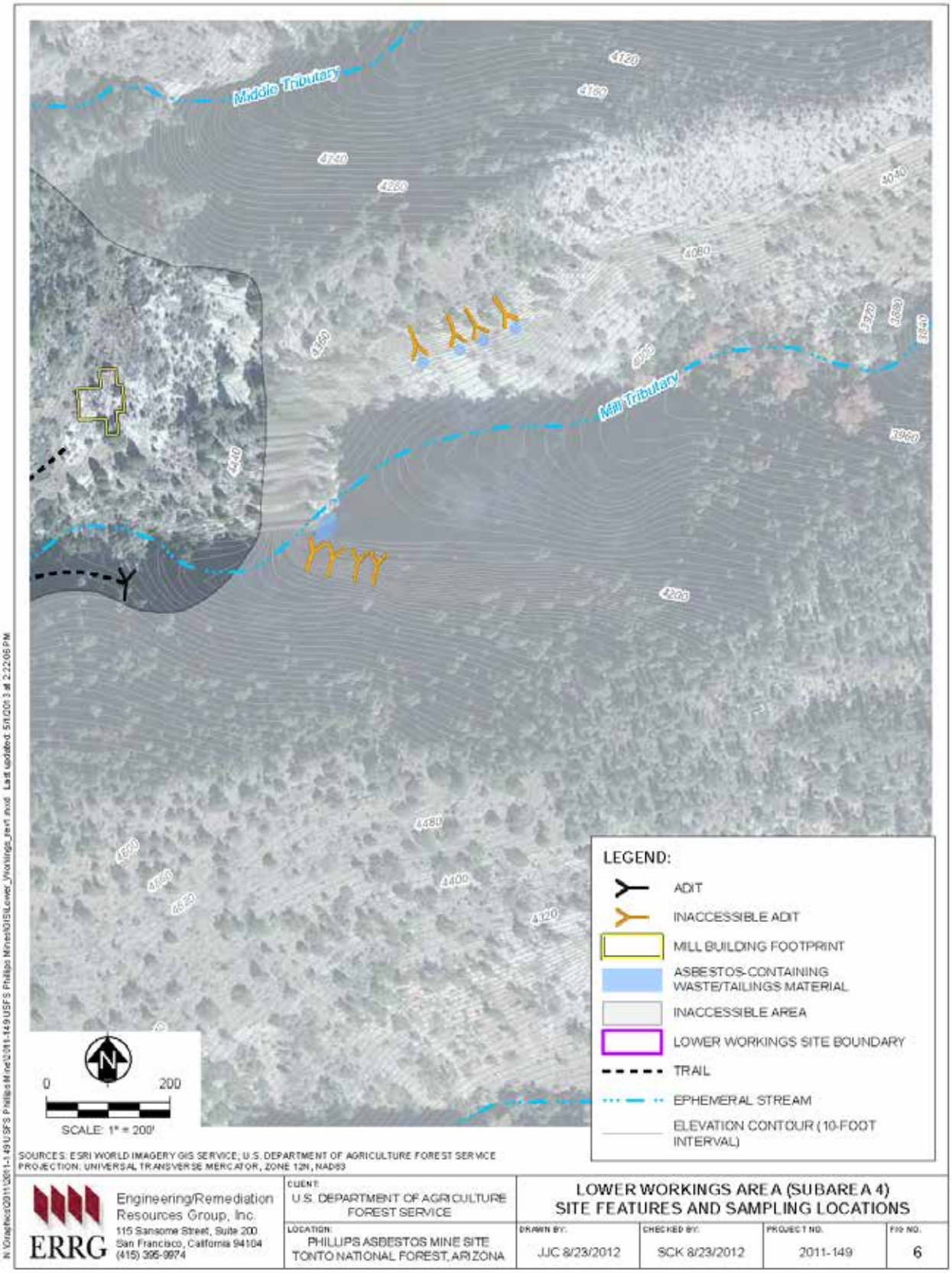

Figure 6. Lower Workings Area (Subarea 4) Site Features and Sampling Locations

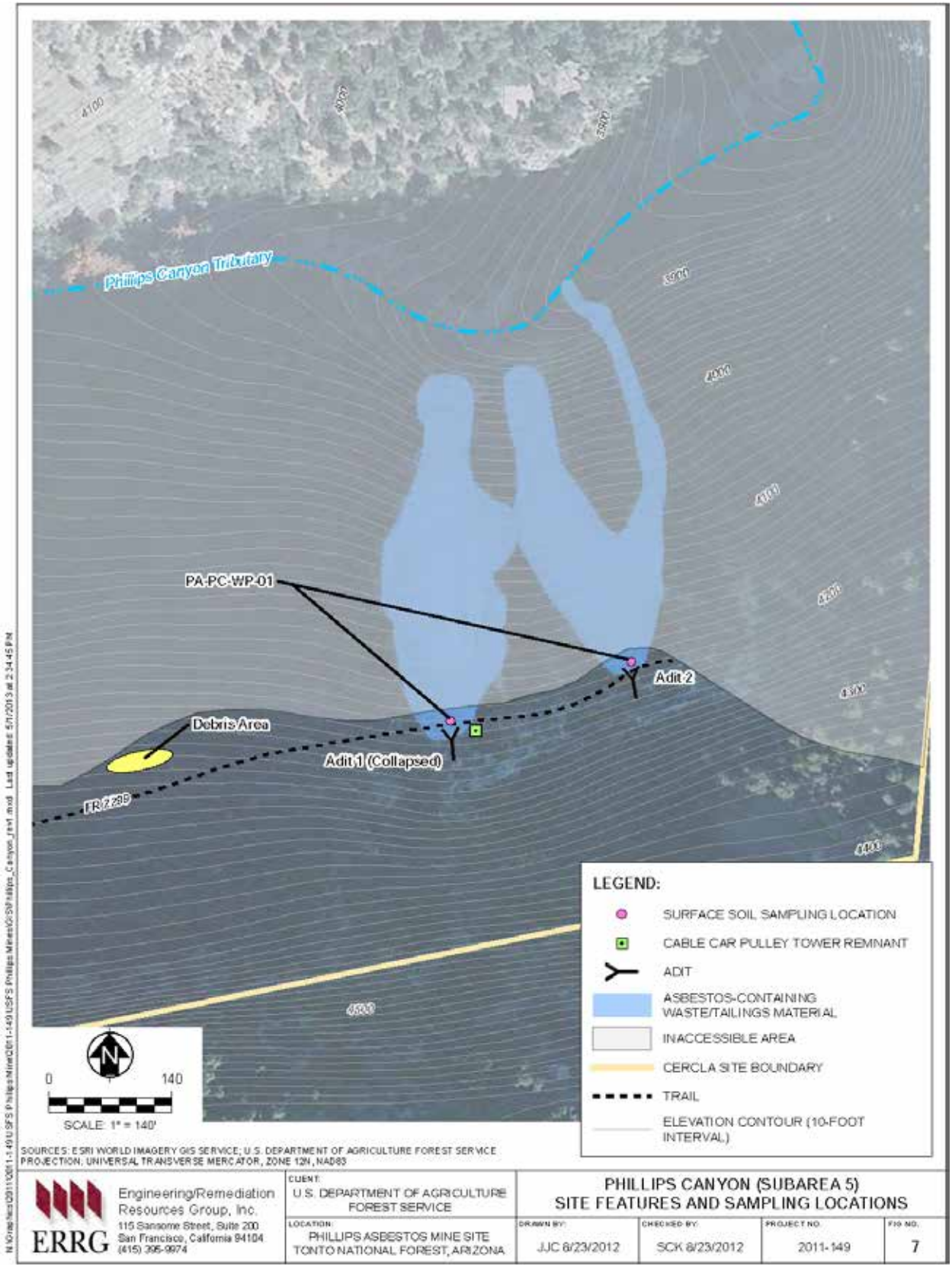

Figure 7. Phillips Canyon Workings Area (Subarea 5) Site Features and Sampling Locations

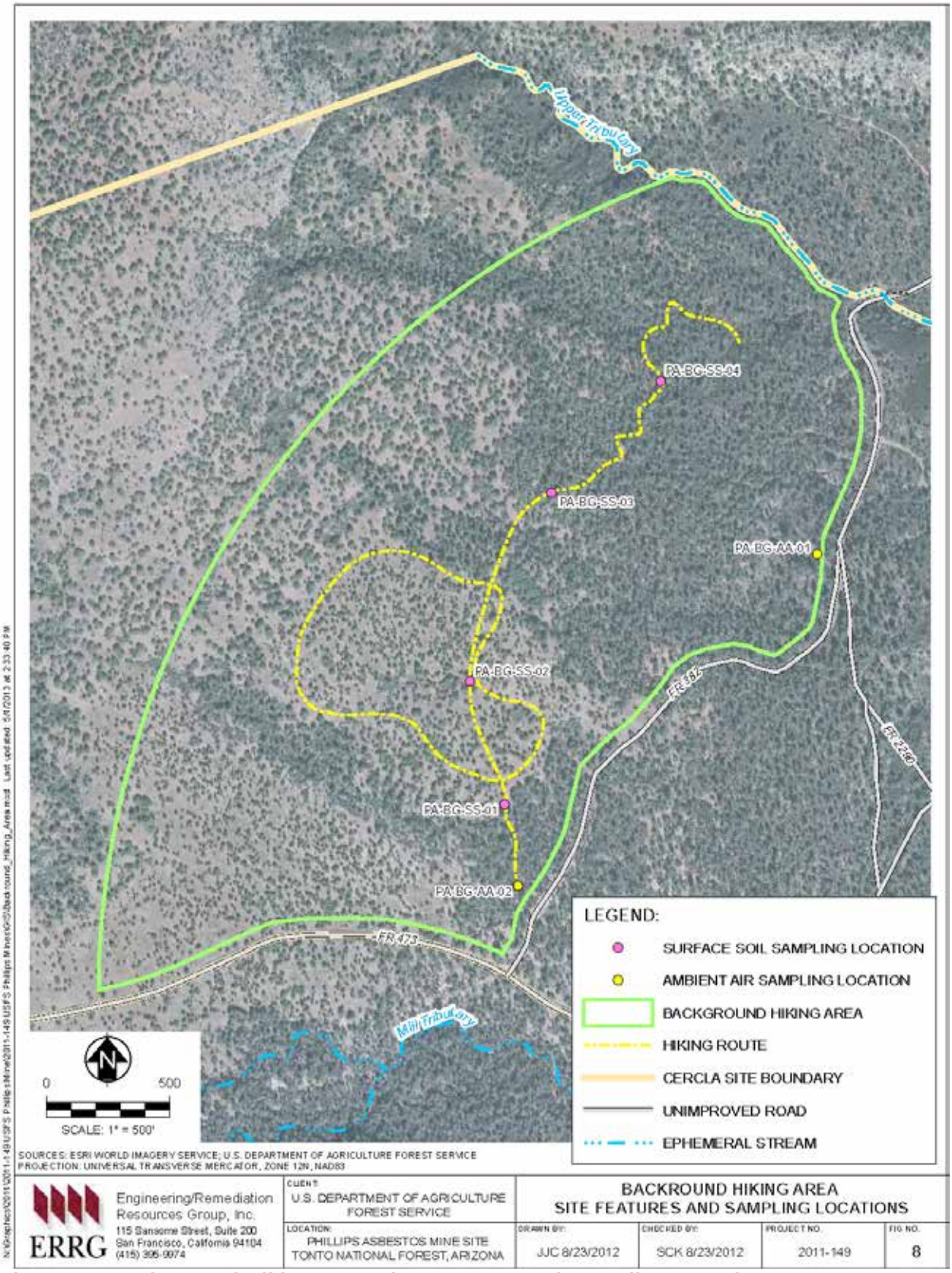

Figure 8. Background Hiking Area Site Features and Sampling Locations

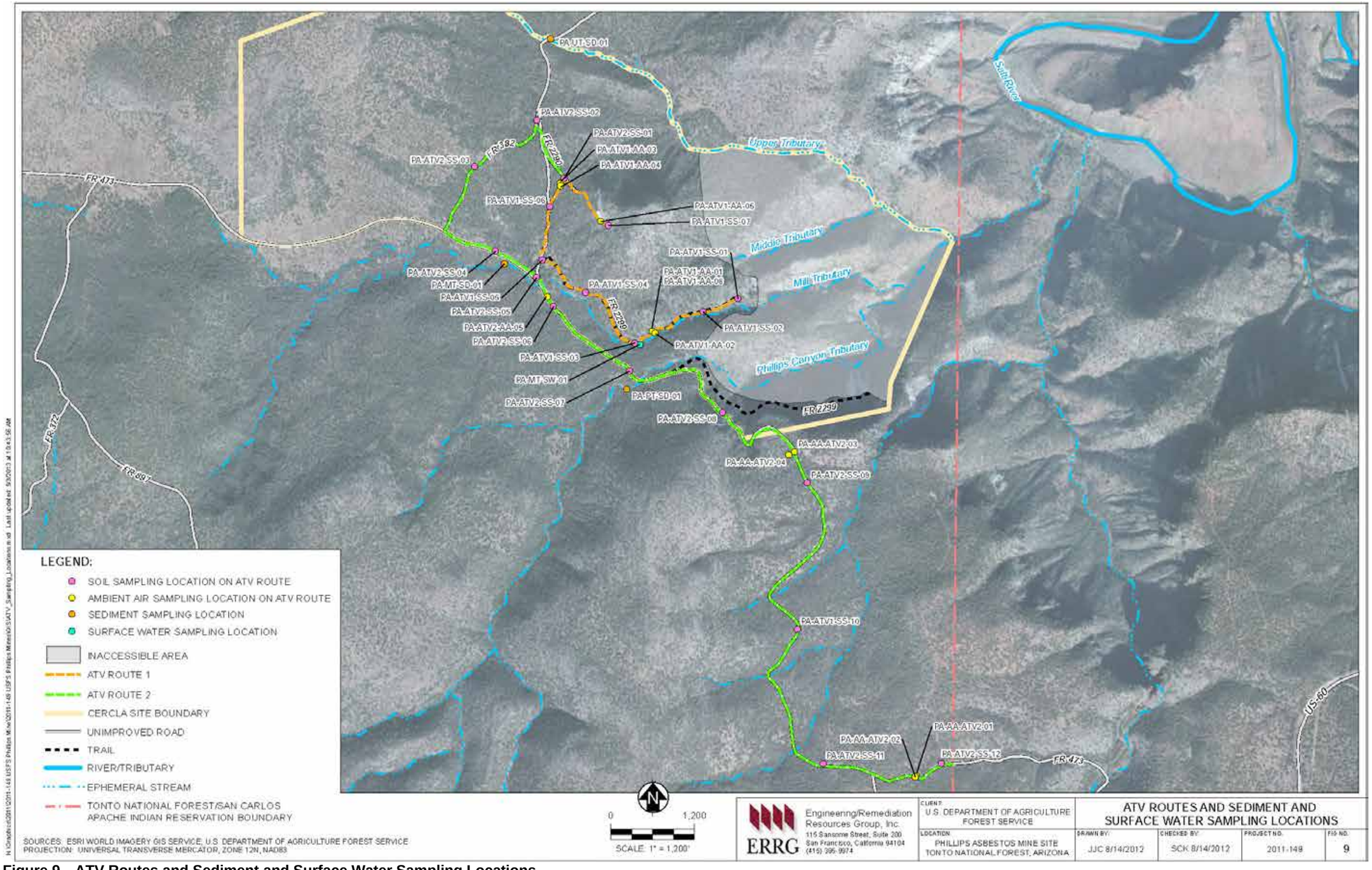

Figure 9. ATV Routes and Sediment and Surface Water Sampling Locations

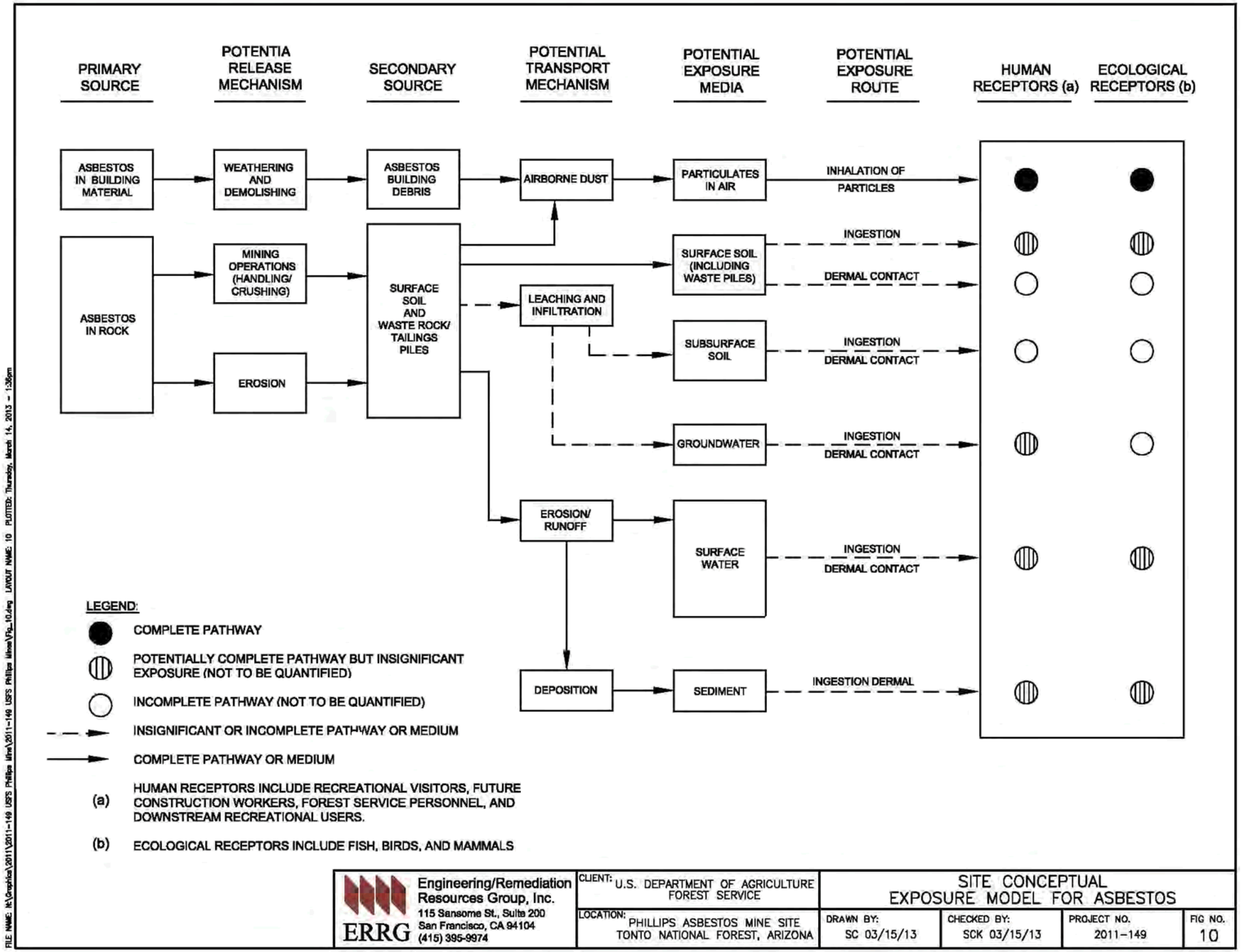

Figure 10. Site Conceptual Exposure Model for Asbestos

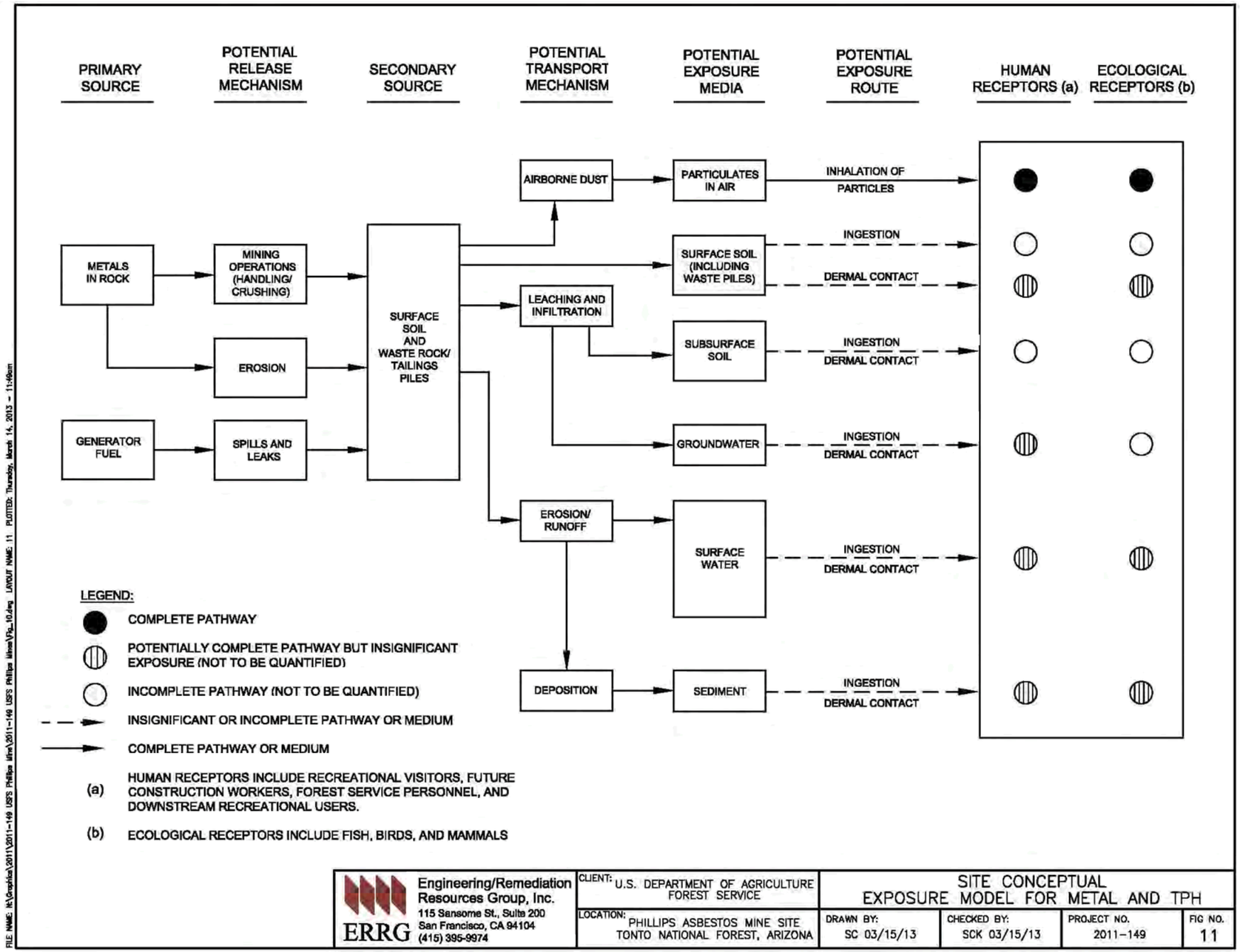

Figure 11. Site Conceptual Exposure Model for Metals and TPH

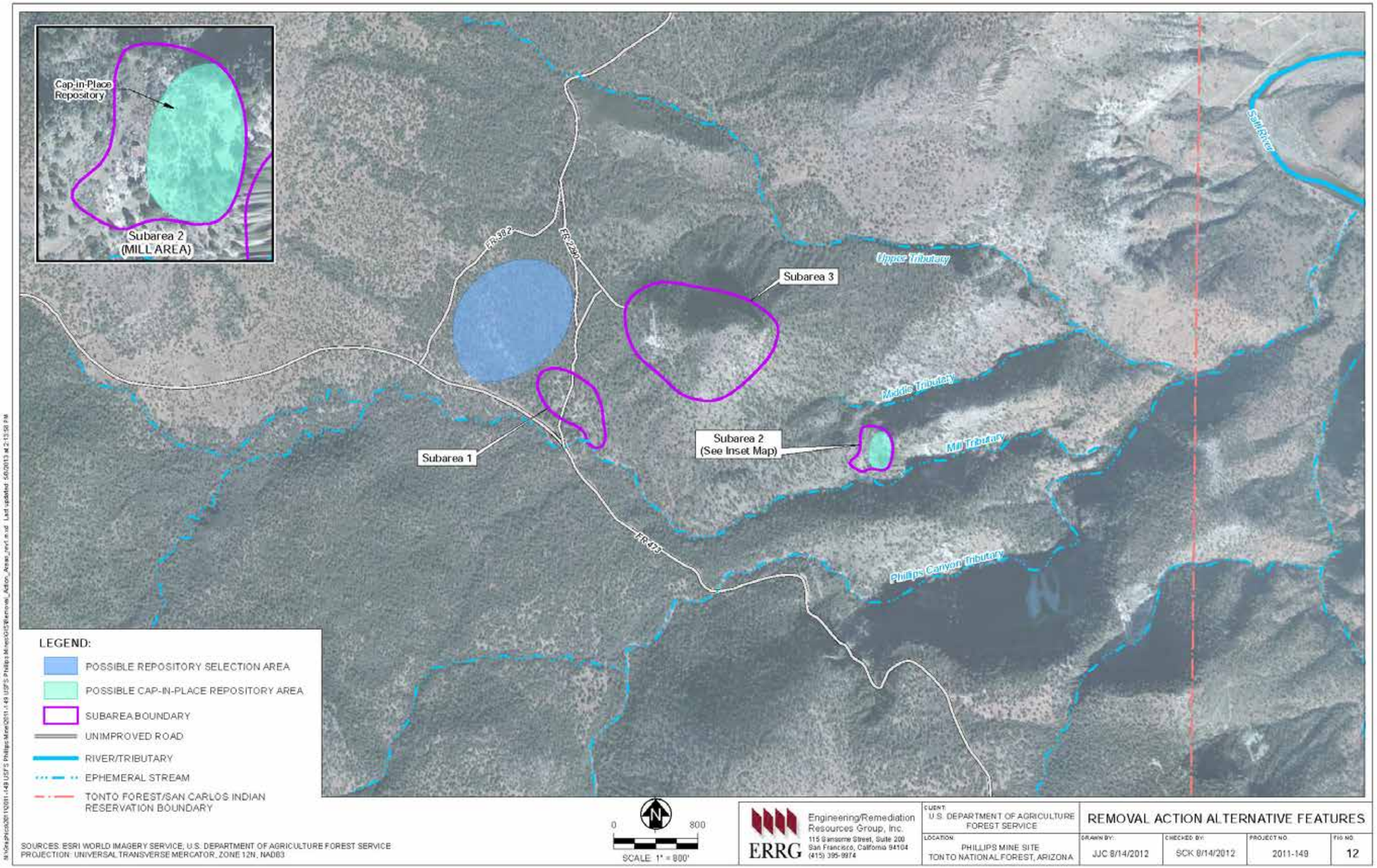

Figure 12. Removal Action Alternative Features

Tables

Table 1. Approximate Volume of Waste for Each Area

Area	Soil and Waste Material (yd^3)	Building Materials (yd^3)
Mine Camp (Subarea 1)	600	200
Mill Area(Subarea 2)	5,600	100
Upper Workings (Subarea 3)	5,000	0
Lower Workings (Subarea 4)	Unknown	0
Phillips Canyon Workings (Subarea 5)	17,500	0
Total Volume	**28,700**	**300**

Notes:
AOC = Area of Concern
yd^3 = cubic yards

Table 2. Sensitive Species Potentially Present in the Vicinity of the Phillips Asbestos Mine Site

Common Name	Federal Status	State of Arizona Status
Desert Sucker (*Catostomus clarki*)[1]	Species of Concern	None
Sonora Sucker (*Catostomus insignis*) [1]	Species of Concern	Wildlife of Special Concern
Razorback Sucker (*Xyrauchen Texanus*), critical habitat[2]	Endangered	Endangered
Roundtail Chub (*Gila robusta*) [1]	Threatened	Wildlife of Special Concern
Golden Eagle (*Aquila chrysaetos*)	Bald and Golden Eagle Protection Act	None
Bald Eagle (*Haliaeetus leucocephalus*)	Bald and Golden Eagle Protection Act	None
Common Black-Hawk (*Buteogallus anthracinus*)	Sensitive	Wildlife of Special Concern

Notes:

1. Appropriate habitat not available at the site; however, these species are present downstream of the site and may therefore be affected by site conditions.

2. Critical habitat in Arizona includes "the Salt River and its 100 year flood plain from State Route 77 bridge to Roosevelt Diversion Dam" (Arizona Game and Fish Department, 2002. "Razorback Sucker," unpublished abstract compiled and edited by the Heritage Data Management System, Phoenix, AZ).

Source: Arizona Department of Fish and Game, 2012. "Environmental Review On-Line Tool." Available Online at: <http://www.azgfd.com/hgis/>.

Table 3. Asbestos Results for Activity-Based and Ambient Air Samples

Sample Name	Date	Total Structures	str/cc
Subarea 1			
PA-MC-AA-01	6/16/2012	0	<0.0054
PA-MC-AA-02	6/16/2012	0	<0.0058
PA-MC-AA-03	6/16/2012	0	<0.0057
PA-MC-AM-01	6/16/2012	0	<0.0111
PA-MC-AM-02	6/16/2012	0	<0.0108
PA-MC-AM-03	*6/16/2012*	*1*	*<0.0166*
PA-MC-AM-04	6/16/2012	0	<0.0114
Subarea 2			
PA-MA-AA-01	6/17/2012	0	<0.0057
PA-MA-AA-02	6/17/2012	0	<0.0057
PA-MA-AM-01	6/17/2012	**8**	**0.0288**
PA-MA-AM-02	6/17/2012	**11**	**0.0385**
PA-MA-AM-03	6/17/2012	0	<0.0111
PA-MA-AM-04	6/17/2012	3	<0.0279
PA-MA-AM-05	6/17/2012	**5**	**0.018**
Subarea 3			
PA-UW-AA-01	6/18/2012	0	<0.0054
PA-UW-AA-02	6/18/2012	0	<0.0057
PA-UW-AM-01	*6/18/2012*	*2*	*<0.0227*
PA-UW-AM-02	6/18/2012	0	<0.0108
PA-UW-AM-03	*6/18/2012*	*1*	*<0.0171*
PA-UW-AM-04	6/18/2012	5	**0.0175**
PA-UW-AM-05	6/18/2012	0	<0.0108
ATV Route 1			
PA-ATV1-AA-01	6/17/2012	0	<0.0057
PA-ATV1-AA-02	6/17/2012	0	<0.0057
PA-ATV1-AA-03	6/17/2012	0	<0.0057
PA-ATV1-AA-04	6/17/2012	0	<0.0057
PA-ATV1-AA-05	*6/17/2012*	*1*	*<0.0090*
PA-ATV1-AA-06	6/17/2012	0	<0.0057
PA-ATV1-AM-01	6/17/2012	0	<0.0105
PA-ATV1-AM-02	6/17/2012	0	<0.0108
PA-ATV1-AM-03[a]	6/17/2012	0	<0.1668
PA-ATV1-AM-04[a]	*6/17/2012*	*1*	*<0.3664*

Table 3. Asbestos Results for Activity-Based and Ambient Air Samples *(continued)*

Sample Name	Date	Total Structures	str/cc
ATV Route 2			
PA-ATV2-AA-01	6/18/2012	0	<0.0057
PA-ATV2-AA-02	6/18/2012	0	<0.0057
PA-ATV2-AA-03	6/18/2012	0	<0.0057
PA-ATV2-AA-04	6/18/2012	0	<0.0057
PA-ATV2-AA-05	6/18/2012	0	<0.0057
PA-ATV2-AM-01	6/18/2012	0	<0.0108
PA-ATV2-AM-02	*6/18/2012*	*2*	*<0.0233*
PA-ATV2-AM-03	6/18/2012	0	<0.0108
PA-ATV2-AM-04[a]	6/18/2012	0	<0.1570
PA-ATV2-AM-05	6/18/2012	0	<0.0111
Background			
PA-BG-AA-01	6/19/2012	0	<0.0057
PA-BG-AA-02	6/19/2012	0	<0.0057
PA-BG-AM-01	6/19/2012	0	<0.0114
PA-BG-AM-02	*6/19/2012*	*1*	*<0.0175*
PA-BG-AM-03	6/19/2012	0	<0.0111
PA-BG-AM-04	6/19/2012	0	<0.0117
Media Blank			
PA-BC-AA-01	6/20/2012	0	<20.90010[b]

Notes:

Sample PA-ATV2-AA-06 was not collected because of a pump failure in the field.

Ambient air samples are designated with "AA" in the sample identification number.

Activity-based air samples are designated with "AM" in the sample identification number.

Results designated as "nondetect" are reported to the limit of detection, which is based on the number of fibers observed and the analytical sensitivity time of 2.9 as specified in the analytical method.

a = filters had a non-uniform deposition or were overloaded with particulates; samples were analyzed using ISO Method 13794, which is an indirect method. Under ISO Method 13794, the particulate is removed from the original filter into a solution, which is then transferred to a secondary filter and analyzed

b = measured in structures per millimeter

Bold = detection of asbestos above reporting limit

Italic = detection of asbestos below reporting limit

ATV = all-terrain vehicle

ISO = International Organization for Standardization

str/cc = structures per cubic centimeter

< = Result was reported to the limit of detection, which is based on the number of fibers observed and the analytical sensitivity times 2.9 as specified in the analytical method.

Table 4. Asbestos Results for Soil, Waste and Sediment Samples

Sample Name	Date	Percent Asbestos
	ATV Route 1 Soil	
PA-ATV1-SS-01	6/15/2012	**0.75**
PA-ATV1-SS-02	6/15/2012	<0.25
PA-ATV1-SS-03	6/15/2012	<0.25
PA-ATV1-SS-04	6/15/2012	<0.25
PA-ATV1-SS-05	6/15/2012	**1**
PA-ATV1-SS-06	6/15/2012	<0.25
PA-ATV1-SS-07	6/15/2012	<0.25
	ATV Route 2 Soil	
PA-ATV2-SS-01	6/15/2012	<0.25
PA-ATV2-SS-02	6/16/2012	<0.25
PA-ATV2-SS-03	6/16/2012	<0.25
PA-ATV2-SS-04	6/16/2012	<0.25
PA-ATV2-SS-05	6/16/2012	<0.25
PA-ATV2-SS-06	6/16/2012	<0.25
PA-ATV2-SS-07	6/16/2012	<0.25
PA-ATV2-SS-08	6/16/2012	<0.25
PA-ATV2-SS-09	6/16/2012	<0.25
PA-ATV2-SS-10	6/16/2012	<0.25
PA-ATV2-SS-11	6/16/2012	<0.25
PA-ATV2-SS-12	6/16/2012	<0.25
	Subarea 1 Soil	
PA-MC-SS-01	6/16/2012	**0.25**
PA-MC-SS-02	6/16/2012	<0.25
PA-MC-SS-03	6/16/2012	<0.25
PA-MC-SS-04	6/16/2012	**0.25**
PA-MC-SS-05	6/16/2012	**1**
	Subarea 2 Soil	
PA-MA-SS-01	6/17/2012	**1.25**
PA-MA-SS-02	6/17/2012	**5.75**
PA-MA-SS-03	6/17/2012	**9.5**
PA-MA-SS-04	6/17/2012	<0.25
PA-MA-SS-05	6/17/2012	**0.5**

Table 4. Asbestos Results for Soil, Waste, and Sediment Samples *(continued)*

Sample Name	Date	Percent Asbestos
	Subarea 3 Soil	
PA-UW-SS-01	6/18/2012	<0.25
PA-UW-SS-02	6/18/2012	<0.25
PA-UW-SS-03	6/18/2012	<0.25
PA-UW-SS-04	6/18/2012	<0.25
PA-UW-SS-05	6/18/2012	**0.5**
PA-UW-SS-06	6/18/2012	**0.25**
	Subarea 3 Waste Rock	
PA-UW-WP-07	6/18/2012	**13.75**
PA-UW-WP-08	6/18/2012	**2.25**
PA-UW-WP-09	6/18/2012	**5**
	Subarea 5 Waste Rock	
PA-PC-WP-01	6/19/2012	**0.25**
	Background Soil	
PA-BG-SS-01	6/19/2012	<0.25
PA-BG-SS-02	6/19/2012	<0.25
PA-BG-SS-03	6/19/2012	<0.25
PA-BG-SS-04	6/19/2012	<0.25
	Background Sediment	
PA-MT-SD-01	6/15/2012	<0.25
PA-PT-SD-01	6/19/2012	<0.25
PA-UT-SD-01	6/16/2012	<0.25

Notes:

ATV = all-terrain vehicle

Bold = detected concentration of asbestos

< = not detected at a concentration less than the reporting limit

Table 5. Screening of Metals and TPH Results for Soil and Waste Samples

Sample ID No.	Date Collected	Description	Arsenic	Barium	Cadmium	Chromium	Cobalt	Copper	Lead	Magnesium	Manganese	Mercury	Nickel	Selenium	Uranium	Zinc	TPH (C10-C32)[a]
PA-ATV1-SS-01	06/15/12	ATV Route 1	<5.0	83	<0.50	30	26	47	10	47,000	360	<0.10	43	<5.0	0.29	69	NA
PA-ATV2-SS-01	06/15/12	ATV Route 2	<5.0	98	<0.50	62	32	53	10	9,100	560	<0.10	46	<5.0	<0.25	62	NA
PA-MC-SS-01	06/16/12	Subarea 1 Soil	9.7	73	0.90	72	34	56	93	15000	530	<0.11	43	<5.0	0.28	340	400
PA-MA-SS-01	06/17/12	Subarea 2 Soil	9.5	37	<0.50	17	7.9	19	7.4	150,000	400	<0.10	13	<5.0	2.3	190	NA
PA-UW-WP-08	06/18/12	Subarea 3 Waste Pile	5.1	60	<0.50	7.3	4.2	15	<5.0	120,000	630	<0.10	3.5	<5.0	0.80	15	NA
PA-UW-SS-01	06/18/12	Subarea 3 Soil	<5.0	35	<0.50	16	29	67	<5.0	9,300	310	<0.10	33	<5.0	<0.25	47	NA
PA-PC-WP-01	06/19/12	Subarea 5 Waste Pile	5.7	64	<0.50	20	16	27	9.1	43,000	320	<0.10	24	<5.0	0.29	66	NA
		Background	7.2	130	<0.50	35	18	23	9.9	4,000	520	<0.10	23	<5.0	0.34	40	NA
		Retained as COPC	**Yes**	No	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	No	**Yes**	No	**Yes**	No	**Yes**	**Yes**	**Yes**
Human Health Criteria and COC Determination																	
		Arizona Non-Residential SRL	10	170,000	510	4,500	13,000	41,000	800	NA	32,000	310	20,000	5,100	200	310,000	18,000
		BLM Soil RMC for Camper	20	NA	70	NA	NA	5,000	1,000	NA	19,000	40	2,700	700	NA	40,000	NA
		BLM Soil RMC for ATV Driver	300	NA	950	NA	NA	70,000	1,000	NA	250,000	550	38,000	9,600	NA	550,000	NA
		COC for Human Health?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Ecological Criteria and COC Determination																	
		BLM Soil Ecological Criteria (Deer mouse)	230	NA	7	NA	NA	640	142	NA	NA	2	NA	NA	NA	419	NA
		BLM Soil Ecological Criteria (Median)	275	NA	3	NA	NA	136	125	NA	NA	8	NA	NA	NA	307	NA
		EPA Ecological SSL (vole)	170	3,200	73	380	2,100	1,100	1,200	NA	5,300	NA	340	2.7	NA	6,800	NA
		EPA Ecological SSL (avian carnivore)	1,100	NA	630	780	1,300	1,600	510	NA	65,000	NA	2,800	83	NA	30,000	NA
		COC for Ecological Receptors?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Notes: All values listed in milligrams per kilogram

All samples represent three-point composites, except for sample PA-PC-WP-01 from Phillips Canyon Workings, which is a two-point composite sample.

Complete laboratory reports, including data qualifiers, are presented in Appendix C.

a = TPH (C10-C32) is sum of TPH-diesel (C10-22) and TPH-oil range organics (C22-C32)

ATV = all-terrain vehicle
BLM = Bureau of Land Management
COC = chemical of concern
COPC = chemical of potential concern
EPA = U.S. Environmental Protection Agency
NA = not analyzed/not available
SRL = soil remediation level
SSL = soil screening level
TPH = total petroleum hydrocarbons
< = nondetect at concentration less than reporting limit

Table 6. Screening of Metals Results for Sediment Samples

Sample ID No.	Date Collected	Description	Arsenic	Barium	Cadmium	Chromium	Cobalt	Copper	Lead	Magnesium	Manganese	Mercury	Nickel	Selenium	Uranium	Zinc
PA-MT-SD-01	6/15/2012	Mill Tributary sediment sample	<5.0	93	<0.50	69	24	27	6.9	5,800	410	<0.10	33	<5.0	<0.25	40
PA-PT-SD-01	6/19/12	Phillips Canyon Tributary sediment sample	<5.0	80	<0.50	18	17	24	<5.0	5,100	270	<0.10	20	<5.0	<0.25	30
		Background	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
		Retained as COPC	No	**Yes**	No	**Yes**	**Yes**	**Yes**	**Yes**	No	**Yes**	No	**Yes**	No	No	**Yes**
Human Health Criteria and COC Determination																
		Arizona Non-Residential SRL	10	170,000	510	4,500	13,000	41,000	800	NA	32,000	310	20,000	5,100	200	310,000
		BLM Sediment RMC for Camper	46	NA	155	NA	NA	5,745	1,000	NA	21,679	46	3,094	774	NA	46,455
		COC for Human Health?	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Ecological Criteria and COC Determination																
		BLM Soil Ecological Criteria (Deer mouse)	230	NA	7	NA	NA	640	142	NA	NA	2	NA	NA	NA	419
		BLM Soil Ecological Criteria (Median)	275	NA	3	NA	NA	136	125	NA	NA	8	NA	NA	NA	307
		EPA Ecological SSL (vole)	170	3,200	73	380	2,100	1,100	1,200	NA	5,300	NA	340	2.7	NA	6,800
		EPA Ecological SSL (avian carnivore)	1,100	NA	630	780	1,300	1,600	510	NA	65,000	NA	2,800	83	NA	30,000
		COC for Ecological Receptors?	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Notes: All values listed in milligrams per kilogram

All samples represent three-point composites

BLM = Bureau of Land Management

COC = chemical of concern

COPC = chemical of potential concern

EPA = U.S. Environmental Protection Agency

NA = not available

NE = not established

SRL = soil remediation level

SSL = soil screen level

TPH = total petroleum hydrocarbons

< = nondetect at concentration less than the reporting limit

Table 7. Screening of Asbestos, Metals and TPH Results for Water Samples

Sample ID No.	Date Collected	Description	Asbestos (MFL)	Arsenic (mg/L)	Barium (mg/L)	Cadmium (mg/L)	Chromium (mg/L)	Cobalt (mg/L)	Copper (mg/L)	Lead (mg/L)	Manganese (mg/L)	Mercury (mg/L)	Nickel (mg/L)	Selenium (mg/L)	Uranium (mg/L)	Zinc (mg/L)	TPH (C10-C32)[a] (mg/L)
PA-MC-GW-01	06/17/12	Subarea 1 groundwater well sample	<0.97	<0.10	0.014	<0.0010	<0.010	<0.040	<0.010	<0.015	0.18	<0.00020	<0.010	<0.10	<0.0010	<0.050	<0.10
PA-MC-GW-01	06/17/12	Subarea 1 groundwater well sample (Dissolved)	NA	<0.10	0.051	<0.0010	<0.010	<0.040	<0.010	<0.015	0.18	<0.00020	<0.010	<0.10	<0.0010	<0.050	NA
PA-MT-SW-01	06/17/12	Subarea 2 Tributary surfacewater sample	<24[b]	<0.10	0.13	<0.0010	<0.010	<0.040	0.011	<0.015	0.37	<0.00020	<0.010	<0.10	0.0020	<0.050	NA
PA-MT-SW-01	06/17/12	Subarea 2 Tributary surface water sample (Dissolved)	NA	<0.10	0.015	<0.0010	<0.010	<0.040	<0.010	<0.015	0.065	<0.00020	<0.010	<0.10	0.0020	<0.050	NA
		Background	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
		Retained as a COPC?	No	No	**Yes**	No	No	No	**Yes**	No	**Yes**	No	No	No	No	No	**Yes**
Human Health Criteria and COC Determination																	
		EPA Region 9 Regional Screening Level for Tap Water	7[c]	0.000045	2.9	0.0069	NA	0.0047	0.62	NA	0.32	NA	0.30	0.078	0.047	4.7	NA
		BLM Groundwater RMC Screening Criteria for Camper	--	0.0001	NA	0.002	NA	NA	0.137	0.015	0.018	0.001	0.074	0.018	NA	1.106	NA
		BLM Groundwater RMC Screening Criteria for Worker	--	0.0007	NA	0.004	NA	NA	0.287	0.015	0.039	0.002	0.155	0.039	NA	2.323	NA
		COC for Human Health?	--	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Ecological Criteria and COC Determination																	
		EPA Freshwater Aquatic Life Acute Exposure	--	0.340	NA	0.002	0.570	NA	0.013	0.065	NA	0.0014	0.470	NA	NA	0.120	NA
		EPA Freshwater Aquatic Life Chronic Exposure	--	0.150	NA	0.00025	0.074	NA	0.009	0.0025	NA	0.00077	0.052	0.005	NA	0.120	NA
		COC for Ecological Receptors?	--	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Notes:

Complete laboratory reports, including data qualifiers, are presented in Appendix C

a = TPH (C10-C32) is sum of TPH-diesel (C10-22) and TPH-oil range organics (C22-C32).

b = Reporting limit exceeds screening criteria because excessive particulate matter was present in the sample.

c = EPA Maximum Contaminant Level for Drinking Water.

BLM = Bureau of Land Management

COC = chemical of concern

COPC = chemical of potential concern

EPA = U.S. Environmental Protection Agency

MFL = million fibers per liter

mg/L = milligrams per liter

NA = not available

NE = not established

RMC = risk management criteria

TPH = total petroleum hydrocarbons

< = nondetect at concentrations less than the reporting limit

Table 8. Risk Screening of Asbestos Results for Air Samples with Detectable Concentrations

Sample ID No.	Date Collected	Asbestos (str/cc)	TWF	IUR	Risk
Subarea 2 Activity-Based Air Samples					
PA-MA-AM-01	06/17/12	0.0288	0.018	0.094	4.9×10^{-7}
PA-MA-AM-02	06/17/12	0.0385	0.018	0.094	6.5×10^{-7}
PA-MA-AM-05	06/17/12	0.0180	0.018	0.094	3.0×10^{-7}
Subarea 3 Activity-Based Air Samples					
PA-UW-AM-04	06/18/12	0.0175	0.018	0.10	3.2×10^{-7}

Notes:

IUR = inhalation Unit Risk in str/cc^{-1}

str/cc = structures per cubic centimeter

TWF = time weighting factor

Table 9. Potential Federal Chemical-Specific ARARs

Requirement	Prerequisite	Citation	Preliminary ARAR Determination	Comments
Framework for Investigating Asbestos-Contaminated Superfund Sites				
Establishes procedures for the evaluation of sites contaminated by asbestos	Potentially contaminated soil or asbestos source material	Non-promulgated guidance developed by EPA (EPA, 2008)[a]	To be considered	Provides a framework for the investigation and characterization of sites with potential asbestos contamination.

Notes: Based on the risk-based screening conducted in Section 4 of this EE/CA, asbestos was the only COC retained. No other contaminants have been identified at the site; therefore, no other federal or state promulgated chemical-specific ARARs have been evaluated. Naturally occurring asbestos and asbestos in soil are not specifically regulated by the federal government. No cleanup action levels or screening criteria are promulgated for asbestos.

a = Guidance document available online at http://epa.gov/superfund/health/contaminants/asbestos/pdfs/framework_asbestos_guidance.pdf

ARAR = applicable or relevant and appropriate requirement

COC = chemical of concern

EE/CA = Engineering Evaluation/Cost Analysis

EPA = U.S. Environmental Protection Agency

Table 10. Potential Federal Location-Specific ARARs

Location	Requirement	Prerequisite	Citation	Preliminary ARAR Determination	Comments
Endangered Species Act of 1973					
Habitat upon which endangered species or threatened species depend	Federal agencies may not jeopardize the continued existence of any listed species or cause the destruction or adverse modification of critical habitat.	Determination of effect upon endangered or threatened species or its habitat; critical habitat upon which endangered species or threatened species depend.	16 USC §§ 1531–1543	Not Applicable	Although this act is relevant, it is not appropriate, thus it is not considered an ARAR because no federally listed species or designated habitat is known to be present at or adjacent to the site. Compliance with this act will be required if any federally listed species or suitable habitat is identified at the site.
Bald and Golden Eagle Protection Act					
Habitat upon which Bald or Golden Eagles depend	Requires the protection of Bald and Golden Eagles and their habitat from any disturbance that interferes with or interrupts normal breeding, feeding, or sheltering habitats and causes injury, death, or nest abandonment.	Determination of effect upon Bald or Golden Eagles or their habitat; critical habitat upon which they depend.	16 USC §§ 668–668c	Applicable	The Arizona Game and Fish Department indicates that both Bald and Golden Eagles may be present within 3 miles of the site. This act may not be appropriate (thus not an ARAR) if a determination is made that no Bald or Golden Eagles or designated habitat is present at or adjacent to the site.

Table 10. Potential Federal Location-Specific ARARs *(continued)*

Location	Requirement	Prerequisite	Citation	Preliminary ARAR Determination	Comments
			Migratory Bird Treaty Act of 1972		
Migratory bird area	Protects almost all species of native migratory birds in the U.S. from unregulated "take."	Presence of migratory birds.	16 USC §§ 703–715	Applicable	The Common Black-Hawk, which is protected under the Migratory Bird Treaty has been identified as having habitat within 3 miles of the site. The potential exists for the Common Black-Hawk to inhabit the site. This act may not be appropriate (thus not an ARAR) if a determination is made that no Common Black Hawk or designated habitat is present at or adjacent to the site.
			National Historic Preservation Act of 1966, as Amended		
Federal land	Establishes a program for the preservation of historic federal properties within the U.S.	Property included in or eligible for the National Register of Historic Places.	16 USC § 470 36 CFR 800	Relevant and appropriate	To date, no historical or archaeological resources have been identified at the site. Compliance with this act will be required if archaeological resources are identified. If any removal action would cause irreparable loss or destruction of significant scientific, prehistoric, historical, or archaeological data, it will be necessary to follow the procedures in the statute to provide for data recovery and preservation activities.

Table 10. Potential Federal Location-Specific ARARs *(continued)*

Location	Requirement	Prerequisite	Citation	Preliminary ARAR Determination	Comments
Archaeological and Historic Preservation Act					
Federal land	Establishes procedures to provide for preservation of historical and archaeological data that might be destroyed through alteration of terrain as a result of a federal construction project or a federally licensed activity or program.	Federal construction project or federally licensed activity or program.	16 USC §§ 469–469(c)(1) 40 CFR § 6.301(c)	Applicable	Applicable if removal activities occur in areas previously undisturbed where the potential exists to affect archaeological or historical resources.
Archaeological Resources Protection Act of 1979, as Amended					
Federal land	Prohibits unauthorized excavation, removal, damage, alteration, or defacement of archaeological resources located on public lands unless such action is conducted pursuant to a permit.	Archaeological resources on federal land.	Public Law No. 96-95 16 USC § 470aa–470mm	Applicable	Archaeological resources are potentially present in several areas of Subarea 1 (see Figure 3, areas of special archaeological concern).

Notes:

ARAR = applicable or relevant and appropriate requirement

CFR = Code of Federal Regulations

USC = United States Code

§ = Section

Table 11. Potential Federal Action-Specific ARARs

Action	Requirement	Prerequisite	Citation	Preliminary ARAR Determination	Comments
Clean Water Act, as Amended					
Construction activities	Construction that disturbs at least 1 acre must use best management practices to control stormwater discharges.	Construction activities at least 1 acre in size.	33 USC, Chapter 26, §§ 1251–1387 Clean Water Act §402 40 CFR §§ 122.44(k)(2) and (4)	Applicable	Applicable to alternatives that will disturb more than 1 acre.
Clean Air Act National Emissions Standard for Hazardous Air Pollutants					
Construction activities	The CAA requires the enforcement of regulations to protect the general public from exposure to airborne contaminants that are known to be hazardous to human health.	The presence of hazardous asbestos in materials that may be disturbed by construction activities.	40 CFR Parts 61 and 63, Subpart M	Applicable	Asbestos is a hazardous air pollutant present at the site that will be disturbed during implementation of a removal action.
Construction activities	Provides specific standards for inactive waste disposal sites for asbestos mills and manufacturing and fabricating operations. Includes requirements for covering asbestos-containing waste material, engineering controls to limit site access, and signage.	Potential air emissions from the disturbance of asbestos mill tailings or the demolition of buildings containing asbestos.	40 CFR § 61.151	Applicable	The site is a former asbestos mill and as such may be subject to the requirements of this regulation. .

Table 11. Potential Federal Action-Specific ARARs *(continued)*

Action	Requirement	Prerequisite	Citation	Preliminary ARAR Determination	Comments
Magnuson-Stevens Fishery Conservation and Management Act of 1976, as Amended					
Fishery under management	Provides for conservation and management of specified fisheries within specified fishery conservation zones.	Presence of managed fisheries	16 USC §§ 1801–1882	Relevant and appropriate	Site actions must evaluate potential adverse effects or harm to any managed fisheries downstream from the site. To date, surface water at the site has not been identified as a medium of concern.
Native American Graves Protection and Repatriation Act					
Excavation and ground disturbance	Requires that Native American graves not be disturbed and that, if discovered, excavation and ground disturbance will be stopped.	Excavation and ground-disturbing activities	25 USC§3001 et seq. 43 CFR Part 10	Relevant and appropriate	Protects Native American graves from desecration through the removal and trafficking of human remains and cultural items. If such protected items are inadvertently discovered during excavation, the excavation must cease and the affiliated tribes must be notified and consulted. Applies to ground-disturbing activities such as soil grading and removal.
American Indian Religious Freedom Act					
Excavation and ground disturbance	Protects traditional religious rights and cultural practices of Native Americans, including access to sacred sites, freedom to worship, and use and possession of objects considered sacred.	Excavation and ground-disturbing activities	42 USC§1996 et seq.	Relevant and appropriate	This act requires that excavation and soil grading have no negative impact on the free practice of religion by Native American groups. If sacred sites are discovered in the course of soil disturbances, work will be stopped and appropriate notifications made.

Table 11. Potential Federal Action-Specific ARARs *(continued)*

Action	Requirement	Prerequisite	Citation	Preliminary ARAR Determination	Comments
Corrective Action Management Units and Temporary Units Regulations					
Construction of onsite CAMU for waste consolidation and repository	These regulations allow for the designation and creation of a CAMU for the onsite consolidation of contaminated soil and debris.	Construction of an onsite repository for contaminated materials must meet designation requirements outlined in 40 CFR § 264.552(c)	40 CFR Part 264, Subpart S and 40 CFR § 264.552(c)	Relevant and appropriate	These rule may apply if an onsite repository is constructed to contain excavated mine waste piles, demolished building material, and mining equipment.
Hazardous Materials Transportation Act					
Off-site disposal	Requires special training and handling of materials designated as hazardous	Transportation of a materials identified as hazardous	49 CFR Parts 171-177 and 40 CFR Part 263	Potentially Applicable	Sets standards that apply to the transport of hazardous waste. Transportation of asbestos waste is covered under Parts 171 and 172; requires waste containment and shipping papers.
RCRA Subtitle C – Hazardous Waste Management					
Offsite disposal	Specifies hazardous waste identification, management, and disposal requirements.	If mine waste and soil are disposed of off site	42 USC § 6901 40 CFR Parts 260–279	Potentially Applicable	If off-site disposal is part of the selected alternative TCLP analysis will be conducted to determine if leachable components are present in waste material.
RCRA Subtitle D – Managing Municipal and Solid Waste					
Offsite disposal	Establishes guidelines for the management of nonhazardous solid waste.	If mine waste, soil, and building demolition material and mining equipment are disposed of off site	42 USC § 6901 40 CFR Parts 257 and 258	Potentially Applicable	Applicable if mine waste, soil, demolished building material, and other debris considered nonhazardous waste is hauled off site.

Notes:
ARARs = applicable or relevant and appropriate requirements
CAA = Clean Air Act
CAMU = Corrective Action Management Unit
CFR = Code of Federal Regulations
RCRA = Resource Conservation and Recovery Act
USC = United States Code
§ = Section

Table 12. Potential State Action-Specific ARARs

Action	Requirement	Prerequisite	Citation	Preliminary ARAR Determination	Comments and Compliance Measures
Arizona Mined Land Reclamation Statute and Regulations					
Site cleanup	Mined Land Reclamation – Public Safety Standards: Reclamation activities at mining units shall be designed to reduce hazards to the public.	Mining site	AAC § R11-2-601	Relevant and appropriate	Requirements related to the site's physical condition are not considered relevant for environmental cleanup under CERCLA, but are appropriate for any final action taken to reclaim the site.
Site restoration	Soil Conservation: Prior to disturbing soil in an area expected to be revegetated, soil as reasonably available from the area to support the stated revegetation will be conserved.	Mining site	ARS § 27-974	Relevant and appropriate	Onsite soil will be conserved to the maximum extent practical to regrade and revegetate the site.
Site cleanup	Mined Land Reclamation: Erosion Control and Topographic Contouring – Mining units shall be reclaimed to a stable condition for erosion and seismic activity. Grading and other topographic contour methods shall be conducted, as necessary, to establish final land forms, which are stable under static and dynamic conditions as certified by a qualified engineer considering seismic conditions and safety.	Mining site	AAC § R11-2-602	Relevant and appropriate	Regrading and recontouring is included in the alternatives.

Table 12. Potential State Action Specific ARARs *(continued)*

Action	Requirement	Prerequisite	Citation	Preliminary ARAR Determination	Comments and Compliance Measures
Arizona Mined Land Reclamation Statute and Regulations					
Site restoration	Revegetation: Where surface disturbances result in compaction of soil, ripping, discing, or other means shall be used in revegetated areas to reduce compaction and establish a suitable root zone. Revegetation shall be conducted to establish plant species to support the post-mining use. Vegetation shall be planted during a favorable season. Soil stabilization or irrigation measures may be used.	Mining site	AAC § R11-2-701-702	Relevant and appropriate	Revegetation shall occur in an appropriate manner.
Site restoration	Redistribution of Soil: Before redistribution of soil, the regraded land shall be treated if necessary to reduce the potential for slippage of the redistributed material or to enhance root penetration. Soil and other materials shall be redistributed in a manner that prevents excessive compaction and achieves a thickness consistent with approved post-mining use.	Mining site	AAC § R11-2-704	Relevant and appropriate	Regrading shall occur in an appropriate manner.

Notes:

AAC = Arizona Administrative Code

ARAR = applicable or relevant and appropriate requirement

CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act

§ = Section

Table 13. Screening of Potential General Response Actions and Technologies

Response Action	Technology and Process	Description	Screening Summary
1. No Action	None	None	Retained; required by CERCLA
2. Institutional Controls	▪ Legal and administrative mechanisms	▪ Closure order	Retained because: ▪ Protective of human health ▪ Effective, easily implementable
3. In-Situ Treatment	▪ In-situ mixing with binders ▪ Biologic treatment	▪ In-drum mixing with binding agents is used as a small-batch treatment for asbestos ▪ "Bioweathering" using fungi or lichen has been tested at the laboratory scale, but not used full scale	Not retained because: ▪ Small-batch mixing not practical ▪ Bioweathering not proven effective outside of laboratory; requires containerizing bio treatment so nonnative species are not introduced to the site
4. Engineering Controls	▪ Install signs at the site to warn of potential dangers and announce area closure ▪ Install fencing ▪ Road blocks ▪ Engineered repository or soil cap ▪ Close open adits ▪ Erosion controls	▪ Block roads to contaminated areas ▪ Install fences around accessible hazardous areas ▪ Excavate source material for placement in onsite repository ▪ Consolidate waste material in place ▪ Construct soil cap over repositories ▪ Seal adit openings or secure adits with bat closures	Retained because: ▪ Protective of human health and the environment ▪ Effective, easily implementable ▪ Meets RAOs
5. Offsite Disposal	▪ Remove source materials for disposal off site	▪ Excavate source materials ▪ Load source materials into dump trucks and transport to an offsite disposal facility	Retained because: ▪ Protective of human health and the environment ▪ Effective, easily implementable ▪ Meets RAOs

Notes: RAOs = remedial action objectives

Table 14. Comparative Analysis of Removal Action Alternatives

Evaluation Criteria	Alternative 1 No Action	Alternative 2 Institutional and Engineering Controls	Alternative 3A Excavation and Onsite Encapsulation of Source Materials from Subareas 1, 2, and 3	Alternative 3B Excavation and Onsite Encapsulation of Source Materials from Subareas 1 and 3, and Consolidation of Soil and Waste Materials and Cap In Place at Subarea 2	Alternative 4 Excavation and Offsite Disposal of Source Materials from Subareas 1, 2, and 3
Effectiveness	**Qualitative Ranking**				
Protection of Human Health and Environment	No	No	Yes	Yes	Yes
Compliance with ARARs and TBCs	NA	No	Yes	Yes	Yes
Long-Term Effectiveness	Low	Low	Moderate	Moderate	High
Short-Term Effectiveness	Low	Low	High	High	High
Achieves RAOs	No	No	Yes	Yes	Yes
Reduction of Toxicity, Mobility, and Volume through Treatment	Low	Low	Low	Low	Low
Implementability	**Qualitative Ranking**				
Technical Feasibility	High	High	High	High	Moderate
Administrative Feasibility	High	High	High	High	High
Availability of Services or Materials	NA	High	High	High	Moderate
Community and Regulatory Agency Acceptance	Low	Low	High	High	Moderate

Table 14. Comparative Analysis of Removal Action Alternatives *(continued)*

Evaluation Criteria	Alternative 1 No Action	Alternative 2 Institutional and Engineering Controls	Alternative 3A Excavation and Onsite Encapsulation of Source Materials from Subareas 1, 2, and 3	Alternative 3B Excavation and Onsite Encapsulation of Source Materials from Subareas 1 and 3, and Consolidation of Soil and Waste Materials and Cap In Place at Subarea 2	Alternative 4 Excavation and Offsite Disposal of Source Materials from Subareas 1, 2, and 3
Cost	**Removal Action Cost**				
Period of Analysis (Years)	30	30	30	30	30
Estimated Capital Cost	$0	$797,852	$1,289,593	$1,210,465	$13,580,792
Estimated Annual/Periodic Cost	$0	$319,200/$105,000	$478,800/$234,000	$547,200/$279,000	$478,800/$210,000
Estimated Total Cost	$0	$1,222,052	$2,002,393	$2,036,665	$14,269,592
Estimated Total Present Value of Alternative	$0	$1,110,932	$1,896,628	$1,817,501	$14,088,016
EE/CA Range (-30% / +50%)	$0	$777,653/$1,666,398	$1,327,640/$2,844,942	$1,272,250/$2,726,251	$9,861,611/$21,132,024

Notes:

ARARs = applicable or relevant and appropriate requirements

EE/CA = Engineering Evaluation/Cost Analysis

NA = not applicable

RAOs = removal action objectives

TBCs = To Be Considered

Appendix A. Photographic Log

Appendix A. Photographic Log

Photograph A-1: ATV Route 1 and location of soil sample (PA-ATV1-SS-05) residence in the background, looking north.
Phillips Asbestos Mine Site, Tonto National Forest, Gila County, Arizona
Photographed by: Christine Wang (ERRG) Date: June 15, 2012

Photograph A-2: Shed in Mine Camp, looking northwest.
Phillips Asbestos Mine Site, Tonto National Forest, Gila County, Arizona
Photographed by: Samantha Caruthers-Knight (ERRG) Date: June 16, 2012

Photograph A-3: Generator shed in Mine Camp, facing northwest.
Phillips Asbestos Mine Site, Tonto National Forest, Gila County, Arizona
Photographed by: Samantha Caruthers-Knight (ERRG) Date: June 16, 2012

Photograph A-4: View of generator in shed interior, looking southwest.
Phillips Asbestos Mine Site, Tonto National Forest, Gila County, Arizona
Photographed by: Samantha Caruthers-Knight (ERRG) Date: June 16, 2012

Photograph A-5: Residence in Mine Camp, looking southeast.
Phillips Asbestos Mine Site, Tonto National Forest, Gila County, Arizona
Photographed by: Samantha Caruthers-Knight (ERRG) Date: June 16, 2012

Photograph A-6: Mine Camp office building, looking south.
Phillips Asbestos Mine Site, Tonto National Forest, Gila County, Arizona
Photographed by: Samantha Caruthers-Knight (ERRG) Date: June 16, 2012

Appendix A. Photographic Log

Photograph A-7: Mine Camp dorm building, looking south.
Phillips Asbestos Mine Site, Tonto National Forest, Gila County, Arizona
Photographed by: Samantha Caruthers-Knight (ERRG) Date: June 16, 2012

Photograph A-8: Interior basement of Mine Camp dorm building, looking northeast. **Phillips Asbestos Mine Site, Tonto National Forest, Gila County, Arizona** Photographed by: Samantha Caruthers-Knight (ERRG) Date: June 16, 2012

Photograph A-9: Mine Camp dorm building, looking north.
Phillips Asbestos Mine Site, Tonto National Forest, Gila County, Arizona

Photographed by: Samantha Caruthers-Knight (ERRG) Date: June 16, 2012

Photograph A-10: Mine Camp shop building, looking north.
Phillips Asbestos Mine Site, Tonto National Forest, Gila County, Arizona
Photographed by: Samantha Caruthers-Knight (ERRG) Date: June 16, 2012

Photograph A-11: Mine Camp shop building, looking south.
Phillips Asbestos Mine Site, Tonto National Forest, Gila County, Arizona
Photographed by: Samantha Caruthers-Knight (ERRG) Date: June 16, 2012

Photograph A-12: Mine Camp chimney and foundation, looking northeast.
Phillips Asbestos Mine Site, Tonto National Forest, Gila County, Arizona Photographed by: Samantha Caruthers-Knight (ERRG) Date: June 16, 2012

Photograph A-13: Mill tailings material on top of the town mill foundation, looking east.
Phillips Asbestos Mine Site, Tonto National Forest, Gila County, Arizona
Photographed by: Samantha Caruthers-Knight (ERRG) Date: June 16, 2012

Photograph A-14: Mine Camp town mill foundation, looking southeast.
Phillips Asbestos Mine Site, Tonto National Forest, Gila County, Arizona Photographed by: Samantha Caruthers-Knight (ERRG) Date: June 16, 2012

Photograph A-15: Mine Camp pad/foundation east of the town mill with the dorm building in the background, looking southeast.
Phillips Asbestos Mine Site, Tonto National Forest, Gila County, Arizona
Photographed by: Samantha Caruthers-Knight (ERRG) Date: June 16, 2012

Photograph A-16: Mine Camp pad/foundation in southeast corner of the site, looking southeast.
Phillips Asbestos Mine Site, Tonto National Forest, Gila County, Arizona
Photographed by: Samantha Caruthers-Knight (ERRG) Date: June 16, 2012

Photograph A-17: Mine Camp debris pile with the residence in the background, looking southwest.
Phillips Asbestos Mine Site, Tonto National Forest, Gila County, Arizona
Photographed by: Samantha Caruthers-Knight (ERRG) Date: June 16, 2012

Photograph A-18: Mine Camp pit and collapsed shed. Possible outhouse, looking south.
Phillips Asbestos Mine Site, Tonto National Forest, Gila County, Arizona
Photographed by: Samantha Caruthers-Knight (ERRG) Date: June 16, 2012

Photograph A-19: Mine Camp dump area near the chimney, looking west.
Phillips Asbestos Mine Site, Tonto National Forest, Gila County, Arizona
Photographed by: Samantha Caruthers-Knight (ERRG) Date: June 16, 2012

Photograph A-20: Mine Camp pit, looking north.
Phillips Asbestos Mine Site, Tonto National Forest, Gila County, Arizona
Photographed by: Samantha Caruthers-Knight (ERRG) Date: June 16, 2012

Photograph A-21: Mine Camp metal tank, looking south.
Phillips Asbestos Mine Site, Tonto National Forest, Gila County, Arizona
Photographed by: Samantha Caruthers-Knight (ERRG) Date: June 16, 2012

Photograph A-22: View of disturbed ground near an abandoned vehicle location at the Mine Camp, looking north.
Phillips Asbestos Mine Site, Tonto National Forest, Gila County, Arizona
Photographed by: Samantha Caruthers-Knight (ERRG) Date: June 16, 2012

Photograph A-23: Mine Camp shooting area north of the pad/foundation looking north.
Phillips Asbestos Mine Site, Tonto National Forest, Gila County, Arizona
Photographed by: Samantha Caruthers-Knight (ERRG) Date: June 16, 2012

Photograph A-24: Modern poly tank in Mine Camp, facing northeast.
Phillips Asbestos Mine Site, Tonto National Forest, Gila County, Arizona
Photographed by: Samantha Caruthers-Knight (ERRG) Date: June 16, 2012

Photograph A-25: Mill Camp shed with groundwater well in the foreground, looking southwest.
Phillips Asbestos Mine Site, Tonto National Forest, Gila County, Arizona
Photographed by: Samantha Caruthers-Knight (ERRG) Date: June 17, 2012

Photograph A-26: Mine Camp groundwater well, looking west.
Phillips Asbestos Mine Site, Tonto National Forest, Gila County, Arizona
Photographed by: Samantha Caruthers-Knight (ERRG) Date: June 17, 2012

Photograph A-27: Mine Camp corral, looking southwest.
Phillips Asbestos Mine Site, Tonto National Forest, Gila County, Arizona
Photographed by: Samantha Caruthers-Knight (ERRG) Date: June 16, 2012

Photograph A-28: Mine Camp corral and remnants of concrete trough, looking northwest.
Phillips Asbestos Mine Site, Tonto National Forest, Gila County, Arizona
Photographed by: Samantha Caruthers-Knight (ERRG) Date: June 16, 2012

Photograph A-29: Mill Area metal pulley structure, looking east.
Phillips Asbestos Mine Site, Tonto National Forest, Gila County, Arizona
Photographed by: Christine Wang (ERRG) Date: June 17, 2012

Photograph A-30: Mill Area building and cable car pulley tower remnants, looking northwest.
Phillips Asbestos Mine Site, Tonto National Forest, Gila County, Arizona
Photographed by: Christine Wang (ERRG) Date: June 17, 2012

Photograph A-31: Interior of the northern section of the mill building in the Mill Area, looking south.
Phillips Asbestos Mine Site, Tonto National Forest, Gila County, Arizona
Photographed by: Christine Wang (ERRG) Date: June 17, 2012

Photograph A-32: Eastern section of the mill building in the Mill Area, looking west. **Phillips Asbestos Mine Site, Tonto National Forest, Gila County, Arizona** Photographed by: Christine Wang (ERRG) Date: June 17, 2012

Photograph A-33: Asbestos pile southeast of mill building in the Mill Area, looking west.
Phillips Asbestos Mine Site, Tonto National Forest, Gila County, Arizona
Photographed by: Christine Wang (ERRG) Date: June 17, 2012

Photograph A-34: Metal debris in the Mill Area, looking east.
Phillips Asbestos Mine Site, Tonto National Forest, Gila County, Arizona
Photographed by: Christine Wang (ERRG) Date: June 17, 2012

Photograph A-35: Soil and debris in the Mill Area, looking east.
Phillips Asbestos Mine Site, Tonto National Forest, Gila County, Arizona
Photographed by: Christine Wang (ERRG) Date: June 17, 2012

Photograph A-36: Asbestos and debris piles in the Mill Area to the east of mill building looking west.
Phillips Asbestos Mine Site, Tonto National Forest, Gila County, Arizona
Photographed by: Christine Wang (ERRG) Date: June 17, 2012

Photograph A-37: Asbestos piles in the southwest corner of the Mill Area, adjacent to the trail looking south.
Phillips Asbestos Mine Site, Tonto National Forest, Gila County, Arizona
Photographed by: Christine Wang (ERRG) Date: June 17, 2012

Photograph A-38: Metal bin trailer in the Mill Area looking north.
Phillips Asbestos Mine Site, Tonto National Forest, Gila County, Arizona
Photographed by: Christine Wang (ERRG) Date: June 17, 2012

Photograph A-39: View of the Mill Area from Mill Road, looking east. A waste pile and the corner of the mill building can be seen from the center to the left of the photograph.
Phillips Asbestos Mine Site, Tonto National Forest, Gila County, Arizona
Photographed by: Christine Wang (ERRG) Date: June 15, 2012

Photograph A-40: View of the Mill Area from end of Mill Road, looking north. **Phillips Asbestos Mine Site, Tonto National Forest, Gila County, Arizona** Photographed by: Christine Wang (ERRG) Date: June 15, 2012

Photograph A-41: Upper Workings Adit 1 opening, looking west.
Phillips Asbestos Mine Site, Tonto National Forest, Gila County, Arizona
Photographed by: Samantha Caruthers-Knight (ERRG) Date: June 18, 2012

Photograph A-42: Upper Workings Adit 2, looking northwest.
Phillips Asbestos Mine Site, Tonto National Forest, Gila County, Arizona
Photographed by: Samantha Caruthers-Knight (ERRG) Date: June 18, 2012

Photograph A-43: Upper Workings Adit 2A, looking north.
Phillips Asbestos Mine Site, Tonto National Forest, Gila County, Arizona
Photographed by: Samantha Caruthers-Knight (ERRG) Date: June 18, 2012

Photograph A-44: Upper Workings Adit 3, looking south.
Phillips Asbestos Mine Site, Tonto National Forest, Gila County, Arizona
Photographed by: Samantha Caruthers-Knight (ERRG) Date: June 18, 2012

Photograph A-45: Upper Workings Adit 3, looking southwest.
Phillips Asbestos Mine Site, Tonto National Forest, Gila County, Arizona
Photographed by: Samantha Caruthers-Knight (ERRG) Date: June 18, 2012

Photograph A-46: Upper Workings Adit 4 opening, looking north.
Phillips Asbestos Mine Site, Tonto National Forest, Gila County, Arizona
Photographed by: Samantha Caruthers-Knight (ERRG) Date: June 18, 2012

Photograph A-47: Upper Workings Adit 5, partially collapsed, looking east.
Phillips Asbestos Mine Site, Tonto National Forest, Gila County, Arizona Photographed by: Samantha Caruthers-Knight (ERRG) Date: June 18, 2012

Photograph A-48: Upper Workings Adit 6 opening, looking southeast.
Phillips Asbestos Mine Site, Tonto National Forest, Gila County, Arizona
Photographed by: Samantha Caruthers-Knight (ERRG) Date: June 18, 2012

Photograph A-49: Upper Workings Adit 6 opening, looking northeast.
Phillips Asbestos Mine Site, Tonto National Forest, Gila County, Arizona
Photographed by: Samantha Caruthers-Knight (ERRG) Date: June 18, 2012

Photograph A-50: Upper Workings Adit 7 opening, looking west.
Phillips Asbestos Mine Site, Tonto National Forest, Gila County, Arizona
Photographed by: Samantha Caruthers-Knight (ERRG) Date: June 18, 2012

Photograph A-51: Upper Workings Adit 7 opening, looking west.
Phillips Asbestos Mine Site, Tonto National Forest, Gila County, Arizona
Photographed by: Samantha Caruthers-Knight (ERRG) Date: June 18, 2012

Photograph A-52: Interior of Upper Workings Adit 7, looking west.
Phillips Asbestos Mine Site, Tonto National Forest, Gila County, Arizona
Photographed by: Samantha Caruthers-Knight (ERRG) Date: June 18, 2012

Photograph A-53: Upper Workings Adit 8 opening, looking west.
Phillips Asbestos Mine Site, Tonto National Forest, Gila County, Arizona
Photographed by: Samantha Caruthers-Knight (ERRG) Date: June 18, 2012

Photograph A-54: Upper Workings Adit 9 opening, looking east.
Phillips Asbestos Mine Site, Tonto National Forest, Gila County, Arizona
Photographed by: Samantha Caruthers-Knight (ERRG) Date: June 18, 2012

Photograph A-55: Upper Workings Adit 10 opening, looking east.
Phillips Asbestos Mine Site, Tonto National Forest, Gila County, Arizona
Photographed by: Samantha Caruthers-Knight (ERRG) Date: June 18, 2012

Photograph A-56: Upper Workings Adit 11 opening, looking east.
Phillips Asbestos Mine Site, Tonto National Forest, Gila County, Arizona
Photographed by: Samantha Caruthers-Knight (ERRG) Date: June 18, 2012

Photograph A-57: Upper Workings Adit 12 opening, looking east.
Phillips Asbestos Mine Site, Tonto National Forest, Gila County, Arizona
Photographed by: Samantha Caruthers-Knight (ERRG) Date: June 18, 2012

Photograph A-58: Upper Workings Area, Test Pit , looking east.
Phillips Asbestos Mine Site, Tonto National Forest, Gila County, Arizona
Photographed by: Samantha Caruthers-Knight (ERRG) Date: June 18, 2012

Photograph A-59: Upper Workings Area waste rock pile from Upper Workings Adit 1, looking west.
Phillips Asbestos Mine Site, Tonto National Forest, Gila County, Arizona
Photographed by: Samantha Caruthers-Knight (ERRG) Date: June 18, 2012

Photograph A-60: Waste pile from Upper Workings Adit 2, looking north.
Phillips Asbestos Mine Site, Tonto National Forest, Gila County, Arizona Photographed by: Samantha Caruthers-Knight (ERRG) Date: June 18, 2012

Photograph A-61: Possible Adit 3 waste rock at the Upper Workings Area, looking east.
Phillips Asbestos Mine Site, Tonto National Forest, Gila County, Arizona
Photographed by: Samantha Caruthers-Knight (ERRG) Date: June 18, 2012

Photograph A-62: Upper Workings Area closeup of a waste rock specimen.
Phillips Asbestos Mine Site, Tonto National Forest, Gila County, Arizona Photographed by: Samantha Caruthers-Knight (ERRG) Date: June 18, 2012

Photograph A-63: Upper Workings Adit 4 waste pile, looking south.
Phillips Asbestos Mine Site, Tonto National Forest, Gila County, Arizona
Photographed by: Samantha Caruthers-Knight (ERRG) Date: June 18, 2012

Photograph A-64: View from the Upper Workings Area adits (5-8) access road, looking north.
Phillips Asbestos Mine Site, Tonto National Forest, Gila County, Arizona
Photographed by: Tanner Bennett (ERRG) Date: June 18, 2012

Photograph A-65: View of large waste rock piles below Upper Workings Area adits, looking northeast.
Phillips Asbestos Mine Site, Tonto National Forest, Gila County, Arizona
Photographed by: Tanner Bennett (ERRG) Date: June 18, 2012

Photograph A-66: Upper Workings Area waste rock pond area, looking south. **Phillips Asbestos Mine Site, Tonto National Forest, Gila County, Arizona** Photographed by: Tanner Bennett (ERRG) Date: June 19, 2012

Photograph A-67: View of accessible Lower Workings adit across the tributary from the Mill Area,looking west.
Phillips Asbestos Mine Site, Tonto National Forest, Gila County, Arizona
Photographed by: Christine Wang (ERRG) Date: June 15, 2012

Photograph A-68: Accessible Lower Workings adit, looking west.
Phillips Asbestos Mine Site, Tonto National Forest, Gila County, Arizona
Photographed by: Tanner Bennett (ERRG) Date: June 19, 2012

Photograph A-69: Phillips Canyon Workings Adit 2 opening, looking southeast. **Phillips Asbestos Mine Site, Tonto National Forest, Gila County, Arizona** Photographed by: Tanner Bennett (ERRG) Date: June 19, 2012

Photograph A-70: Side view of Phillips Canyon Workings Area waste rock pile looking east. **Phillips Asbestos Mine Site, Tonto National Forest, Gila County, Arizona**
Photographed by: Tanner Bennett (ERRG) Date: June 19, 2012

Photograph A-71: Top of Phillips Canyon Workings Area waste rock pile, looking north.
Phillips Asbestos Mine Site, Tonto National Forest, Gila County, Arizona
Photographed by: Tanner Bennett (ERRG) Date: June 19, 2012

Photograph A-72: Side view of large waste rock pile at the Phillips Canyon Workings Area, looking west.
Phillips Asbestos Mine Site, Tonto National Forest, Gila County, Arizona
Photographed by: Tanner Bennett (ERRG) Date: June 19, 2012

Photograph A-73: Large waste rock pile below Phillips Canyon Workings Adit 2, continues to the bottom of the canyon, looking northwest.
Phillips Asbestos Mine Site, Tonto National Forest, Gila County, Arizona
Photographed by: Tanner Bennett (ERRG) Date: June 19, 2012

Photograph A-74: View of the Mill Area, Phillips Canyon Workings Area, and cable building at the lookout area from near Upper Workings Adit 2, looking south. **Phillips Asbestos Mine Site, Tonto National Forest, Gila County, Arizona** Photographed by: Samantha Caruthers-Knight (ERRG) Date: June 18, 2012

Photograph A-75: Mine debris near the Phillips Canyon Workings Area piles, looking east.
Phillips Asbestos Mine Site, Tonto National Forest, Gila County, Arizona
Photographed by: Christine Wang (ERRG) Date: June 19, 2012

Photograph A-76: Pulley cable from Phillips Canyon Workings Adit 2 to a structure above, looking south.
Phillips Asbestos Mine Site, Tonto National Forest, Gila County, Arizona
Photographed by: Tanner Bennett (ERRG) Date: June 19, 2012

Photograph A-77: Foundation, pulley structure remnants, and pulley cable by Phillips Canyon Workings Adit 2, looking northeast.
Phillips Asbestos Mine Site, Tonto National Forest, Gila County, Arizona
Photographed by: Tanner Bennett (ERRG) Date: June 19, 2012

Photograph A-78: Corner of the foundation for the pulley structure at the Phillips Canyon Workings Area, looking north.
Phillips Asbestos Mine Site, Tonto National Forest, Gila County, Arizona
Photographed by: Tanner Bennett (ERRG) Date: June 19, 2012

Photograph A-79: Metal debris downslope of the pulley structure foundation at the Phillips Canyon Workings Area, looking northwest.
Phillips Asbestos Mine Site, Tonto National Forest, Gila County, Arizona
Photographed by: Tanner Bennett (ERRG) Date: June 19, 2012

Photograph A-80: Metal debris down the trail, west of Phillips Canyon Workings Adit 2, looking west.
Phillips Asbestos Mine Site, Tonto National Forest, Gila County, Arizona
Photographed by: Tanner Bennett (ERRG) Date: June 19, 2012

Photograph A-81: Pad/foundation and metal debris down the trail, west of Phillips Canyon Workings Adit 2, looking northeast.
Phillips Asbestos Mine Site, Tonto National Forest, Gila County, Arizona
Photographed by: Tanner Bennett (ERRG) Date: June 19, 2012

Photograph A-82: View of the Phillips Canyon Workings Area waste piles from the Upper Workings Area, looking east.
Phillips Asbestos Mine Site, Tonto National Forest, Gila County, Arizona
Photographed by: Tanner Bennett (ERRG) Date: June 18, 2012

Photograph A-83: View of the mill tributary background sediment sample site, looking west.
Phillips Asbestos Mine Site, Tonto National Forest, Gila County, Arizona
Photographed by: Christine Wang (ERRG) Date: June 15, 2012

Photograph A-84: ATV Route 2 and location of soil sample 2 (PA-ATV1-SS-02), looking west.
Phillips Asbestos Mine Site, Tonto National Forest, Gila County, Arizona
Photographed by: Christine Wang (ERRG) Date: June 15, 2012

Photograph A-85: "Marker NE-E1" at Mine Camp, looking northwest.
Phillips Asbestos Mine Site, Tonto National Forest, Gila County, Arizona
Photographed by: Christine Wang (ERRG) Date: June 15, 2012

Photograph A-86: ATV Route 1 and location of soil sample (PA-ATV1-SS-07), looking northwest.
Phillips Asbestos Mine Site, Tonto National Forest, Gila County, Arizona
Photographed by: Christine Wang (ERRG) Date: June 15, 2012

Photograph A-87: Location of upper tributary sediment sample, looking south.
Phillips Asbestos Mine Site, Tonto National Forest, Gila County, Arizona
Photographed by: Samantha Caruthers-Knight (ERRG)Date: June 16, 2012

Photograph A-88: PA-ATV2-SS-06 sample location, looking north.
Phillips Asbestos Mine Site, Tonto National Forest, Gila County, Arizona
Photographed by: Samantha Caruthers-Knight (ERRG) Date: June 16, 2012

Photograph A-89: PA-ATV2-SS-08 sample location, looking northeast.
Phillips Asbestos Mine Site, Tonto National Forest, Gila County, Arizona Photographed by: Samantha Caruthers-Knight (ERRG) Date: June 16, 2012

Photograph A-90: PA-ATV2-SS-09 sample location, looking east.
Phillips Asbestos Mine Site, Tonto National Forest, Gila County, Arizona
Photographed by: Samantha Caruthers-Knight (ERRG) Date: June 16, 2012

Photograph A-91: Mill Area from the Upper Workings Area, looking east.
Phillips Asbestos Mine Site, Tonto National Forest, Gila County, Arizona Photographed by: Tanner Bennett (ERRG) Date: June 18, 2012

Appendix B. Summary of Previous Sample Results

Table B-1. Asbestos Sampling Results from 2008 Removal Preliminary Assessment Report

Sample ID	Description	Result	NESHAPS
MINE CAMP			
Building A – Shop			
PA-MC-A01	Shingle	5-10%	Cat I non-friable ACM
PA-MC-A02	Floor Tile, Basement Room		
	Layer #1 off-white, floor tile	<=1%	
	Layer #2 black, mastic	2-5%	Cat I non-friable ACM
PA-MC-A03	Ceiling Material, Basement Room		
	Layer #1 gray, paint	0	Cat I non-friable ACM
	Layer #2 off-white panel	50-60%	Friable RACM
Building B – Dorm			
PA-MC-B04	Roof Felt – All Over Ground	0	
PA-MC-B05	Wallboard, white panel	30-40%	Friable RACM
PA-MC-B06	Pile on Floor		
	Layer #1 white, drywall core	0	
	Layer #2 black, roof ply	0	
Building C – Town Mill Slab			
PA-MC-C07	Pile of Tile/Shingles, white drywall core	0	
PA-MC-C08	Clumped Fibers, off-white insulation	70-80%	Friable RACM
PA-MC-C09	Soil in Center of Mill, brown soil	0	
Building D – Residence			
PA-MC-D10	Stucco, exterior		
	Layer #1 off-white stucco	10-20%	Friable RACM
	Layer #2 off-white panel	50-60%	Friable RACM
PA-MC-D11	Ceiling Board, Matches Walls		
	Layer #1 off-white plaster	>1-2%	Friable RACM
	Layer #2 off-white panel	50-60%	Friable RACM

Table B-1. Asbestos Sampling Results from 2008 Removal Preliminary Assessment Report *(continued)*

Sample ID	Description	Result	NESHAPS
MINE CAMP *(continued)*			
Building D – Residence *(continued)*			
PA-MC-D12	Roof Shingles gray cement/asbestos board	5-10%	Cat II ACM
Building F – Shop			
PA-MC-F13	Pile On Slab (1/3 cy) off-white debris	0	
Building G – Office			
PA-MC-G14	Debris on floor, white panel	30-40%	Friable RACM
PA-MC-G15	Exterior Wall, white stucco	10-20%	Friable RACM
MILL SITE			
PA-MS-001	Tailings on road above south of building	2-5%	NB
PA-MS-002	Residue in building on shelves and floor	30-40%	Friable RACM
PA-MS-003	Tailings below building	10-20%	NB
PA-MS-004	Tailings below building near lower edge In small surface drainage	≤1%	

Notes: All data from: Forest Service, 2009. "Removal Preliminary Assessment Report, Phillips Asbestos Mine, Mill, and Mine Camp." September.

AZ SRL = No soil remediation level set by Arizona Department of Equality

MC = mine camp

MS = mill site

NB = not a building material

PA = Phillips Asbestos

Appendix C. Laboratory Analytical Results for EE/CA Sampling

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

4625 East Cotton Center Blvd. Ste 189, Phoenix, AZ 85040 (602) 437-3340 Fax:(602) 454-9303

LABORATORY REPORT

Prepared For: Engineering/Remediation Resources Group, Inc.
4585 Pacheco Blvd.
Martinez, CA 94553-2233
Attention: Samantha Caruthers-Knight

Project: 2011-149

Sampled: 06/15/12-06/19/12
Received: 06/20/12
Issued: 06/30/12 11:23

NELAP #01109CA / AZ100001 Arizona DHS#AZ0728

The results listed within this Laboratory Report pertain only to the samples tested in the laboratory. The analyses contained in this report were performed in accordance with the applicable certifications as noted. All soil samples are reported on a wet weight basis unless otherwise noted in the report. This Laboratory Report is confidential and is intended for the sole use of TestAmerica and its client. This report shall not be reproduced, except in full, without written permission from TestAmerica. The Chain of Custody, 1 page, is included and is an integral part of this report.
This entire report was reviewed and approved for release.

CASE NARRATIVE

LABORATORY ID	CLIENT ID	MATRIX
PVF1519-01	PA-MT-SD-01	Soil
PVF1519-02	PA-ATV1-SS-01	Soil
PVF1519-03	PA-ATV2-SS-01	Soil
PVF1519-04	PA-MC-SS-01	Soil
PVF1519-05	PA-MA-SS-01	Soil
PVF1519-06	PA-MC-GW-01	Water
PVF1519-07	PA-MC-GW-01	Water
PVF1519-08	PA-MT-SW-01	Water
PVF1519-09	PA-MT-SW-01	Water
PVF1519-10	PA-VW-SS-01	Soil
PVF1519-11	PA-VW-WP-08	Soil
PVF1519-12	PA-BG-SS-01	Soil
PVF1519-13	PA-PC-WP-01	Soil
PVF1519-14	PA-PT-SD-01	Soil

TestAmerica Phoenix

Denise Harrington
Project Manager

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SAMPLE RECEIPT:	Samples were received intact, at 2°C, on ice and with chain of custody documentation.
HOLDING TIMES:	All samples were analyzed within prescribed holding times and/or in accordance with the TestAmerica Sample Acceptance Policy unless otherwise noted in the report.
PRESERVATION:	Samples requiring preservation were verified prior to sample analysis.
QA/QC CRITERIA:	All analyses met method criteria, except as noted in the report with data qualifiers.
	N1 = The RPD exceeded the acceptance limit due to sample matrix effects.
COMMENTS:	No significant observations were made.
SUBCONTRACTED:	No analyses were subcontracted to an outside laboratory.

Reviewed By:

Denise Harrington

TestAmerica Phoenix

Denise Harrington
Project Manager

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Engineering/Remediation Resources Group, Inc.
4585 Pacheco Blvd.
Martinez, CA 94553-2233
Attention: Samantha Caruthers-Knight

Project ID: 2011-149
Report Number: PVF1519

Sampled: 06/15/12-06/19/12
Received: 06/20/12

EXTRACTABLE FUEL HYDROCARBONS (EPA 3510/8015D)

Analyte	Method	Batch	Reporting Limit	Sample Result	Dilution Factor	Date Extracted	Date Analyzed	Data Qualifiers
Sample ID: PVF1519-06 (PA-MC-GW-01 - Water)					**Sampled: 06/17/12**			
Reporting Units: mg/l								
Extractable Fuel Hydrocarbons (C10 - C32)	EPA 8015D	12F0919	0.10	ND	1	6/23/2012	6/27/2012	
Surrogate : o-terphenyl (37-140%)				*79 %*				

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Project ID: 2011-149
Report Number: PVF1519

Sampled: 06/15/12-06/19/12
Received: 06/20/12

EXTRACTABLE FUEL HYDROCARBONS (ADHS 8015AZR1)

Analyte	Method	Batch	Reporting Limit	Sample Result	Dilution Factor	Date Extracted	Date Analyzed	Data Qualifiers
Sample ID: PVF1519-04 (PA-MC-SS-01 - Soil)					**Sampled: 06/16/12**			
Reporting Units: mg/kg								
DRO (C10-C22)	8015AZ R.1	12F1087	30	ND	0.992	6/27/2012	6/28/2012	
ORO (C22-C32)	8015AZ R.1	12F1087	100	**400**	0.992	6/27/2012	6/28/2012	
Total (C10-C32)	8015AZ R.1	12F1087	130	**400**	0.992	6/27/2012	6/28/2012	
Surrogate: o-terphenyl (70-130%)				*103 %*				

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Project ID: 2011-149
Report Number: PVF1519

Sampled: 06/15/12-06/19/12
Received: 06/20/12

TOTAL METALS

Analyte	Method	Batch	Reporting Limit	Sample Result	Dilution Factor	Date Extracted	Date Analyzed	Data Qualifiers
Sample ID: PVF1519-01 (PA-MT-SD-01 - Soil)				**Sampled: 06/15/12**				
Reporting Units: mg/kg								
Arsenic	EPA 6010B	12F0983	5.0	ND	0.98	6/26/2012	6/27/2012	
Barium	EPA 6010B	12F0983	5.0	**93**	0.98	6/26/2012	6/27/2012	
Cadmium	EPA 6010B	12F0983	0.50	ND	0.98	6/26/2012	6/27/2012	
Chromium	EPA 6010B	12F0983	2.0	**69**	0.98	6/26/2012	6/27/2012	
Cobalt	EPA 6010B	12F0983	2.0	**24**	0.98	6/26/2012	6/27/2012	
Copper	EPA 6010B	12F0983	5.0	**27**	0.98	6/26/2012	6/27/2012	
Lead	EPA 6010B	12F0983	5.0	**6.9**	0.98	6/26/2012	6/27/2012	
Magnesium	EPA 6010B	12F0983	25	**5800**	0.98	6/26/2012	6/27/2012	
Manganese	EPA 6010B	12F0983	2.0	**410**	0.98	6/26/2012	6/27/2012	
Mercury	EPA 7471A	12F1001	0.10	ND	1.03	6/28/2012	6/28/2012	
Nickel	EPA 6010B	12F0983	2.0	**33**	0.98	6/26/2012	6/27/2012	
Selenium	EPA 6010B	12F0983	5.0	ND	0.98	6/26/2012	6/27/2012	
Zinc	EPA 6010B	12F0983	10	**40**	0.98	6/26/2012	6/27/2012	
Sample ID: PVF1519-02 (PA-ATV1-SS-01 - Soil)				**Sampled: 06/15/12**				
Reporting Units: mg/kg								
Arsenic	EPA 6010B	12F0983	5.0	ND	0.98	6/26/2012	6/27/2012	
Barium	EPA 6010B	12F0983	5.0	**83**	0.98	6/26/2012	6/27/2012	
Cadmium	EPA 6010B	12F0983	0.50	ND	0.98	6/26/2012	6/27/2012	
Chromium	EPA 6010B	12F0983	2.0	**30**	0.98	6/26/2012	6/27/2012	
Cobalt	EPA 6010B	12F0983	2.0	**26**	0.98	6/26/2012	6/27/2012	
Copper	EPA 6010B	12F0983	5.0	**47**	0.98	6/26/2012	6/27/2012	
Lead	EPA 6010B	12F0983	5.0	**10**	0.98	6/26/2012	6/27/2012	
Magnesium	EPA 6010B	12F0983	250	**47000**	9.8	6/26/2012	6/28/2012	
Manganese	EPA 6010B	12F0983	2.0	**360**	0.98	6/26/2012	6/27/2012	
Mercury	EPA 7471A	12F1001	0.10	ND	0.938	6/28/2012	6/28/2012	
Nickel	EPA 6010B	12F0983	2.0	**43**	0.98	6/26/2012	6/27/2012	
Selenium	EPA 6010B	12F0983	5.0	ND	0.98	6/26/2012	6/27/2012	
Zinc	EPA 6010B	12F0983	10	**69**	0.98	6/26/2012	6/27/2012	

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Engineering/Remediation Resources Group, Inc.
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Attention: Samantha Caruthers-Knight

Project ID: 2011-149
Report Number: PVF1519

Sampled: 06/15/12-06/19/12
Received: 06/20/12

TOTAL METALS

Analyte	Method	Batch	Reporting Limit	Sample Result	Dilution Factor	Date Extracted	Date Analyzed	Data Qualifiers
Sample ID: PVF1519-03 (PA-ATV2-SS-01 - Soil)					**Sampled: 06/15/12**			
Reporting Units: mg/kg								
Arsenic	EPA 6010B	12F0983	5.0	ND	0.99	6/26/2012	6/27/2012	
Barium	EPA 6010B	12F0983	5.0	**98**	0.99	6/26/2012	6/27/2012	
Cadmium	EPA 6010B	12F0983	0.50	ND	0.99	6/26/2012	6/27/2012	
Chromium	EPA 6010B	12F0983	2.0	**62**	0.99	6/26/2012	6/27/2012	
Cobalt	EPA 6010B	12F0983	2.0	**32**	0.99	6/26/2012	6/27/2012	
Copper	EPA 6010B	12F0983	5.0	**53**	0.99	6/26/2012	6/27/2012	
Lead	EPA 6010B	12F0983	5.0	**10**	0.99	6/26/2012	6/27/2012	
Magnesium	EPA 6010B	12F0983	25	**9100**	0.99	6/26/2012	6/27/2012	
Manganese	EPA 6010B	12F0983	2.0	**560**	0.99	6/26/2012	6/27/2012	
Mercury	EPA 7471A	12F1001	0.10	ND	1.03	6/28/2012	6/28/2012	
Nickel	EPA 6010B	12F0983	2.0	**46**	0.99	6/26/2012	6/27/2012	
Selenium	EPA 6010B	12F0983	5.0	ND	0.99	6/26/2012	6/27/2012	
Zinc	EPA 6010B	12F0983	10	**62**	0.99	6/26/2012	6/27/2012	
Sample ID: PVF1519-04 (PA-MC-SS-01 - Soil)					**Sampled: 06/16/12**			
Reporting Units: mg/kg								
Arsenic	EPA 6010B	12F0983	5.0	**9.7**	0.98	6/26/2012	6/27/2012	
Barium	EPA 6010B	12F0983	5.0	**73**	0.98	6/26/2012	6/27/2012	
Cadmium	EPA 6010B	12F0983	0.50	**0.90**	0.98	6/26/2012	6/27/2012	
Chromium	EPA 6010B	12F0983	2.0	**72**	0.98	6/26/2012	6/27/2012	
Cobalt	EPA 6010B	12F0983	2.0	**34**	0.98	6/26/2012	6/27/2012	
Copper	EPA 6010B	12F0983	5.0	**56**	0.98	6/26/2012	6/27/2012	
Lead	EPA 6010B	12F0983	5.0	**93**	0.98	6/26/2012	6/27/2012	
Magnesium	EPA 6010B	12F0983	25	**15000**	0.98	6/26/2012	6/27/2012	
Manganese	EPA 6010B	12F0983	2.0	**530**	0.98	6/26/2012	6/27/2012	
Mercury	EPA 7471A	12F1001	0.11	ND	1.11	6/28/2012	6/28/2012	
Nickel	EPA 6010B	12F0983	2.0	**43**	0.98	6/26/2012	6/27/2012	
Selenium	EPA 6010B	12F0983	5.0	ND	0.98	6/26/2012	6/27/2012	
Zinc	EPA 6010B	12F0983	10	**340**	0.98	6/26/2012	6/27/2012	

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Engineering/Remediation Resources Group, Inc.
4585 Pacheco Blvd.
Martinez, CA 94553-2233
Attention: Samantha Caruthers-Knight

Project ID: 2011-149
Report Number: PVF1519

Sampled: 06/15/12-06/19/12
Received: 06/20/12

TOTAL METALS

Analyte	Method	Batch	Reporting Limit	Sample Result	Dilution Factor	Date Extracted	Date Analyzed	Data Qualifiers
Sample ID: PVF1519-05 (PA-MA-SS-01 - Soil)					**Sampled: 06/17/12**			
Reporting Units: mg/kg								
Arsenic	EPA 6010B	12F0983	5.0	**9.5**	0.99	6/26/2012	6/27/2012	
Barium	EPA 6010B	12F0983	5.0	**37**	0.99	6/26/2012	6/27/2012	
Cadmium	EPA 6010B	12F0983	0.50	ND	0.99	6/26/2012	6/27/2012	
Chromium	EPA 6010B	12F0983	2.0	**17**	0.99	6/26/2012	6/27/2012	
Cobalt	EPA 6010B	12F0983	2.0	**7.9**	0.99	6/26/2012	6/27/2012	
Copper	EPA 6010B	12F0983	5.0	**19**	0.99	6/26/2012	6/27/2012	
Lead	EPA 6010B	12F0983	5.0	**7.4**	0.99	6/26/2012	6/27/2012	
Magnesium	EPA 6010B	12F0983	250	**150000**	9.9	6/26/2012	6/28/2012	
Manganese	EPA 6010B	12F0983	2.0	**400**	0.99	6/26/2012	6/27/2012	
Mercury	EPA 7471A	12F1001	0.10	ND	0.938	6/28/2012	6/28/2012	
Nickel	EPA 6010B	12F0983	2.0	**13**	0.99	6/26/2012	6/27/2012	
Selenium	EPA 6010B	12F0983	5.0	ND	0.99	6/26/2012	6/27/2012	
Zinc	EPA 6010B	12F0983	10	**190**	0.99	6/26/2012	6/27/2012	
Sample ID: PVF1519-06 (PA-MC-GW-01 - Water)					**Sampled: 06/17/12**			
Reporting Units: mg/l								
Arsenic	EPA 200.7	12F0929	0.10	ND	1	6/24/2012	6/25/2012	
Barium	EPA 200.7	12F0929	0.010	**0.014**	1	6/24/2012	6/25/2012	
Cadmium	EPA 200.7	12F0929	0.0010	ND	1	6/24/2012	6/25/2012	
Chromium	EPA 200.7	12F0929	0.010	ND	1	6/24/2012	6/25/2012	
Cobalt	EPA 200.7	12F0929	0.040	ND	1	6/24/2012	6/25/2012	
Copper	EPA 200.7	12F0929	0.010	ND	1	6/24/2012	6/25/2012	
Hardness, Total	SM2340B	[CALC]	8.2	**120**	1	6/24/2012	6/25/2012	
Lead	EPA 200.7	12F0929	0.015	ND	1	6/24/2012	6/25/2012	
Magnesium	EPA 200.7	12F0929	2.0	**28**	1	6/24/2012	6/25/2012	
Manganese	EPA 200.7	12F0929	0.010	**0.18**	1	6/24/2012	6/25/2012	
Mercury	EPA 245.1	12F1003	0.00020	ND	1	6/27/2012	6/27/2012	
Nickel	EPA 200.7	12F0929	0.010	ND	1	6/24/2012	6/25/2012	
Selenium	EPA 200.7	12F0929	0.10	ND	1	6/24/2012	6/25/2012	
Zinc	EPA 200.7	12F0929	0.050	ND	1	6/24/2012	6/25/2012	

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Attention: Samantha Caruthers-Knight

Project ID: 2011-149
Report Number: PVF1519

Sampled: 06/15/12-06/19/12
Received: 06/20/12

TOTAL METALS

Analyte	Method	Batch	Reporting Limit	Sample Result	Dilution Factor	Date Extracted	Date Analyzed	Data Qualifiers
Sample ID: PVF1519-08 (PA-MT-SW-01 - Water)					**Sampled: 06/17/12**			
Reporting Units: mg/l								
Arsenic	EPA 200.7	12F0929	0.10	ND	1	6/24/2012	6/25/2012	
Barium	EPA 200.7	12F0929	0.010	**0.13**	1	6/24/2012	6/25/2012	
Cadmium	EPA 200.7	12F0929	0.0010	ND	1	6/24/2012	6/25/2012	
Chromium	EPA 200.7	12F0929	0.010	ND	1	6/24/2012	6/25/2012	
Cobalt	EPA 200.7	12F0929	0.040	ND	1	6/24/2012	6/25/2012	
Copper	EPA 200.7	12F0929	0.010	**0.011**	1	6/24/2012	6/25/2012	
Hardness, Total	SM2340B	[CALC]	8.2	**460**	1	6/24/2012	6/25/2012	
Lead	EPA 200.7	12F0929	0.015	ND	1	6/24/2012	6/25/2012	
Magnesium	EPA 200.7	12F0929	2.0	**110**	1	6/24/2012	6/25/2012	
Manganese	EPA 200.7	12F0929	0.010	**0.37**	1	6/24/2012	6/25/2012	
Mercury	EPA 245.1	12F1003	0.00020	ND	1	6/27/2012	6/27/2012	
Nickel	EPA 200.7	12F0929	0.010	ND	1	6/24/2012	6/25/2012	
Selenium	EPA 200.7	12F0929	0.10	ND	1	6/24/2012	6/25/2012	
Zinc	EPA 200.7	12F0929	0.050	ND	1	6/24/2012	6/25/2012	
Sample ID: PVF1519-10 (PA-VW-SS-01 - Soil)					**Sampled: 06/18/12**			
Reporting Units: mg/kg								
Arsenic	EPA 6010B	12F0983	5.0	ND	0.962	6/26/2012	6/27/2012	
Barium	EPA 6010B	12F0983	5.0	**35**	0.962	6/26/2012	6/27/2012	
Cadmium	EPA 6010B	12F0983	0.50	ND	0.962	6/26/2012	6/27/2012	
Chromium	EPA 6010B	12F0983	2.0	**16**	0.962	6/26/2012	6/27/2012	
Cobalt	EPA 6010B	12F0983	2.0	**29**	0.962	6/26/2012	6/27/2012	
Copper	EPA 6010B	12F0983	5.0	**67**	0.962	6/26/2012	6/27/2012	
Lead	EPA 6010B	12F0983	5.0	ND	0.962	6/26/2012	6/27/2012	
Magnesium	EPA 6010B	12F0983	25	**9300**	0.962	6/26/2012	6/27/2012	
Manganese	EPA 6010B	12F0983	2.0	**310**	0.962	6/26/2012	6/27/2012	
Mercury	EPA 7471A	12F1001	0.10	ND	0.968	6/28/2012	6/28/2012	
Nickel	EPA 6010B	12F0983	2.0	**33**	0.962	6/26/2012	6/27/2012	
Selenium	EPA 6010B	12F0983	5.0	ND	0.962	6/26/2012	6/27/2012	
Zinc	EPA 6010B	12F0983	10	**47**	0.962	6/26/2012	6/27/2012	

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Attention: Samantha Caruthers-Knight

Project ID: 2011-149
Report Number: PVF1519

Sampled: 06/15/12-06/19/12
Received: 06/20/12

TOTAL METALS

Analyte	Method	Batch	Reporting Limit	Sample Result	Dilution Factor	Date Extracted	Date Analyzed	Data Qualifiers
Sample ID: PVF1519-11 (PA-VW-WP-08 - Soil)					**Sampled: 06/18/12**			
Reporting Units: mg/kg								
Arsenic	EPA 6010B	12F0983	5.0	**5.1**	0.98	6/26/2012	6/27/2012	
Barium	EPA 6010B	12F0983	5.0	**60**	0.98	6/26/2012	6/27/2012	
Cadmium	EPA 6010B	12F0983	0.50	ND	0.98	6/26/2012	6/27/2012	
Chromium	EPA 6010B	12F0983	2.0	**7.3**	0.98	6/26/2012	6/27/2012	
Cobalt	EPA 6010B	12F0983	2.0	**4.2**	0.98	6/26/2012	6/27/2012	
Copper	EPA 6010B	12F0983	5.0	**15**	0.98	6/26/2012	6/27/2012	
Lead	EPA 6010B	12F0983	5.0	ND	0.98	6/26/2012	6/27/2012	
Magnesium	EPA 6010B	12F0983	250	**120000**	9.8	6/26/2012	6/28/2012	
Manganese	EPA 6010B	12F0983	2.0	**630**	0.98	6/26/2012	6/27/2012	
Mercury	EPA 7471A	12F1001	0.10	ND	1.03	6/28/2012	6/28/2012	
Nickel	EPA 6010B	12F0983	2.0	**3.5**	0.98	6/26/2012	6/27/2012	
Selenium	EPA 6010B	12F0983	5.0	ND	0.98	6/26/2012	6/27/2012	
Zinc	EPA 6010B	12F0983	10	**15**	0.98	6/26/2012	6/27/2012	
Sample ID: PVF1519-12 (PA-BG-SS-01 - Soil)					**Sampled: 06/19/12**			
Reporting Units: mg/kg								
Arsenic	EPA 6010B	12F0983	5.0	**7.2**	1	6/26/2012	6/27/2012	
Barium	EPA 6010B	12F0983	5.0	**130**	1	6/26/2012	6/27/2012	
Cadmium	EPA 6010B	12F0983	0.50	ND	1	6/26/2012	6/27/2012	
Chromium	EPA 6010B	12F0983	2.0	**35**	1	6/26/2012	6/27/2012	
Cobalt	EPA 6010B	12F0983	2.0	**18**	1	6/26/2012	6/27/2012	
Copper	EPA 6010B	12F0983	5.0	**23**	1	6/26/2012	6/27/2012	
Lead	EPA 6010B	12F0983	5.0	**9.9**	1	6/26/2012	6/27/2012	
Magnesium	EPA 6010B	12F0983	25	**4000**	1	6/26/2012	6/27/2012	
Manganese	EPA 6010B	12F0983	2.0	**520**	1	6/26/2012	6/27/2012	
Mercury	EPA 7471A	12F1002	0.10	ND	0.968	6/28/2012	6/28/2012	
Nickel	EPA 6010B	12F0983	2.0	**23**	1	6/26/2012	6/27/2012	
Selenium	EPA 6010B	12F0983	5.0	ND	1	6/26/2012	6/27/2012	
Zinc	EPA 6010B	12F0983	10	**40**	1	6/26/2012	6/27/2012	

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Engineering/Remediation Resources Group, Inc.
4585 Pacheco Blvd.
Martinez, CA 94553-2233
Attention: Samantha Caruthers-Knight

Project ID: 2011-149
Report Number: PVF1519

Sampled: 06/15/12-06/19/12
Received: 06/20/12

TOTAL METALS

Analyte	Method	Batch	Reporting Limit	Sample Result	Dilution Factor	Date Extracted	Date Analyzed	Data Qualifiers
Sample ID: PVF1519-13 (PA-PC-WP-01 - Soil)					**Sampled: 06/19/12**			
Reporting Units: mg/kg								
Arsenic	EPA 6010B	12F0983	5.0	**5.7**	0.971	6/26/2012	6/27/2012	
Barium	EPA 6010B	12F0983	5.0	**64**	0.971	6/26/2012	6/27/2012	
Cadmium	EPA 6010B	12F0983	0.50	ND	0.971	6/26/2012	6/27/2012	
Chromium	EPA 6010B	12F0983	2.0	**20**	0.971	6/26/2012	6/27/2012	
Cobalt	EPA 6010B	12F0983	2.0	**16**	0.971	6/26/2012	6/27/2012	
Copper	EPA 6010B	12F0983	5.0	**27**	0.971	6/26/2012	6/27/2012	
Lead	EPA 6010B	12F0983	5.0	**9.1**	0.971	6/26/2012	6/27/2012	
Magnesium	EPA 6010B	12F0983	250	**43000**	9.71	6/26/2012	6/28/2012	
Manganese	EPA 6010B	12F0983	2.0	**320**	0.971	6/26/2012	6/27/2012	
Mercury	EPA 7471A	12F1002	0.10	ND	0.952	6/28/2012	6/28/2012	
Nickel	EPA 6010B	12F0983	2.0	**24**	0.971	6/26/2012	6/27/2012	
Selenium	EPA 6010B	12F0983	5.0	ND	0.971	6/26/2012	6/27/2012	
Zinc	EPA 6010B	12F0983	10	**66**	0.971	6/26/2012	6/27/2012	
Sample ID: PVF1519-14 (PA-PT-SD-01 - Soil)					**Sampled: 06/19/12**			
Reporting Units: mg/kg								
Arsenic	EPA 6010B	12F0983	5.0	ND	0.962	6/26/2012	6/27/2012	
Barium	EPA 6010B	12F0983	5.0	**80**	0.962	6/26/2012	6/27/2012	
Cadmium	EPA 6010B	12F0983	0.50	ND	0.962	6/26/2012	6/27/2012	
Chromium	EPA 6010B	12F0983	2.0	**18**	0.962	6/26/2012	6/27/2012	
Cobalt	EPA 6010B	12F0983	2.0	**17**	0.962	6/26/2012	6/27/2012	
Copper	EPA 6010B	12F0983	5.0	**24**	0.962	6/26/2012	6/27/2012	
Lead	EPA 6010B	12F0983	5.0	ND	0.962	6/26/2012	6/27/2012	
Magnesium	EPA 6010B	12F0983	25	**5100**	0.962	6/26/2012	6/27/2012	
Manganese	EPA 6010B	12F0983	2.0	**270**	0.962	6/26/2012	6/27/2012	
Mercury	EPA 7471A	12F1002	0.10	ND	0.923	6/28/2012	6/28/2012	
Nickel	EPA 6010B	12F0983	2.0	**20**	0.962	6/26/2012	6/27/2012	
Selenium	EPA 6010B	12F0983	5.0	ND	0.962	6/26/2012	6/27/2012	
Zinc	EPA 6010B	12F0983	10	**30**	0.962	6/26/2012	6/27/2012	

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4585 Pacheco Blvd.
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Attention: Samantha Caruthers-Knight

Project ID: 2011-149
Report Number: PVF1519

Sampled: 06/15/12-06/19/12
Received: 06/20/12

TOTAL METALS BY ICP/MS

Analyte	Method	Batch	Reporting Limit	Sample Result	Dilution Factor	Date Extracted	Date Analyzed	Data Qualifiers
Sample ID: PVF1519-01 (PA-MT-SD-01 - Soil)					**Sampled: 06/15/12**			
Reporting Units: mg/kg								
Uranium	EPA 6020	12F1012	0.25	ND	5	6/26/2012	6/29/2012	M4, D1, T2
Sample ID: PVF1519-02 (PA-ATV1-SS-01 - Soil)					**Sampled: 06/15/12**			
Reporting Units: mg/kg								
Uranium	EPA 6020	12F1012	0.25	**0.29**	5	6/26/2012	6/29/2012	D1, T2
Sample ID: PVF1519-03 (PA-ATV2-SS-01 - Soil)					**Sampled: 06/15/12**			
Reporting Units: mg/kg								
Uranium	EPA 6020	12F1012	0.25	ND	5	6/26/2012	6/29/2012	D1, T2
Sample ID: PVF1519-04 (PA-MC-SS-01 - Soil)					**Sampled: 06/16/12**			
Reporting Units: mg/kg								
Uranium	EPA 6020	12F1012	0.25	**0.28**	5	6/26/2012	6/29/2012	D1, T2
Sample ID: PVF1519-05 (PA-MA-SS-01 - Soil)					**Sampled: 06/17/12**			
Reporting Units: mg/kg								
Uranium	EPA 6020	12F1012	0.25	**2.3**	5	6/26/2012	6/29/2012	D1, T2
Sample ID: PVF1519-06 (PA-MC-GW-01 - Water)					**Sampled: 06/17/12**			
Reporting Units: mg/l								
Uranium	EPA 200.8	12F1184	0.0010	ND	1	6/29/2012	6/30/2012	
Sample ID: PVF1519-08 (PA-MT-SW-01 - Water)					**Sampled: 06/17/12**			
Reporting Units: mg/l								
Uranium	EPA 200.8	12F1184	0.0010	**0.0020**	1	6/29/2012	6/30/2012	
Sample ID: PVF1519-10 (PA-VW-SS-01 - Soil)					**Sampled: 06/18/12**			
Reporting Units: mg/kg								
Uranium	EPA 6020	12F1012	0.25	ND	5	6/26/2012	6/29/2012	D1, T2
Sample ID: PVF1519-11 (PA-VW-WP-08 - Soil)					**Sampled: 06/18/12**			
Reporting Units: mg/kg								
Uranium	EPA 6020	12F1012	0.25	**0.80**	5	6/26/2012	6/29/2012	D1, T2
Sample ID: PVF1519-12 (PA-BG-SS-01 - Soil)					**Sampled: 06/19/12**			
Reporting Units: mg/kg								
Uranium	EPA 6020	12F1012	0.25	**0.34**	5	6/26/2012	6/29/2012	D1, T2

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TOTAL METALS BY ICP/MS

Analyte	Method	Batch	Reporting Limit	Sample Result	Dilution Factor	Date Extracted	Date Analyzed	Data Qualifiers
Sample ID: PVF1519-13 (PA-PC-WP-01 - Soil)					**Sampled: 06/19/12**			
Reporting Units: mg/kg								
Uranium	EPA 6020	12F1012	0.25	**0.29**	5	6/26/2012	6/29/2012	D1, T2
Sample ID: PVF1519-14 (PA-PT-SD-01 - Soil)					**Sampled: 06/19/12**			
Reporting Units: mg/kg								
Uranium	EPA 6020	12F1012	0.25	ND	5	6/26/2012	6/29/2012	D1, T2

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DISSOLVED METALS

Analyte	Method	Batch	Reporting Limit	Sample Result	Dilution Factor	Date Extracted	Date Analyzed	Data Qualifiers
Sample ID: PVF1519-07 (PA-MC-GW-01 - Water)				**Sampled: 06/17/12**				
Reporting Units: mg/l								
Arsenic	EPA 200.7	12F1010	0.10	ND	1	6/26/2012	6/27/2012	
Barium	EPA 200.7	12F1010	0.010	**0.051**	1	6/26/2012	6/27/2012	
Cadmium	EPA 200.7	12F1010	0.0010	ND	1	6/26/2012	6/27/2012	
Chromium	EPA 200.7	12F1010	0.010	ND	1	6/26/2012	6/27/2012	
Cobalt	EPA 200.7	12F1010	0.040	ND	1	6/26/2012	6/27/2012	
Copper	EPA 200.7	12F1010	0.010	ND	1	6/26/2012	6/27/2012	
Lead	EPA 200.7	12F1010	0.015	ND	1	6/26/2012	6/27/2012	
Magnesium	EPA 200.7	12F1010	2.0	**27**	1	6/26/2012	6/27/2012	
Manganese	EPA 200.7	12F1010	0.010	ND	1	6/26/2012	6/27/2012	
Mercury	EPA 245.1	12F0953	0.00020	ND	1	6/26/2012	6/26/2012	
Nickel	EPA 200.7	12F1010	0.010	ND	1	6/26/2012	6/27/2012	
Selenium	EPA 200.7	12F1010	0.10	ND	1	6/26/2012	6/27/2012	
Zinc	EPA 200.7	12F1010	0.050	ND	1	6/26/2012	6/27/2012	
Sample ID: PVF1519-09 (PA-MT-SW-01 - Water)				**Sampled: 06/17/12**				
Reporting Units: mg/l								
Arsenic	EPA 200.7	12F1010	0.10	ND	1	6/26/2012	6/27/2012	
Barium	EPA 200.7	12F1010	0.010	**0.15**	1	6/26/2012	6/27/2012	
Cadmium	EPA 200.7	12F1010	0.0010	ND	1	6/26/2012	6/27/2012	
Chromium	EPA 200.7	12F1010	0.010	ND	1	6/26/2012	6/27/2012	
Cobalt	EPA 200.7	12F1010	0.040	ND	1	6/26/2012	6/27/2012	
Copper	EPA 200.7	12F1010	0.010	ND	1	6/26/2012	6/27/2012	
Lead	EPA 200.7	12F1010	0.015	ND	1	6/26/2012	6/27/2012	
Magnesium	EPA 200.7	12F1010	2.0	**100**	1	6/26/2012	6/27/2012	
Manganese	EPA 200.7	12F1010	0.010	**0.065**	1	6/26/2012	6/27/2012	
Mercury	EPA 245.1	12F0953	0.00020	ND	1	6/26/2012	6/26/2012	
Nickel	EPA 200.7	12F1010	0.010	ND	1	6/26/2012	6/27/2012	
Selenium	EPA 200.7	12F1010	0.10	ND	1	6/26/2012	6/27/2012	
Zinc	EPA 200.7	12F1010	0.050	ND	1	6/26/2012	6/27/2012	

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DISSOLVED METALS BY ICP/MS

Analyte	Method	Batch	Reporting Limit	Sample Result	Dilution Factor	Date Extracted	Date Analyzed	Data Qualifiers
Sample ID: PVF1519-07 (PA-MC-GW-01 - Water)					**Sampled: 06/17/12**			
Reporting Units: ng/l								
Uranium	EPA 200.8	12F1180	0.0010	ND	1	6/29/2012	6/30/2012	
Sample ID: PVF1519-09 (PA-MT-SW-01 - Water)					**Sampled: 06/17/12**			
Reporting Units: ng/l								
Uranium	EPA 200.8	12F1180	0.0010	**0.0026**	1	6/29/2012	6/30/2012	

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INORGANICS

Analyte	Method	Batch	Reporting Limit	Sample Result	Dilution Factor	Date Extracted	Date Analyzed	Data Qualifiers
Sample ID: PVF1519-06 (PA-MC-GW-01 - Water)					**Sampled: 06/17/12**			
Reporting Units: mg/l								
Alkalinity as CaCO3	SM 2320B	12F0869	6.0	**280**	1	6/22/2012	6/23/2012	
Bicarbonate Alkalinity as CaCO3	SM 2320B	12F0869	6.0	**280**	1	6/22/2012	6/23/2012	
Carbonate Alkalinity as CaCO3	SM 2320B	12F0869	6.0	ND	1	6/22/2012	6/23/2012	
Hydroxide Alkalinity as CaCO3	SM 2320B	12F0869	6.0	ND	1	6/22/2012	6/23/2012	
Total Suspended Solids	SM 2540D	12F0880	10	**27**	1	6/22/2012	6/22/2012	
Alkalinity, Phenolphthalein	SM 2320B	12F0869	6.0	ND	1	6/22/2012	6/23/2012	
Sample ID: PVF1519-08 (PA-MT-SW-01 - Water)					**Sampled: 06/17/12**			
Reporting Units: mg/l								
Alkalinity as CaCO3	SM 2320B	12F0869	6.0	**550**	1	6/22/2012	6/23/2012	
Bicarbonate Alkalinity as CaCO3	SM 2320B	12F0869	6.0	**550**	1	6/22/2012	6/23/2012	
Carbonate Alkalinity as CaCO3	SM 2320B	12F0869	6.0	ND	1	6/22/2012	6/23/2012	
Hydroxide Alkalinity as CaCO3	SM 2320B	12F0869	6.0	ND	1	6/22/2012	6/23/2012	
Total Suspended Solids	SM 2540D	12F0880	20	**430**	2	6/22/2012	6/22/2012	
Alkalinity, Phenolphthalein	SM 2320B	12F0869	6.0	ND	1	6/22/2012	6/23/2012	

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METHOD BLANK/QC DATA

EXTRACTABLE FUEL HYDROCARBONS (EPA 3510/8015D)

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Data Qualifiers
Batch: 12F0919 Extracted: 06/25/12										
Blank Analyzed: 06/25/2012 (12F0919-BLK1)										
Extractable Fuel Hydrocarbons (C10 - C32)	ND	0.10	mg/l							
Surrogate: o-terphenyl	*0.0885*		*mg/l*	*0.100*		*88*	*37-140*			
LCS Analyzed: 06/25/2012 (12F0919-BS1)										**Q8**
Extractable Fuel Hydrocarbons (C10 - C32)	0.372	0.10	mg/l	0.400		93	47-128			
Surrogate: o-terphenyl	*0.0882*		*mg/l*	*0.100*		*88*	*58-116*			
LCS Dup Analyzed: 06/25/2012 (12F0919-BSD1)										**Q8**
Extractable Fuel Hydrocarbons (C10 - C32)	0.411	0.10	mg/l	0.400		103	47-128	10	29	
Surrogate: o-terphenyl	*0.0871*		*mg/l*	*0.100*		*87*	*58-116*			

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METHOD BLANK/QC DATA

EXTRACTABLE FUEL HYDROCARBONS (ADHS 8015AZR1)

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Data Qualifiers
Batch: 12F1087 Extracted: 06/27/12										
Blank Analyzed: 06/28/2012 (12F1087-BLK1)										
DRO (C10-C22)	ND	30	mg/kg							
ORO (C22-C32)	ND	100	mg/kg							
Total (C10-C32)	ND	130	mg/kg							
Surrogate: o-terphenyl	*44.7*		*mg/kg*	*49.8*		*90*	*70-130*			
LCS Analyzed: 06/28/2012 (12F1087-BS1)										
DRO (C10-C22)	190	30	mg/kg	199		94	70-130			
ORO (C22-C32)	400	100	mg/kg	399		101	70-130			
Surrogate: o-terphenyl	*47.7*		*mg/kg*	*49.9*		*96*	*70-130*			
LCS Dup Analyzed: 06/28/2012 (12F1087-BSD1)										
DRO (C10-C22)	200	30	mg/kg	199		102	70-130	8	20	
ORO (C22-C32)	430	100	mg/kg	398		109	70-130	8	20	
Surrogate: o-terphenyl	*50.0*		*mg/kg*	*49.8*		*100*	*70-130*			
Matrix Spike Analyzed: 06/28/2012 (12F1087-MS1)					**Source: PVF1722-01**					
DRO (C10-C22)	190	30	mg/kg	199	ND	98	56-145			
ORO (C22-C32)	400	100	mg/kg	398	ND	102	77-136			
Surrogate: o-terphenyl	*47.8*		*mg/kg*	*49.8*		*96*	*70-130*			
Matrix Spike Dup Analyzed: 06/28/2012 (12F1087-MSD1)					**Source: PVF1722-01**					
DRO (C10-C22)	200	30	mg/kg	200	ND	100	56-145	3	30	
ORO (C22-C32)	420	100	mg/kg	400	ND	105	77-136	3	20	
Surrogate: o-terphenyl	*48.5*		*mg/kg*	*50.0*		*97*	*70-130*			

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METHOD BLANK/QC DATA

TOTAL METALS

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Data Qualifiers
Batch: 12F0929 Extracted: 06/24/12										
Blank Analyzed: 06/25/2012 (12F0929-BLK1)										
Arsenic	ND	0.10	mg/l							
Barium	ND	0.010	mg/l							
Cadmium	ND	0.0010	mg/l							
Chromium	ND	0.010	mg/l							
Cobalt	ND	0.040	mg/l							
Copper	ND	0.010	mg/l							
Lead	ND	0.015	mg/l							
Magnesium	ND	2.0	mg/l							
Manganese	ND	0.010	mg/l							
Nickel	ND	0.010	mg/l							
Selenium	ND	0.10	mg/l							
Zinc	ND	0.050	mg/l							
LCS Analyzed: 06/25/2012 (12F0929-BS1)										
Arsenic	1.03	0.10	mg/l	1.00		103	85-115			
Barium	1.04	0.010	mg/l	1.00		104	85-115			
Cadmium	1.02	0.0010	mg/l	1.00		102	85-115			
Chromium	1.05	0.010	mg/l	1.00		105	85-115			
Cobalt	1.03	0.040	mg/l	1.00		103	85-115			
Copper	0.991	0.010	mg/l	1.00		99	85-115			
Lead	1.03	0.015	mg/l	1.00		103	85-115			
Magnesium	21.4	2.0	mg/l	21.0		102	85-115			
Manganese	1.03	0.010	mg/l	1.00		103	85-115			
Nickel	1.04	0.010	mg/l	1.00		104	85-115			
Selenium	1.03	0.10	mg/l	1.00		103	85-115			
Zinc	1.07	0.050	mg/l	1.00		107	85-115			
LCS Dup Analyzed: 06/25/2012 (12F0929-BSD1)										
Arsenic	0.982	0.10	mg/l	1.00		98	85-115	4	20	
Barium	1.01	0.010	mg/l	1.00		101	85-115	3	20	
Cadmium	0.972	0.0010	mg/l	1.00		97	85-115	5	20	
Chromium	1.01	0.010	mg/l	1.00		101	85-115	4	20	
Cobalt	0.987	0.040	mg/l	1.00		99	85-115	4	20	
Copper	0.947	0.010	mg/l	1.00		95	85-115	5	20	
Lead	0.984	0.015	mg/l	1.00		98	85-115	5	20	
Magnesium	21.0	2.0	mg/l	21.0		100	85-115	2	20	

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Engineering/Remediation Resources Group, Inc.
4585 Pacheco Blvd.
Martinez, CA 94553-2233
Attention: Samantha Caruthers-Knight

Project ID: 2011-149
Report Number: PVF1519

Sampled: 06/15/12-06/19/12
Received: 06/20/12

METHOD BLANK/QC DATA

TOTAL METALS

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Data Qualifiers
Batch: 12F0929 Extracted: 06/24/12										
LCS Dup Analyzed: 06/25/2012 (12F0929-BSD1)										
Manganese	1.00	0.010	mg/l	1.00		100	85-115	3	20	
Nickel	0.997	0.010	mg/l	1.00		100	85-115	4	20	
Selenium	0.987	0.10	mg/l	1.00		99	85-115	4	20	
Zinc	1.03	0.050	mg/l	1.00		103	85-115	4	20	
Matrix Spike Analyzed: 06/25/2012 (12F0929-MS1)					**Source: PVF1302-01**					
Arsenic	1.01	0.10	mg/l	1.00	0.0109	100	70-130			
Barium	2.01	0.010	mg/l	1.00	0.943	107	70-130			
Cadmium	0.980	0.0010	mg/l	1.00	ND	98	70-130			
Chromium	1.00	0.010	mg/l	1.00	ND	100	70-130			
Cobalt	0.985	0.040	mg/l	1.00	ND	98	70-130			
Copper	0.970	0.010	mg/l	1.00	0.00796	96	70-130			
Lead	0.992	0.015	mg/l	1.00	ND	99	70-130			
Magnesium	50.3	2.0	mg/l	21.0	27.6	108	70-130			
Manganese	1.01	0.010	mg/l	1.00	ND	101	70-130			
Nickel	0.998	0.010	mg/l	1.00	0.0115	99	70-130			
Selenium	1.00	0.10	mg/l	1.00	0.00689	100	70-130			
Zinc	1.03	0.050	mg/l	1.00	ND	103	70-130			
Matrix Spike Dup Analyzed: 06/25/2012 (12F0929-MSD1)					**Source: PVF1302-01**					
Arsenic	1.03	0.10	mg/l	1.00	0.0109	102	70-130	2	20	
Barium	2.02	0.010	mg/l	1.00	0.943	108	70-130	0.2	20	
Cadmium	1.00	0.0010	mg/l	1.00	ND	100	70-130	2	20	
Chromium	1.01	0.010	mg/l	1.00	ND	101	70-130	1	20	
Cobalt	0.996	0.040	mg/l	1.00	ND	100	70-130	1	20	
Copper	0.982	0.010	mg/l	1.00	0.00796	97	70-130	1	20	
Lead	1.01	0.015	mg/l	1.00	ND	101	70-130	2	20	
Magnesium	50.4	2.0	mg/l	21.0	27.6	108	70-130	0.07	20	
Manganese	1.02	0.010	mg/l	1.00	ND	102	70-130	1	20	
Nickel	1.01	0.010	mg/l	1.00	0.0115	100	70-130	1	20	
Selenium	1.05	0.10	mg/l	1.00	0.00689	104	70-130	4	20	
Zinc	1.06	0.050	mg/l	1.00	ND	106	70-130	3	20	

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Project ID: 2011-149
Report Number: PVF1519

Sampled: 06/15/12-06/19/12
Received: 06/20/12

METHOD BLANK/QC DATA

TOTAL METALS

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Data Qualifiers
Batch: 12F0983 Extracted: 06/26/12										
Blank Analyzed: 06/27/2012 (12F0983-BLK1)										
Arsenic	ND	5.0	mg/kg							
Barium	ND	5.0	mg/kg							
Cadmium	ND	0.50	mg/kg							
Chromium	ND	2.0	mg/kg							
Cobalt	ND	2.0	mg/kg							
Copper	ND	5.0	mg/kg							
Lead	ND	5.0	mg/kg							
Magnesium	ND	25	mg/kg							
Manganese	ND	2.0	mg/kg							
Nickel	ND	2.0	mg/kg							
Selenium	ND	5.0	mg/kg							
Zinc	ND	10	mg/kg							
LCS Analyzed: 06/27/2012 (12F0983-BS1)										
Arsenic	44.9	5.0	mg/kg	50.0		90	81-109			
Barium	49.0	5.0	mg/kg	50.0		98	87-114			
Cadmium	44.2	0.50	mg/kg	50.0		88	83-110			
Chromium	48.4	2.0	mg/kg	50.0		97	86-112			
Cobalt	47.4	2.0	mg/kg	50.0		95	88-111			
Copper	48.4	5.0	mg/kg	50.0		97	81-110			
Lead	46.7	5.0	mg/kg	50.0		93	83-113			
Magnesium	971	25	mg/kg	1050		92	84-109			
Manganese	48.7	2.0	mg/kg	50.0		97	87-112			
Nickel	47.4	2.0	mg/kg	50.0		95	81-114			
Selenium	41.4	5.0	mg/kg	50.0		83	78-110			
Zinc	50.2	10	mg/kg	50.0		100	82-112			
LCS Dup Analyzed: 06/27/2012 (12F0983-BSD1)										
Arsenic	44.6	5.0	mg/kg	49.0		91	81-109	0.6	20	
Barium	48.2	5.0	mg/kg	49.0		98	87-114	2	20	
Cadmium	43.8	0.50	mg/kg	49.0		89	83-110	0.8	20	
Chromium	48.1	2.0	mg/kg	49.0		98	86-112	0.7	20	
Cobalt	46.8	2.0	mg/kg	49.0		95	88-111	1	20	
Copper	47.7	5.0	mg/kg	49.0		97	81-110	1	20	
Lead	46.2	5.0	mg/kg	49.0		94	83-113	1	20	
Magnesium	960	25	mg/kg	1030		93	84-109	1	20	

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Report Number: PVF1519

Sampled: 06/15/12-06/19/12
Received: 06/20/12

METHOD BLANK/QC DATA

TOTAL METALS

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Data Qualifiers
Batch: 12F0983 Extracted: 06/26/12										
LCS Dup Analyzed: 06/27/2012 (12F0983-BSD1)										
Manganese	48.4	2.0	mg/kg	49.0		99	87-112	0.7	20	
Nickel	47.0	2.0	mg/kg	49.0		96	81-114	0.8	20	
Selenium	41.1	5.0	mg/kg	49.0		84	78-110	0.7	20	
Zinc	47.3	10	mg/kg	49.0		97	82-112	6	20	
Matrix Spike Analyzed: 06/27/2012 (12F0983-MS1)					**Source: PVF1376-07**					
Arsenic	47.1	5.0	mg/kg	50.0	5.81	83	75-125			
Barium	222	5.0	mg/kg	50.0	149	145	75-125			*M3*
Cadmium	41.9	0.50	mg/kg	50.0	0.178	83	75-125			
Chromium	54.6	2.0	mg/kg	50.0	12.2	85	75-125			
Cobalt	46.3	2.0	mg/kg	50.0	5.35	82	75-125			
Copper	60.3	5.0	mg/kg	50.0	13.6	93	75-125			
Lead	63.3	5.0	mg/kg	50.0	19.1	88	75-125			
Magnesium	6780	25	mg/kg	1050	5230	147	75-125			*M3*
Manganese	256	2.0	mg/kg	50.0	204	105	75-125			*M3*
Nickel	52.3	2.0	mg/kg	50.0	12.9	79	75-125			
Selenium	39.2	5.0	mg/kg	50.0	1.26	76	75-125			
Zinc	240	10	mg/kg	50.0	122	235	75-125			*M3*
Matrix Spike Dup Analyzed: 06/27/2012 (12F0983-MSD1)					**Source: PVF1376-07**					
Arsenic	47.3	5.0	mg/kg	49.5	5.81	84	75-125	0.5	20	
Barium	235	5.0	mg/kg	49.5	149	172	75-125	6	20	*M3*
Cadmium	41.9	0.50	mg/kg	49.5	0.178	84	75-125	0.08	20	
Chromium	54.5	2.0	mg/kg	49.5	12.2	85	75-125	0.2	20	
Cobalt	46.3	2.0	mg/kg	49.5	5.35	83	75-125	0.03	20	
Copper	60.8	5.0	mg/kg	49.5	13.6	95	75-125	0.8	20	
Lead	61.9	5.0	mg/kg	49.5	19.1	86	75-125	2	20	
Magnesium	6900	25	mg/kg	1040	5230	160	75-125	2	20	*M3*
Manganese	257	2.0	mg/kg	49.5	204	108	75-125	0.4	20	*M3*
Nickel	52.7	2.0	mg/kg	49.5	12.9	80	75-125	0.7	20	
Selenium	39.1	5.0	mg/kg	49.5	1.26	76	75-125	0.3	20	
Zinc	182	10	mg/kg	49.5	122	120	75-125	28	20	*M3, N1*

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Project ID: 2011-149
Report Number: PVF1519

Sampled: 06/15/12-06/19/12
Received: 06/20/12

METHOD BLANK/QC DATA

TOTAL METALS

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Data Qualifiers
Batch: 12F1001 Extracted: 06/28/12										
Blank Analyzed: 06/28/2012 (12F1001-BLK1)										
Mercury	ND	0.10	mg/kg							
LCS Analyzed: 06/28/2012 (12F1001-BS1)										
Mercury	1.59	0.10	mg/kg	1.61		99	80-120			
LCS Dup Analyzed: 06/28/2012 (12F1001-BSD1)										
Mercury	1.73	0.10	mg/kg	1.73		100	80-120	8	20	
Matrix Spike Analyzed: 06/28/2012 (12F1001-MS1)					**Source: PVF1297-08**					
Mercury	1.53	0.091	mg/kg	1.51	0.00265	101	75-125			
Matrix Spike Dup Analyzed: 06/28/2012 (12F1001-MSD1)					**Source: PVF1297-08**					
Mercury	1.54	0.10	mg/kg	1.54	0.00265	100	75-125	0.8	20	
Batch: 12F1002 Extracted: 06/28/12										
Blank Analyzed: 06/28/2012 (12F1002-BLK1)										
Mercury	ND	0.10	mg/kg							
LCS Analyzed: 06/28/2012 (12F1002-BS1)										
Mercury	1.71	0.10	mg/kg	1.58		108	80-120			
LCS Dup Analyzed: 06/28/2012 (12F1002-BSD1)										
Mercury	1.85	0.10	mg/kg	1.80		103	80-120	8	20	
Matrix Spike Analyzed: 06/28/2012 (12F1002-MS1)					**Source: PVF1638-10**					
Mercury	1.68	0.10	mg/kg	1.61	0.00464	104	75-125			

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Report Number: PVF1519

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Received: 06/20/12

METHOD BLANK/QC DATA

TOTAL METALS

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Data Qualifiers
Batch: 12F1002 Extracted: 06/28/12										
Matrix Spike Dup Analyzed: 06/28/2012 (12F1002-MSD1)					**Source: PVF1638-10**					
Mercury	1.80	0.10	mg/kg	1.74	0.00464	103	75-125	7	20	
Batch: 12F1003 Extracted: 06/27/12										
Blank Analyzed: 06/27/2012 (12F1003-BLK1)										
Mercury	ND	0.00020	mg/l							
LCS Analyzed: 06/27/2012 (12F1003-BS1)										
Mercury	0.00883	0.00020	mg/l	0.0100		88	85-115			
LCS Dup Analyzed: 06/27/2012 (12F1003-BSD1)										
Mercury	0.00893	0.00020	mg/l	0.0100		89	85-115	1	20	
Matrix Spike Analyzed: 06/27/2012 (12F1003-MS1)					**Source: PVF1311-01**					
Mercury	0.00831	0.00020	mg/l	0.0100	ND	83	70-130			
Matrix Spike Dup Analyzed: 06/27/2012 (12F1003-MSD1)					**Source: PVF1311-01**					
Mercury	0.00858	0.00020	mg/l	0.0100	ND	86	70-130	3	20	

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Received: 06/20/12

METHOD BLANK/QC DATA

TOTAL METALS BY ICP/MS

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Data Qualifiers
Batch: 12F1012 Extracted: 06/26/12										
Blank Analyzed: 06/29/2012 (12F1012-BLK1)										
Uranium	ND	0.050	mg/kg							
LCS Analyzed: 06/29/2012 (12F1012-BS1)										
Uranium	5.05	0.050	mg/kg	5.00		101	80-120			
LCS Dup Analyzed: 06/29/2012 (12F1012-BSD1)										
Uranium	5.14	0.050	mg/kg	5.00		103	80-120	2	20	
Matrix Spike Analyzed: 06/29/2012 (12F1012-MS1)					**Source: PVF1519-01**					
Uranium	5.29	0.25	mg/kg	5.00	0.107	104	75-125			*M4*
Matrix Spike Dup Analyzed: 06/29/2012 (12F1012-MSD1)					**Source: PVF1519-01**					
Uranium	5.19	0.25	mg/kg	5.00	0.107	102	75-125	2	20	*M4, N1*
Batch: 12F1184 Extracted: 06/29/12										
Blank Analyzed: 06/30/2012 (12F1184-BLK1)										
Uranium	ND	0.0010	mg/l							
LCS Analyzed: 06/30/2012 (12F1184-BS1)										
Uranium	0.0978	0.0010	mg/l	0.100		98	85-115			
LCS Dup Analyzed: 06/30/2012 (12F1184-BSD1)										
Uranium	0.0965	0.0010	mg/l	0.100		96	85-115	1	20	
Matrix Spike Analyzed: 06/30/2012 (12F1184-MS1)					**Source: PVF1894-02**					
Uranium	0.0932	0.0010	mg/l	0.100	ND	93	70-130			

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METHOD BLANK/QC DATA

TOTAL METALS BY ICP/MS

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Data Qualifiers
Batch: 12F1184 Extracted: 06/29/12										
Matrix Spike Dup Analyzed: 06/30/2012 (12F1184-MSD1)					**Source: PVF1894-02**					
Uranium	0.0967	0.0010	mg/l	0.100	ND	97	70-130	4	20	

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METHOD BLANK/QC DATA

DISSOLVED METALS

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Data Qualifiers
Batch: 12F0953 Extracted: 06/26/12										
Blank Analyzed: 06/26/2012 (12F0953-BLK1)										
Mercury	ND	0.00020	mg/l							
LCS Analyzed: 06/26/2012 (12F0953-BS1)										
Mercury	0.00968	0.00020	mg/l	0.0100		97	85-115			
LCS Dup Analyzed: 06/26/2012 (12F0953-BSD1)										
Mercury	0.00986	0.00020	mg/l	0.0100		99	85-115	2	20	
Matrix Spike Analyzed: 06/26/2012 (12F0953-MS1)					**Source: PVF0959-04**					
Mercury	0.0101	0.00020	mg/l	0.0100	ND	101	70-130			
Matrix Spike Dup Analyzed: 06/26/2012 (12F0953-MSD1)					**Source: PVF0959-04**					
Mercury	0.00978	0.00020	mg/l	0.0100	ND	98	70-130	3	20	
Batch: 12F1010 Extracted: 06/26/12										
Blank Analyzed: 06/27/2012 (12F1010-BLK1)										
Arsenic	ND	0.10	mg/l							
Barium	ND	0.010	mg/l							
Cadmium	ND	0.0010	mg/l							
Chromium	ND	0.010	mg/l							
Cobalt	ND	0.040	mg/l							
Copper	ND	0.010	mg/l							
Lead	ND	0.015	mg/l							
Magnesium	ND	2.0	mg/l							
Manganese	ND	0.010	mg/l							
Nickel	ND	0.010	mg/l							
Selenium	ND	0.10	mg/l							
Zinc	ND	0.050	mg/l							

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METHOD BLANK/QC DATA

DISSOLVED METALS

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Data Qualifiers
Batch: 12F1010 Extracted: 06/26/12										
LCS Analyzed: 06/27/2012 (12F1010-BS1)										
Arsenic	0.988	0.10	mg/l	1.00		99	85-115			
Barium	1.02	0.010	mg/l	1.00		102	85-115			
Cadmium	0.949	0.0010	mg/l	1.00		95	85-115			
Chromium	1.00	0.010	mg/l	1.00		100	85-115			
Cobalt	0.991	0.040	mg/l	1.00		99	85-115			
Copper	0.940	0.010	mg/l	1.00		94	85-115			
Lead	0.968	0.015	mg/l	1.00		97	85-115			
Magnesium	20.4	2.0	mg/l	21.0		97	85-115			
Manganese	0.999	0.010	mg/l	1.00		100	85-115			
Nickel	1.01	0.010	mg/l	1.00		101	85-115			
Selenium	0.989	0.10	mg/l	1.00		99	85-115			
Zinc	1.05	0.050	mg/l	1.00		105	85-115			
LCS Dup Analyzed: 06/27/2012 (12F1010-BSD1)										
Arsenic	0.985	0.10	mg/l	1.00		98	85-115	0.3	20	
Barium	1.01	0.010	mg/l	1.00		101	85-115	0.4	20	
Cadmium	0.947	0.0010	mg/l	1.00		95	85-115	0.1	20	
Chromium	1.00	0.010	mg/l	1.00		100	85-115	0.006	20	
Cobalt	0.990	0.040	mg/l	1.00		99	85-115	0.1	20	
Copper	0.937	0.010	mg/l	1.00		94	85-115	0.2	20	
Lead	0.965	0.015	mg/l	1.00		97	85-115	0.3	20	
Magnesium	20.6	2.0	mg/l	21.0		98	85-115	1	20	
Manganese	1.00	0.010	mg/l	1.00		100	85-115	0.5	20	
Nickel	1.00	0.010	mg/l	1.00		100	85-115	0.3	20	
Selenium	0.987	0.10	mg/l	1.00		99	85-115	0.3	20	
Zinc	1.05	0.050	mg/l	1.00		105	85-115	0.4	20	
Matrix Spike Analyzed: 06/27/2012 (12F1010-MS1)					**Source: PVF1519-07**					
Arsenic	1.01	0.10	mg/l	1.00	0.0117	100	70-130			
Barium	1.05	0.010	mg/l	1.00	0.0508	100	70-130			
Cadmium	0.952	0.0010	mg/l	1.00	ND	95	70-130			
Chromium	0.996	0.010	mg/l	1.00	ND	100	70-130			
Cobalt	0.979	0.040	mg/l	1.00	ND	98	70-130			
Copper	0.949	0.010	mg/l	1.00	0.00276	95	70-130			
Lead	0.964	0.015	mg/l	1.00	ND	96	70-130			
Magnesium	45.7	2.0	mg/l	21.0	27.1	89	70-130			

TestAmerica Phoenix

Denise Harrington
Project Manager

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THE LEADER IN ENVIRONMENTAL TESTING

4625 East Cotton Center Blvd. Ste 189, Phoenix, AZ 85040 (602) 437-3340 Fax (602) 454-9303

Engineering/Remediation Resources Group, Inc.
4585 Pacheco Blvd.
Martinez, CA 94553-2233
Attention: Samantha Caruthers-Knight

Project ID: 2011-149
Report Number: PVF1519

Sampled: 06/15/12-06/19/12
Received: 06/20/12

METHOD BLANK/QC DATA

DISSOLVED METALS

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Data Qualifiers
Batch: 12F1010 Extracted: 06/26/12										
Matrix Spike Analyzed: 06/27/2012 (12F1010-MS1)					**Source: PVF1519-07**					
Manganese	1.00	0.010	mg/l	1.00	ND	100	70-130			
Nickel	0.985	0.010	mg/l	1.00	ND	98	70-130			
Selenium	0.999	0.10	mg/l	1.00	0.0177	98	70-130			
Zinc	1.05	0.050	mg/l	1.00	0.0214	103	70-130			
Matrix Spike Dup Analyzed: 06/27/2012 (12F1010-MSD1)					**Source: PVF1519-07**					
Arsenic	1.01	0.10	mg/l	1.00	0.0117	100	70-130	0.03	20	
Barium	1.05	0.010	mg/l	1.00	0.0508	100	70-130	0.5	20	
Cadmium	0.944	0.0010	mg/l	1.00	ND	94	70-130	0.8	20	
Chromium	0.994	0.010	mg/l	1.00	ND	99	70-130	0.2	20	
Cobalt	0.978	0.040	mg/l	1.00	ND	98	70-130	0.2	20	
Copper	0.947	0.010	mg/l	1.00	0.00276	94	70-130	0.2	20	
Lead	0.963	0.015	mg/l	1.00	ND	96	70-130	0.1	20	
Magnesium	45.8	2.0	mg/l	21.0	27.1	89	70-130	0.2	20	
Manganese	0.998	0.010	mg/l	1.00	ND	100	70-130	0.6	20	
Nickel	0.981	0.010	mg/l	1.00	ND	98	70-130	0.4	20	
Selenium	1.00	0.10	mg/l	1.00	0.0177	98	70-130	0.08	20	
Zinc	1.05	0.050	mg/l	1.00	0.0214	103	70-130	0.3	20	

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Project Manager

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Engineering/Remediation Resources Group, Inc.
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Attention: Samantha Caruthers-Knight

Project ID: 2011-149
Report Number: PVF1519

Sampled: 06/15/12-06/19/12
Received: 06/20/12

METHOD BLANK/QC DATA

DISSOLVED METALS BY ICP/MS

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Data Qualifiers
Batch: 12F1180 Extracted: 06/29/12										
Blank Analyzed: 06/30/2012 (12F1180-BLK1)										
Uranium	ND	0.0010	mg/l							
LCS Analyzed: 06/30/2012 (12F1180-BS1)										
Uranium	0.0970	0.0010	mg/l	0.100		97	85-115			
LCS Dup Analyzed: 06/30/2012 (12F1180-BSD1)										
Uranium	0.0920	0.0010	mg/l	0.100		92	85-115	5	20	
Matrix Spike Analyzed: 06/30/2012 (12F1180-MS1)					**Source: PVF1837-04**					
Uranium	0.0990	0.0010	mg/l	0.100	0.00327	96	70-130			
Matrix Spike Dup Analyzed: 06/30/2012 (12F1180-MSD1)					**Source: PVF1837-04**					
Uranium	0.0979	0.0010	mg/l	0.100	0.00327	95	70-130	1	20	

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Martinez, CA 94553-2233
Attention: Samantha Caruthers-Knight

Project ID: 2011-149
Report Number: PVF1519

Sampled: 06/15/12-06/19/12
Received: 06/20/12

METHOD BLANK/QC DATA

INORGANICS

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Data Qualifiers
Batch: 12F0869 Extracted: 06/22/12										
Blank Analyzed: 06/23/2012 (12F0869-BLK1)										
Alkalinity as CaCO3	ND	6.0	mg/l							
Bicarbonate Alkalinity as CaCO3	ND	6.0	mg/l							
Carbonate Alkalinity as CaCO3	ND	6.0	mg/l							
Hydroxide Alkalinity as CaCO3	ND	6.0	mg/l							
Alkalinity, Phenolphthalein	ND	6.0	mg/l							
LCS Analyzed: 06/23/2012 (12F0869-BS2)										
Alkalinity as CaCO3	253	6.0	mg/l	250		101	90-110			
LCS Dup Analyzed: 06/23/2012 (12F0869-BSD2)										
Alkalinity as CaCO3	254	6.0	mg/l	250		102	90-110	0.4	20	
Duplicate Analyzed: 06/23/2012 (12F0869-DUP1)					**Source: PVF1504-01**					
Alkalinity as CaCO3	140	6.0	mg/l		140			0.002	20	
Bicarbonate Alkalinity as CaCO3	140	6.0	mg/l		140			0.002	20	
Carbonate Alkalinity as CaCO3	ND	6.0	mg/l		ND				20	
Hydroxide Alkalinity as CaCO3	ND	6.0	mg/l		ND				20	
Alkalinity, Phenolphthalein	ND	6.0	mg/l		ND				20	
Duplicate Analyzed: 06/23/2012 (12F0869-DUP2)					**Source: PVF1504-03**					
Alkalinity as CaCO3	169	6.0	mg/l		169			0.2	20	
Bicarbonate Alkalinity as CaCO3	169	6.0	mg/l		169			0.2	20	
Carbonate Alkalinity as CaCO3	ND	6.0	mg/l		ND				20	
Hydroxide Alkalinity as CaCO3	ND	6.0	mg/l		ND				20	
Alkalinity, Phenolphthalein	ND	6.0	mg/l		ND				20	
Batch: 12F0880 Extracted: 06/22/12										
Blank Analyzed: 06/22/2012 (12F0880-BLK1)										
Total Suspended Solids	ND	1.0	mg/l							

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Denise Harrington
Project Manager

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4585 Pacheco Blvd.
Martinez, CA 94553-2233
Attention: Samantha Caruthers-Knight

Project ID: 2011-149
Report Number: PVF1519

Sampled: 06/15/12-06/19/12
Received: 06/20/12

METHOD BLANK/QC DATA

INORGANICS

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Data Qualifiers
Batch: 12F0880 Extracted: 06/22/12										
LCS Analyzed: 06/22/2012 (12F0880-BS1)										
Total Suspended Solids	200	10	mg/l	200		100	90-110			
LCS Dup Analyzed: 06/22/2012 (12F0880-BSD1)										
Total Suspended Solids	199	10	mg/l	200		100	90-110	0.5	10	
Duplicate Analyzed: 06/22/2012 (12F0880-DUP1)					**Source: PVF1436-01**					
Total Suspended Solids	344	40	mg/l		360			5	10	
Duplicate Analyzed: 06/22/2012 (12F0880-DUP2)					**Source: PVF1482-01**					
Total Suspended Solids	5100	200	mg/l		4580			11	10	*R9*

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Engineering/Remediation Resources Group, Inc.	Project ID: 2011-149	
4585 Pacheco Blvd.		Sampled: 06/15/12-06/19/12
Martinez, CA 94553-2233	Report Number: PVF1519	Received: 06/20/12
Attention: Samantha Caruthers-Knight		

DATA QUALIFIERS AND DEFINITIONS

D1	Sample required dilution due to matrix.
M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The associated blank spike recovery was acceptable.
M4	The analysis of the spiked sample required a dilution such that the spike recovery calculation does not provide useful information. The associated blank spike recovery was acceptable.
N1	See case narrative.
Q8	Insufficient sample received to meet method QC requirements. Batch QC requirements satisfy ADEQ policies 0154.000 and 0155.000.
R9	Sample RPD exceeded the laboratory acceptance limit
T2	Cited ADHS licensed method does not contain this analyte as part of method compound list.
ND	Analyte NOT DETECTED at or above the reporting limit or MDL, if MDL is specified.
RPD	Relative Percent Difference

ADDITIONAL COMMENTS

For Extractable Fuel Hydrocarbons (EFH, DRO, ORO) by 8015b/d :

Unless otherwise noted, Extractable Fuel Hydrocarbons by method 8015b/d (EFH, DRO, ORO) are quantitated against a Diesel Fuel Standard.

TestAmerica Phoenix

Denise Harrington
Project Manager

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Martinez, CA 94553-2233
Attention: Samantha Caruthers-Knight

Project ID: 2011-149
Report Number: PVF1519

Sampled: 06/15/12-06/19/12
Received: 06/20/12

Certification Summary

TestAmerica Phoenix

Method	Matrix	Nelac	Arizona
8015AZ R.1	Soil		X
EPA 200.7	Water		X
EPA 200.8	Water		X
EPA 245.1	Water		X
EPA 6010B	Soil	N/A	X
EPA 6020	Soil		X
EPA 7471A	Soil		X
EPA 8015D	Water		X
SM2320B	Water		X
SM 2540D	Water		X
SM2340B	Water		X

Nevada and NELAP provide analyte specific accreditations. Analyte specific information for TestAmerica may be obtained by contacting the laboratory or visiting our website at www.testamericainc.com

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Denise Harrington
Project Manager

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THE LEADER IN ENVIRONMENTAL TESTING

TAL-0013-550 (10/10)

CHAIN OF CUSTODY FORM

PVF1519

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[ ] Tucson - 1870 W. Prince Road, Suite 59, Tucson, AZ 85705 (520) 807-3801 FAX (520) 807-3803
[ ] Las Vegas - 6000 S Eastern Ave., Suite 5E, Las Vegas, NV 89119 (702) 429-1264

Page 1 of 1

Client Name/Address: Engineering/Remediation Resources Group, 4585 Pacheco Blvd, Martinez, CA 94553

Project/PO Number: 2011-149

Project Manager: Samantha Caruthers-Knight

Phone Number: 415 848 7100 Cell 510-851-3279

Sampler: Samantha Caruthers-Knight

Fax Number: 925 969 0751

Analysis Required

Sample Description	Sample Matrix	Container Type	# of Cont.	Sampling Date	Sampling Time	Preservatives	EPA 6010/6020 EPA 7471 (total metals)	EPA 9045 D (paste pH)	EPA 6002-78-054	EPA 6010/6020 EPA 7471 (dissolved metals)	EPA 8015 (TPH-dro)	EPA 300.7/6010B (ward vess)	SM 2320B (calk, bicarb, carb)	MI 160.2 (TSS)	Split pH	Special Instructions
PA-MT-SD-01	S	8.07 jar	2	06/15/12	1220		X					-01			X	Please homogenize
PA-ATV1-SS-01	S	8.07 jar	2	06/15/12	1345		X					-02			X	
PA-ATV2-SS-01	S	8.07 jar	2	06/15/12	1530		X					-03			X	
PA-MC-SS-01	S	8.07 jar	2	06/16/12	1340		X				X	-04			X	
~~PA-VT-SD-01~~	S	8.07 jar	2	06/16/12	1550		X	SCP								
PA-MA-SS-01	S	8.07 jar	2	06/17/12	1205		X					-05			X	
PA-MC-GW-01	W	various	5	06/17/12	1645	various	X			X	X	X	X	X		-06/07
PA-MT-GW-01	W	various	3	06/17/12	1700	various	X			X	X	X	X	X		-08/09
PA-UW-SS-01	S	8.07 jar	2	06/18/12	1030		X					~~-08~~			X	-10
PA-UW-WP-08	S	8.07 jar	2	06/18/12	1230		X					~~-09~~			X	-11
PA-BU-SS-01	S	8.07 jar	2	06/19/12	0840		X					~~-10~~			X	-12
PA-PC-WP-01	S	8.07 jar	2	06/19/12	1440		X					~~-11~~			X	-13
PA-PT-SD-01	S	8.07 jar	2	06/19/12	1310	SCP	X					~~-12~~			X	-14

Relinquished By:	Date/Time:	Received By:	Date/Time:	Turnaround Time: (Check)
[signature]	6/20/12 1510			same day ____ 72 hours ____
Relinquished By:	Date/Time:	Received By:	Date/Time:	24 hours ____ 5 days ____
				48 hours ____ normal X
Relinquished By:	Date/Time:	Received in Lab By: [signature]	Date/Time: 6-20-12 1510	Sample Integrity: (Check) intact X on ice X

Note: By relinquishing samples to TestAmerica, client agrees to pay for the services requested on this chain of custody form and any additional analyses performed on this project. Payment for services is due within 30 days from the date of invoice. Sample(s) will be disposed of after 30 days.

1.9°C

EMSL Analytical, Inc.
200 Route 130 North Cinnaminson, NJ 08077
Phone/Fax: (800) 220-3675 / (856) 786-5974
http://www.emsl.com / cinnasblab@EMSL.com

EMSL Order ID:	041216229
Customer ID:	ERRG25
Customer PO:	
Project ID:	

Attn:	Samantha Caruthers-Knight Engineering/Remediation Resources Group 4585 Pacheco Blvd Suite 200 Martinez, CA 94553	Phone: Fax: Collected: Received: Analyzed:	(925) 969-0750 06/17/2012 06/22/2012 07/06/2012
Proj:	2011-149		

Test Report: Determination of Asbestos Structures > 10µm in Water Performed by the 100.2 Method (EPA 600/R-94/134)

Sample ID Client / EMSL	Sample Filtration Date/Time	Original Sample Vol. Filtered (ml)	Effective Filter Area (mm²)	Area Analyzed (mm²)	ASBESTOS Asbestos Types	Fibers Detected	Analytical Sensitivity	Concentration	Confidence Limits
							MFL (million fibers per liter)		
PA-MC-GW-01 041216229-0001	6/22/2012 12:30 PM	5	1280	0.2640	None Detected	ND	0.97	<0.97	0.00 - 3.60
Due to excessive particulate the analytical sensitivity of 0.2 MFL as required by the method was not reached.									
PA-MT-SW-01 041216229-0002	6/22/2012 12:30 PM	0.20	1280	0.2640	None Detected	ND	24.00	<24.00	0.00 - 89.00
Due to excessive particulate the analytical sensitivity of 0.2 MFL as required by the method was not reached.									

Samples ozonated priort to analysis.

Analyst(s)
Steig Breloff (2)

Stephen Siegel, CIH, Laboratory Manager
or Other Approved Signatory

Any questions please contact Steve Siegel.

Initial report from: 07/06/2012 14:16:55

Sample collection and containers provided by the client, acceptable bottle blank level is defined as ≤0.01MFL>10um. ND=None Detected. This report may not be reproduced, except in full, without written permission by EMSL Analytical, Inc. The test results contained within this report meet the requirements of NELAC unless otherwise noted. This report relates only to the samples reported above. Samples received in good condition unless otherwise noted.

Samples analyzed by EMSL Analytical, Inc. Cinnaminson, NJ NELAC NJ DEP 03036

EMSL Analytical, Inc.
200 Route 130 North, Cinnaminson, NJ 08077
Phone/Fax: (800) 220-3675 / (856) 786-5974
http://www.emsl.com cinnasblab@EMSL.com

EMSL Order:	041216520
CustomerID:	ERRG25
CustomerPO:	
ProjectID:	

Attn: **Samantha Caruthers-Knight**
Engineering/Remediation Resources Group
4585 Pacheco Blvd
Suite 200
Martinez, CA 94553

Project: **2011-149**

Phone:	(925) 969-0750
Fax:	
Received:	06/22/12 9:30 AM
Analysis Date:	7/8/2012
Collected:	6/15/2012

Test Report: PLM Analysis of Bulk Samples for Asbestos via EPA 600/R-93/116 Method with CARB 435 Prep (Milling) Level A for 0.25% Target Analytical Sensitivity

			Non-Asbestos		Asbestos
Sample	**Description**	**Appearance**	**% Fibrous**	**% Non-Fibrous**	**% Type**
PA-MT-SD-01 *041216520-0001*		Brown Non-Fibrous Homogeneous		100.00% Non-fibrous (other)	**None Detected**
PA-ATV1-SS-01 *041216520-0002*		Brown Non-Fibrous Homogeneous		99.25% Non-fibrous (other)	**0.75% Chrysotile**
PA-ATV1-SS-02 *041216520-0003*		Brown Non-Fibrous Homogeneous		100.00% Non-fibrous (other)	**None Detected**
PA-ATV1-SS-03 *041216520-0004*		Brown Non-Fibrous Homogeneous		100.00% Non-fibrous (other)	**None Detected**
PA-ATV1-SS-04 *041216520-0005*		Brown Non-Fibrous Homogeneous		100.00% Non-fibrous (other)	**None Detected**
PA-ATV1-SS-05 *041216520-0006*		Brown Non-Fibrous Homogeneous		99.00% Non-fibrous (other)	**1.00% Chrysotile**
PA-ATV1-SS-07 *041216520-0007*		Brown Non-Fibrous Homogeneous		100.00% Non-fibrous (other)	**None Detected**

Analyst(s)

Baojia Ke (1)
Matthew Batongbacal (45)

Stephen Siegel, CIH, Laboratory Manager
or other approved signatory

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Samples analyzed by EMSL Analytical, Inc San Leandro, CA

Initial report from 07/08/2012 18:02:27

EMSL Analytical, Inc.
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Phone/Fax: (800) 220-3675 / (856) 786-5974
http://www.emsl.com cinnasblab@EMSL.com

EMSL Order:	041216520
CustomerID:	ERRG25
CustomerPO:	
ProjectID:	

Attn: **Samantha Caruthers-Knight**
Engineering/Remediation Resources Group
4585 Pacheco Blvd
Suite 200
Martinez, CA 94553

Phone:	(925) 969-0750
Fax:	
Received:	06/22/12 9:30 AM
Analysis Date:	7/8/2012
Collected:	6/15/2012

Project: **2011-149**

Test Report: PLM Analysis of Bulk Samples for Asbestos via EPA 600/R-93/116 Method with CARB 435 Prep (Milling) Level A for 0.25% Target Analytical Sensitivity

Sample	Description	Appearance	Non-Asbestos % Fibrous	Non-Asbestos % Non-Fibrous	Asbestos % Type
PA-ATV2-SS-01 *041216520-0008*		Brown Non-Fibrous Homogeneous		100.00% Non-fibrous (other)	**None Detected**
PA-ATV1-SS-06 *041216520-0009*		Brown Non-Fibrous Homogeneous		100.00% Non-fibrous (other)	**None Detected**
PA-MC-SS-01 *041216520-0010*		Brown Non-Fibrous Homogeneous		99.75% Non-fibrous (other)	**0.25% Chrysotile**
PA-MC-SS-02 *041216520-0011*		Brown Non-Fibrous Homogeneous		100.00% Non-fibrous (other)	**None Detected**
PA-MC-SS-03 *041216520-0012*		Brown Non-Fibrous Homogeneous		100.00% Non-fibrous (other)	**None Detected**
PA-MC-SS-04 *041216520-0013*		Brown Non-Fibrous Homogeneous		99.75% Non-fibrous (other)	**0.25% Chrysotile**
PA-MC-SS-05 *041216520-0014*		Brown Non-Fibrous Homogeneous		99.00% Non-fibrous (other)	**1.00% Chrysotile**

Analyst(s)

Baojia Ke (1)
Matthew Batongbacal (45)

Stephen Siegel, CIH, Laboratory Manager
or other approved signatory

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Samples analyzed by EMSL Analytical, Inc San Leandro, CA

Initial report from 07/08/2012 18:02:27

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Phone/Fax: (800) 220-3675 / (856) 786-5974
http://www.emsl.com cinnasblab@EMSL.com

EMSL Order:	041216520
CustomerID:	ERRG25
CustomerPO:	
ProjectID:	

Attn: **Samantha Caruthers-Knight**
Engineering/Remediation Resources Group
4585 Pacheco Blvd
Suite 200
Martinez, CA 94553

Project: **2011-149**

Phone:	(925) 969-0750
Fax:	
Received:	06/22/12 9:30 AM
Analysis Date:	7/8/2012
Collected:	6/15/2012

Test Report: PLM Analysis of Bulk Samples for Asbestos via EPA 600/R-93/116 Method with CARB 435 Prep (Milling) Level A for 0.25% Target Analytical Sensitivity

			Non-Asbestos		Asbestos
Sample	**Description**	**Appearance**	**% Fibrous**	**% Non-Fibrous**	**% Type**
PA-UT-SD-01 *041216520-0015*		Brown Non-Fibrous Homogeneous		100.00% Non-fibrous (other)	**None Detected**
PA-ATV2-SS-02 *041216520-0016*		Brown Non-Fibrous Homogeneous		100.00% Non-fibrous (other)	**None Detected**
PA-ATV2-SS-03 *041216520-0017*		Brown Non-Fibrous Homogeneous		100.00% Non-fibrous (other)	**None Detected**
PA-ATV2-SS-04 *041216520-0018*		Brown Non-Fibrous Homogeneous		100.00% Non-fibrous (other)	**None Detected**
PA-ATV2-SS-05 *041216520-0019*		Brown Non-Fibrous Homogeneous		100.00% Non-fibrous (other)	**None Detected**
PA-ATV2-SS-06 *041216520-0020*		Brown Non-Fibrous Homogeneous		100.00% Non-fibrous (other)	**None Detected**
PA-ATV2-SS-07 *041216520-0021*		Brown Non-Fibrous Homogeneous		100.00% Non-fibrous (other)	**None Detected**

Analyst(s)

Baojia Ke (1)
Matthew Batongbacal (45)

Stephen Siegel, CIH, Laboratory Manager
or other approved signatory

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Samples analyzed by EMSL Analytical, Inc San Leandro, CA

Initial report from 07/08/2012 18:02:27

EMSL Analytical, Inc.
200 Route 130 North, Cinnaminson, NJ 08077
Phone/Fax: (800) 220-3675 / (856) 786-5974
http://www.emsl.com cinnasblab@EMSL.com

EMSL Order:	041216520
CustomerID:	ERRG25
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Fax:	
Received:	06/22/12 9:30 AM
Analysis Date:	7/8/2012
Collected:	6/15/2012

Test Report: PLM Analysis of Bulk Samples for Asbestos via EPA 600/R-93/116 Method with CARB 435 Prep (Milling) Level A for 0.25% Target Analytical Sensitivity

Sample	Description	Appearance	Non-Asbestos % Fibrous	Non-Asbestos % Non-Fibrous	Asbestos % Type
PA-ATV2-SS-08 *041216520-0022*		Brown Non-Fibrous Homogeneous		100.00% Non-fibrous (other)	**None Detected**
PA-ATV2-SS-09 *041216520-0023*		Brown Non-Fibrous Homogeneous		100.00% Non-fibrous (other)	**None Detected**
PA-ATV2-SS-10 *041216520-0024*		Brown Non-Fibrous Homogeneous		100.00% Non-fibrous (other)	**None Detected**
PA-ATV2-SS-11 *041216520-0025*		Brown Non-Fibrous Homogeneous		100.00% Non-fibrous (other)	**None Detected**
PA-ATV2-SS-12 *041216520-0026*		Brown Non-Fibrous Homogeneous		100.00% Non-fibrous (other)	**None Detected**
PA-MA-SS-01 *041216520-0027*		Brown Non-Fibrous Homogeneous		98.75% Non-fibrous (other)	**1.25% Chrysotile**
PA-MA-SS-02 *041216520-0028*		Brown Non-Fibrous Homogeneous		94.25% Non-fibrous (other)	**5.75% Chrysotile**

Analyst(s)

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Matthew Batongbacal (45)

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EMSL Order:	041216520
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4585 Pacheco Blvd
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Martinez, CA 94553

Phone:	(925) 969-0750
Fax:	
Received:	06/22/12 9:30 AM
Analysis Date:	7/8/2012
Collected:	6/15/2012

Project: **2011-149**

Test Report: PLM Analysis of Bulk Samples for Asbestos via EPA 600/R-93/116 Method with CARB 435 Prep (Milling) Level A for 0.25% Target Analytical Sensitivity

			Non-Asbestos		Asbestos
Sample	**Description**	**Appearance**	**% Fibrous**	**% Non-Fibrous**	**% Type**
PA-MA-SS-03 *041216520-0029*		Brown Non-Fibrous Homogeneous		90.50% Non-fibrous (other)	**9.50% Chrysotile**
PA-MA-SS-04 *041216520-0030*		Brown Non-Fibrous Homogeneous		100.00% Non-fibrous (other)	**None Detected**
PA-MA-SS-05 *041216520-0031*		Brown Non-Fibrous Homogeneous		99.50% Non-fibrous (other)	**0.50% Chrysotile**
PA-UW-SS-01 *041216520-0032*		Brown Non-Fibrous Homogeneous		100.00% Non-fibrous (other)	**None Detected**
PA-UW-SS-02 *041216520-0033*		Brown Non-Fibrous Homogeneous		100.00% Non-fibrous (other)	**None Detected**
PA-UW-SS-03 *041216520-0034*		Brown Non-Fibrous Homogeneous		100.00% Non-fibrous (other)	**None Detected**
PA-UW-SS-04 *041216520-0035*		Brown Non-Fibrous Homogeneous		100.00% Non-fibrous (other)	**None Detected**

Analyst(s)

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Matthew Batongbacal (45)

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Phone/Fax: (800) 220-3675 / (856) 786-5974
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ProjectID:	

Attn: **Samantha Caruthers-Knight**
Engineering/Remediation Resources Group
4585 Pacheco Blvd
Suite 200
Martinez, CA 94553

Project: **2011-149**

Phone:	(925) 969-0750
Fax:	
Received:	06/22/12 9:30 AM
Analysis Date:	7/8/2012
Collected:	6/15/2012

Test Report: PLM Analysis of Bulk Samples for Asbestos via EPA 600/R-93/116 Method with CARB 435 Prep (Milling) Level A for 0.25% Target Analytical Sensitivity

			Non-Asbestos		Asbestos
Sample	**Description**	**Appearance**	**% Fibrous**	**% Non-Fibrous**	**% Type**
PA-UW-SS-05 *041216520-0036*		Brown Non-Fibrous Homogeneous		99.50% Non-fibrous (other)	**0.50% Chrysotile**
PA-UW-SS-06 *041216520-0037*		Brown Non-Fibrous Homogeneous		99.75% Non-fibrous (other)	**0.25% Chrysotile**
PA-UW-WP-07 *041216520-0038*		Brown Non-Fibrous Homogeneous		86.25% Non-fibrous (other)	**13.75% Chrysotile**
PA-UW-WP-08 *041216520-0039*		Brown Non-Fibrous Homogeneous		97.75% Non-fibrous (other)	**2.25% Chrysotile**
PA-UW-WP-09 *041216520-0040*		Brown Non-Fibrous Homogeneous		95.00% Non-fibrous (other)	**5.00% Chrysotile**
PA-BG-SS-01 *041216520-0041*		Brown Non-Fibrous Homogeneous		100.00% Non-fibrous (other)	**None Detected**
PA-BG-SS-02 *041216520-0042*		Brown Non-Fibrous Homogeneous		100.00% Non-fibrous (other)	**None Detected**

Analyst(s)

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Matthew Batongbacal (45)

Stephen Siegel, CIH, Laboratory Manager
or other approved signatory

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http://www.emsl.com cinnasblab@EMSL.com

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4585 Pacheco Blvd
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Martinez, CA 94553

Project: **2011-149**

Phone:	(925) 969-0750
Fax:	
Received:	06/22/12 9:30 AM
Analysis Date:	7/8/2012
Collected:	6/15/2012

Test Report: PLM Analysis of Bulk Samples for Asbestos via EPA 600/R-93/116 Method with CARB 435 Prep (Milling) Level A for 0.25% Target Analytical Sensitivity

			Non-Asbestos		Asbestos
Sample	**Description**	**Appearance**	**% Fibrous**	**% Non-Fibrous**	**% Type**
PA-BG-SS-03 *041216520-0043*		Brown Non-Fibrous Homogeneous		100.00% Non-fibrous (other)	**None Detected**
PA-BG-SS-04 *041216520-0044*		Brown Non-Fibrous Homogeneous		100.00% Non-fibrous (other)	**None Detected**
PA-PC-WP-01 *041216520-0045*		Brown Non-Fibrous Homogeneous		99.75% Non-fibrous (other)	**0.25% Chrysotile**
PA-PT-SD-01 *041216520-0046*		Brown Non-Fibrous Homogeneous		100.00% Non-fibrous (other)	**None Detected**

Analyst(s)

Baojia Ke (1)
Matthew Batongbacal (45)

Stephen Siegel, CIH, Laboratory Manager
or other approved signatory

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Samples analyzed by EMSL Analytical, Inc San Leandro, CA

Initial report from 07/08/2012 18:02:27

THIS IS THE LAST PAGE OF THE REPORT.

EMSL Analytical, Inc.

Asbestos Data Package

Engineering/Remediation Resources Group, Inc.
Project 2011-149 Phillip's Mine
Data Package 1

EMSL Order ID 041216273

Prepared By: EMSL Special Projects Group

Date: August 7, 2012

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5. Client and EMSL Internal Chains of Custody
6. Equipment Performance Checks
7. NVLAP/AIHA Certifications
8. Customer Correspondence

1. Case Narrative

EMSL ANALYTICAL, INC.
200 RT. 130 NORTH
CINNAMINSON, NJ 08077
PHONE: (800) 220-3675
FAX: (856) 786-0235

August 7, 2012

Engineering/Remediation Resources Group
Samantha Caruthers-Knight
4585 Pacheco Blvd
Suite 200
Martinez, CA 94553
Phone: (925)-969-0750

Re: Narrative, TEM ISO 10312 & ISO 13794; Phillip's Mine; EMSL order ID 041216273
Dear Samantha:

On June 22, 2012, EMSL Analytical, Inc. in Cinnaminson, NJ received forty-eight air samples via FedEx for asbestos content analysis via TEM ISO 10312. The samples were logged in following normal lab procedures. Samples were received under Chain of Custody from Engineering/Remediation Resources Group and arrived in good condition.

TEM ISO 10312

TEM analysis was performed using the following method: TEM ISO 10312: 1995-05-01 Ambient Air-Determination of Asbestos Fibres-Direct Transfer Transmission Electron Microscopy. Client specified analysis utilizing specifications found in Annex E.

Client specified modifications to method as follows:

- An analytical sensitivity of 0.002 S/cc for Ambient Air Samples and 0.004 S/cc for Activity Based Samples was specified verbally by client.
- All field blanks and laboratory blanks each had 10 grid openings analyzed.
- PCM (0.8u) 25mm MCE cassettes were used for sampling.
- Aspect ratio applied was modified to greater than or equal to 3:1.
- A minimum of 4 grid openings were analyzed, from 2 separate grid preparations.
- Width requirement of countable structures was altered to 0.25 microns.
- Structures greater than 5.0 microns in length were recorded.

Results
Samples were analyzed via transmission electron microscopy (TEM) using procedures from ISO 10312. Analysis was performed on a JEOL 100 CX II microscope at approximately 10,000X. Analysis was performed in EMSL's New York, NY laboratory.

The following results were edited and reported on 7/27/2012:
041216273-0027

EMSL ANALYTICAL, INC.
200 RT. 130 NORTH
CINNAMINSON, NJ 08077
PHONE: (800) 220-3675
FAX: (856) 786-0235

The following results were edited and reported on 8/3/2012:
041216273-0017, 041216273-0030, 041216273-0036, 041216273-0045 along with benchsheets for sample 041216273-0024.

TEM ISO 13794

TEM analysis was performed using the following method for applicable samples: TEM ISO 13794: 1999-07-15 Ambient Air-Determination of Asbestos Fibres-Indirect Transfer Transmission Electron Microscopy. Samples that were deemed overloaded or displayed a non uniform deposition, either before or after analysis by ISO 10312, proceeded to analysis by ISO 13794 following approval from client. Filter remnants were slowly ashed and the residue was suspended in de-ionized water. An aliquot of each suspension was filtered onto an MCE filter.

The following samples were analyzed via ISO 13794:
EMSL sample ID: 041216273-0016; Client sample ID: PA-ATVI-AM-03
EMSL sample ID: 041216273-0017; Client sample ID: PA-ATVI-AM-04
EMSL sample ID: 041216273-0040; Client sample ID: PA-ATV2-AM-04

All client-specified modifications for TEM ISO 10312 were also applied to samples analyzed by ISO 13794.

Results
Samples were analyzed via transmission electron microscopy (TEM) using procedures from ISO 13794. Analysis was performed on a JEOL 1200 EX microscope at approximately 10,000X. Analysis was performed in EMSL's Cinnaminson, NJ laboratory.

All reports for samples analyzed by TEM ISO 13794 were amended and reported on 7/27/2012.

Quality Control Performed
The Quality Control (QC) and equipment calibration was performed in compliance with EMSL's Quality Assurance Manual. For this order ID, three inter-analyst QC's were analyzed as well as one intra-analyst QC. Five lab blanks, one ashing blank, one filtration blank, and one hood blank were analyzed for this sample set. All QC results presented within this package were found to be concordant.

I certify that this data package is in compliance with the terms and conditions of the contract, both technically and for completeness, for other than the conditions detailed above. In addition, I certify, that to the best of my knowledge and belief, the data as reported are true and accurate. Release of the data contained in this data package has been authorized by the Laboratory Manager(s) or his designee, as verified by the following signature(s).

Robyn Denton 07 Aug 2012
Date

Robyn Denton
Asbestos Laboratory Manager
EMSL Cinnaminson, NJ

2. Tabulated Sample Results

EMSL

Attention: Samantha Caruthers-Knight
Engineering/Remediation Resources Group
4585 Pacheco Blvd.
Suite 200
Martinez, CA 94553
Phone: (925) 969-0750
Project: 2011-149 Phillips Mine

Customer ID: ERRG25
Customer PO:
Received: 6/22/12 9:30 AM

EMSL Order: 041216273
Analysis Date: 7/5/2012
Report Date: 07/18/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:	041216273-0001	
Customer Sample #:	PA-MC-AA-01	
Date sampled:	6/16/2012	
Initials of Analyst:	DY	
Air volume:	791.1	Liters
Area of collection filter:	385	mm²
Level of analysis (chrysotile):	CD	
Level of analysis (amphibole):	ADX	
Magnification used for fiber counting:	~10,000	X
Aspect ratio for fiber definition:	3:1	
Minimum length to be counted:	> 5.0	microns
Minimum width to be counted:	0.25	microns
Mean dimension of grid openings:	0.0130	mm²
Number of Grid Openings Analyzed:	19	
Analytical Sensitivity:	0.0018	Str/cc
Number of Primary Asbestos Structures Counted:	0	
Number of total asbestos structures counted:	0	
Number of Asbestos Structures > 5 microns:	0	
Number of Asbestos fibers and bundles > 5 microns:	0	
Number of PCM equivalent asbestos structures:	0	
Number of PCM equivalent asbestos fibers:	0	
Concentration of Chrysotile Asbestos:	< 0.0054	Str/cc
Concentration of Amphibole Asbestos:	< 0.0054	Str/cc
Lower 95% Confidence Limit (Chrysotile)	N/A	Str/cc
Upper 95% Confidence Limit (Chrysotile)	< 0.0054	Str/cc
Lower 95% Confidence Limit (Amphibole)	N/A	Str/cc
Upper 95% Confidence Limit (Amphibole)	< 0.0054	Str/cc
Concentration of Asbestos (total):	< 0.0054	Str/cc

Comments:
Non-Countable Asbestos structure present during analysis.
Particulate loading 1-5%

Robyn Denton
Approved Signatory

Attention: Samantha Caruthers-Knight
Engineering/Remediation Resources Group
4585 Pacheco Blvd.
Suite 200
Martinez, CA 94553
Phone: (925) 969-0750
Project: 2011-149 Phillips Mine

Customer ID: ERRG25
Customer PO:
Received: 6/22/12 9:30 AM

EMSL Order: 041216273
Analysis Date: 7/5/2012
Report Date: 07/18/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:	041216273-0002	
Customer Sample #:	PA-MC-AA-03	
Date sampled:	6/16/2012	
Initials of Analyst:	DY	
Air volume:	709.155	Liters
Area of collection filter:	385	mm²
Level of analysis (chrysotile):	CD	
Level of analysis (amphibole):	ADX	
Magnification used for fiber counting:	~10,000	X
Aspect ratio for fiber definition:	3:1	
Minimum length to be counted:	> 5.0	microns
Minimum width to be counted:	0.25	microns
Mean dimension of grid openings:	0.0130	mm²
Number of Grid Openings Analyzed:	21	
Analytical Sensitivity:	0.00190	Str/cc
Number of Primary Asbestos Structures Counted:	0	
Number of total asbestos structures counted:	0	
Number of Asbestos Structures > 5 microns:	0	
Number of Asbestos fibers and bundles > 5 microns:	0	
Number of PCM equivalent asbestos structures:	0	
Number of PCM equivalent asbestos fibers:	0	
Concentration of Chrysotile Asbestos:	< 0.0057	Str/cc
Concentration of Amphibole Asbestos:	< 0.0057	Str/cc
Lower 95% Confidence Limit (Chrysotile)	N/A	Str/cc
Upper 95% Confidence Limit (Chrysotile)	< 0.0057	Str/cc
Lower 95% Confidence Limit (Amphibole)	N/A	Str/cc
Upper 95% Confidence Limit (Amphibole)	< 0.0057	Str/cc
Concentration of Asbestos (total):	**< 0.0057**	**Str/cc**

Comments:
Particulate loading 1-5%

Robyn Denton
Approved Signatory

Attention: Samantha Caruthers-Knight
Engineering/Remediation Resources Group
4585 Pacheco Blvd.
Suite 200
Martinez, CA 94553
Phone: (925) 969-0750
Project: 2011-149 Phillips Mine

Customer ID: ERRG25
Customer PO:
Received: 6/22/12 9:30 AM

EMSL Order: 041216273
Analysis Date: 6/26/2012
Report Date: 07/18/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		041216273-0003	
Customer Sample #:		PA-MC-AM-04	
Date sampled:		6/16/2012	
Initials of Analyst:		PH	
Air volume:		483.975	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~10,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5.0	microns
Minimum width to be counted:		0.25	microns
Mean dimension of grid openings:		0.0130	mm²
Number of Grid Openings Analyzed:		16	
Analytical Sensitivity:		0.0038	Str/cc
Number of Primary Asbestos Structures Counted:		0	
Number of total asbestos structures counted:		0	
Number of Asbestos Structures > 5 microns:		0	
Number of Asbestos fibers and bundles > 5 microns:		0	
Number of PCM equivalent asbestos structures:		0	
Number of PCM equivalent asbestos fibers:		0	
Concentration of Chrysotile Asbestos:	<	0.0114	Str/cc
Concentration of Amphibole Asbestos:	<	0.0114	Str/cc
Lower 95% Confidence Limit (Chrysotile)		N/A	Str/cc
Upper 95% Confidence Limit (Chrysotile)	<	0.0114	Str/cc
Lower 95% Confidence Limit (Amphibole)		N/A	Str/cc
Upper 95% Confidence Limit (Amphibole)	<	0.0114	Str/cc
Concentration of Asbestos (total):	**<**	**0.0114**	**Str/cc**

Comments:
Particulate Loading 8 %

Robyn Denton
Approved Signatory

Attention: Samantha Caruthers-Knight
Engineering/Remediation Resources Group
4585 Pacheco Blvd.
Suite 200
Martinez, CA 94553
Phone: (925) 969-0750
Project: 2011-149 Phillips Mine

Customer ID: ERRG25
Customer PO:
Received: 6/22/12 9:30 AM

EMSL Order: 041216273
Analysis Date:
Report Date: 07/18/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		041216273-0004	
Customer Sample #:		PA-MC-AA-02	
Date sampled:		6/16/2012	
Initials of Analyst:		DY	
Air volume:		641.325	Liters
Area of collection filter:		385	mm^2
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~10,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5.0	microns
Minimum width to be counted:		0.25	microns
Mean dimension of grid openings:		0.013	mm^2
Number of Grid Openings Analyzed:		24	
Analytical Sensitivity:		0.0019	Str/cc
Number of Primary Asbestos Structures Counted:		0	
Number of total asbestos structures counted:		0	
Number of Asbestos Structures > 5 microns:		0	
Number of Asbestos fibers and bundles > 5 microns:		0	
Number of PCM equivalent asbestos structures:		0	
Number of PCM equivalent asbestos fibers:		0	
Concentration of Chrysotile Asbestos:	<	0.0058	Str/cc
Concentration of Amphibole Asbestos:	<	0.0058	Str/cc
Lower 95% Confidence Limit (Chrysotile)		N/A	Str/cc
Upper 95% Confidence Limit (Chrysotile)	<	0.0058	Str/cc
Lower 95% Confidence Limit (Amphibole)		N/A	Str/cc
Upper 95% Confidence Limit (Amphibole)	<	0.0058	Str/cc
Concentration of Asbestos (total):	<	0.0058	**Str/cc**

Comments:
Particulate Loading 1-5%

Robyn Denton
Approved Signatory

Attention: Samantha Caruthers-Knight
Engineering/Remediation Resources Group
4585 Pacheco Blvd.
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Customer ID: ERRG25
Customer PO:
Received: 6/22/12 9:30 AM

EMSL Order: 041216273
Analysis Date: 6/26/2012
Report Date: 07/18/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		041216273-0005	
Customer Sample #:		PA-MC-AM-01	
Date sampled:		6/16/2012	
Initials of Analyst:		PH	
Air volume:		487.575	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~10,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5.0	microns
Minimum width to be counted:		0.25	microns
Mean dimension of grid openings:		0.0130	mm²
Number of Grid Openings Analyzed:		16	
Analytical Sensitivity:		0.0037	Str/cc
Number of Primary Asbestos Structures Counted:		0	
Number of total asbestos structures counted:		0	
Number of Asbestos Structures > 5 microns:		0	
Number of Asbestos fibers and bundles > 5 microns:		0	
Number of PCM equivalent asbestos structures:		0	
Number of PCM equivalent asbestos fibers:		0	
Concentration of Chrysotile Asbestos:	<	0.0111	Str/cc
Concentration of Amphibole Asbestos:	<	0.0111	Str/cc
Lower 95% Confidence Limit (Chrysotile)		N/A	Str/cc
Upper 95% Confidence Limit (Chrysotile)	<	0.0111	Str/cc
Lower 95% Confidence Limit (Amphibole)		N/A	Str/cc
Upper 95% Confidence Limit (Amphibole)	<	0.0111	Str/cc
Concentration of Asbestos (total):	**<**	**0.0111**	**Str/cc**

Comments:
Particulate Loading 3 %

Robyn Denton
Approved Signatory

Attention: Samantha Caruthers-Knight
Engineering/Remediation Resources Group
4585 Pacheco Blvd.
Suite 200
Martinez, CA 94553
Phone: (925) 969-0750
Project: 2011-149 Phillips Mine

Customer ID: ERRG25
Customer PO:
Received: 6/22/12 9:30 AM

EMSL Order: 041216273
Analysis Date: 7/5/2012
Report Date: 07/18/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		041216273-0006	
Customer Sample #:		PA-MC-AM-03	
Date sampled:		6/16/2012	
Initials of Analyst:		GI	
Air volume:		561.6	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~10,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5.0	microns
Minimum width to be counted:		0.25	microns
Mean dimension of grid openings:		0.0130	mm²
Number of Grid Openings Analyzed:		15	
Analytical Sensitivity:		0.0035	Str/cc
Number of Primary Asbestos Structures Counted:		1	
Number of total asbestos structures counted:		1	
Number of Asbestos Structures > 5 microns:		1	
Number of Asbestos fibers and bundles > 5 microns:		1	
Number of PCM equivalent asbestos structures:		1	
Number of PCM equivalent asbestos fibers:		1	
Concentration of Chrysotile Asbestos:	<	0.0166	Str/cc
Concentration of Amphibole Asbestos:	<	0.0166	Str/cc
Lower 95% Confidence Limit (Chrysotile)		N/A	Str/cc
Upper 95% Confidence Limit (Chrysotile)	<	0.0166	Str/cc
Lower 95% Confidence Limit (Amphibole)		N/A	Str/cc
Upper 95% Confidence Limit (Amphibole)	<	0.0166	Str/cc
Concentration of Asbestos (total):	**<**	**0.0166**	**Str/cc**

Comments:
Particulate Loading 10%

Robyn Denton
Approved Signatory

Attention: Samantha Caruthers-Knight
Engineering/Remediation Resources Group
4585 Pacheco Blvd.
Suite 200
Martinez, CA 94553
Phone: (925) 969-0750
Project: 2011-149 Phillips Mine

Customer ID: ERRG25
Customer PO:
Received: 6/22/12 9:30 AM

EMSL Order: 041216273
Analysis Date: 7/6/2012
Report Date: 07/18/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		041216273-0007	
Customer Sample #:		PA-MC-AM-02	
Date sampled:		6/16/2012	
Initials of Analyst:		AF	
Air volume:		584.55	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~10,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5.0	microns
Minimum width to be counted:		0.25	microns
Mean dimension of grid openings:		0.0130	mm²
Number of Grid Openings Analyzed:		14	
Analytical Sensitivity:		0.0036	Str/cc
Number of Primary Asbestos Structures Counted:		0	
Number of total asbestos structures counted:		0	
Number of Asbestos Structures > 5 microns:		0	
Number of Asbestos fibers and bundles > 5 microns:		0	
Number of PCM equivalent asbestos structures:		0	
Number of PCM equivalent asbestos fibers:		0	
Concentration of Chrysotile Asbestos:	<	0.0108	Str/cc
Concentration of Amphibole Asbestos:	<	0.0108	Str/cc
Lower 95% Confidence Limit (Chrysotile)		N/A	Str/cc
Upper 95% Confidence Limit (Chrysotile)	<	0.0108	Str/cc
Lower 95% Confidence Limit (Amphibole)		N/A	Str/cc
Upper 95% Confidence Limit (Amphibole)	<	0.0108	Str/cc
Concentration of Asbestos (total):	**<**	**0.0108**	**Str/cc**

Comments:
Particulate Loading 5-10%

Robyn Denton
Approved Signatory

Attention: Samantha Caruthers-Knight
Engineering/Remediation Resources Group
4585 Pacheco Blvd.
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Phone: (925) 969-0750
Project: 2011-149 Phillips Mine

Customer ID: ERRG25
Customer PO:
Received: 6/22/12 9:30 AM

EMSL Order: 041216273
Analysis Date: 7/6/2012
Report Date: 07/18/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		041216273-0008	
Customer Sample #:		PA-ATV1-AA-01	
Date sampled:		6/17/2012	
Initials of Analyst:		AF	
Air volume:		493.2	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~10,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5.0	microns
Minimum width to be counted:		0.25	microns
Mean dimension of grid openings:		0.0130	mm²
Number of Grid Openings Analyzed:		31	
Analytical Sensitivity:		0.0019	Str/cc
Number of Primary Asbestos Structures Counted:		0	
Number of total asbestos structures counted:		0	
Number of Asbestos Structures > 5 microns:		0	
Number of Asbestos fibers and bundles > 5 microns:		0	
Number of PCM equivalent asbestos structures:		0	
Number of PCM equivalent asbestos fibers:		0	
Concentration of Chrysotile Asbestos:	<	0.0057	Str/cc
Concentration of Amphibole Asbestos:	<	0.0057	Str/cc
Lower 95% Confidence Limit (Chrysotile)		N/A	Str/cc
Upper 95% Confidence Limit (Chrysotile)	<	0.0057	Str/cc
Lower 95% Confidence Limit (Amphibole)		N/A	Str/cc
Upper 95% Confidence Limit (Amphibole)	<	0.0057	Str/cc
Concentration of Asbestos (total):	**<**	**0.0057**	**Str/cc**

Comments:
Particulate loading 10-15%

Robyn Denton
Approved Signatory

Attention: Samantha Caruthers-Knight
Engineering/Remediation Resources Group
4585 Pacheco Blvd.
Suite 200
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Phone: (925) 969-0750
Project: 2011-149 Phillips Mine

Customer ID: ERRG25
Customer PO:
Received: 6/22/12 9:30 AM

EMSL Order: 041216273
Analysis Date: 7/6/2012
Report Date: 07/18/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		041216273-0009	
Customer Sample #:		PA-ATV1-AA-02	
Date sampled:		6/17/2012	
Initials of Analyst:		AF	
Air volume:		374.94	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~10,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5.0	microns
Minimum width to be counted:		0.25	microns
Mean dimension of grid openings:		0.0130	mm²
Number of Grid Openings Analyzed:		40	
Analytical Sensitivity:		0.0019	Str/cc
Number of Primary Asbestos Structures Counted:		0	
Number of total asbestos structures counted:		0	
Number of Asbestos Structures > 5 microns:		0	
Number of Asbestos fibers and bundles > 5 microns:		0	
Number of PCM equivalent asbestos structures:		0	
Number of PCM equivalent asbestos fibers:		0	
Concentration of Chrysotile Asbestos:	<	0.0057	Str/cc
Concentration of Amphibole Asbestos:	<	0.0057	Str/cc
Lower 95% Confidence Limit (Chrysotile)		N/A/	Str/cc
Upper 95% Confidence Limit (Chrysotile)	<	0.0057	Str/cc
Lower 95% Confidence Limit (Amphibole)		N/A/	Str/cc
Upper 95% Confidence Limit (Amphibole)	<	0.0057	Str/cc
Concentration of Asbestos (total):	**<**	**0.0057**	**Str/cc**

Comments:
Particulate loading 10-15%

Robyn Denton
Approved Signatory

Attention: Samantha Caruthers-Knight
Engineering/Remediation Resources Group
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Phone: (925) 969-0750
Project: 2011-149 Phillips Mine

Customer ID: ERRG25
Customer PO:
Received: 6/22/12 9:30 AM

EMSL Order: 041216273
Analysis Date: 7/6/2012
Report Date: 07/18/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		041216273-0010	
Customer Sample #:		PA-ATV1-AA-03	
Date sampled:		6/17/2012	
Initials of Analyst:		AF	
Air volume:		375.85	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~10,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5.0	microns
Minimum width to be counted:		0.25	microns
Mean dimension of grid openings:		0.0130	mm²
Number of Grid Openings Analyzed:		40	
Analytical Sensitivity:		0.0019	Str/cc
Number of Primary Asbestos Structures Counted:		0	
Number of total asbestos structures counted:		0	
Number of Asbestos Structures > 5 microns:		0	
Number of Asbestos fibers and bundles > 5 microns:		0	
Number of PCM equivalent asbestos structures:		0	
Number of PCM equivalent asbestos fibers:		0	
Concentration of Chrysotile Asbestos:	<	0.0057	Str/cc
Concentration of Amphibole Asbestos:	<	0.0057	Str/cc
Lower 95% Confidence Limit (Chrysotile)		N/A	Str/cc
Upper 95% Confidence Limit (Chrysotile)	<	0.0057	Str/cc
Lower 95% Confidence Limit (Amphibole)		N/A	Str/cc
Upper 95% Confidence Limit (Amphibole)	<	0.0057	Str/cc
Concentration of Asbestos (total):	**<**	**0.0057**	**Str/cc**

Comments:
Particulate Loading 1-5%

Robyn Denton
Approved Signatory

Attention: Samantha Caruthers-Knight
Engineering/Remediation Resources Group
4585 Pacheco Blvd.
Suite 200
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Phone: (925) 969-0750
Project: 2011-149 Phillips Mine

Customer ID: ERRG25
Customer PO:
Received: 6/22/12 9:30 AM

EMSL Order: 041216273
Analysis Date: 7/6/2012
Report Date: 07/18/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		041216273-0012	
Customer Sample #:		PA-ATV1-AA-05	
Date sampled:		6/17/2012	
Initials of Analyst:		DY	
Air volume:		385.38	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~10,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5.0	microns
Minimum width to be counted:		0.25	microns
Mean dimension of grid openings:		0.0130	mm²
Number of Grid Openings Analyzed:		40	
Analytical Sensitivity:		0.0019	Str/cc
Number of Primary Asbestos Structures Counted:		1	
Number of total asbestos structures counted:		1	
Number of Asbestos Structures > 5 microns:		1	
Number of Asbestos fibers and bundles > 5 microns:		1	
Number of PCM equivalent asbestos structures:		1	
Number of PCM equivalent asbestos fibers:		1	
Concentration of Chrysotile Asbestos:	<	0.0090	Str/cc
Concentration of Amphibole Asbestos:	<	0.0090	Str/cc
Lower 95% Confidence Limit (Chrysotile)		<N/A	Str/cc
Upper 95% Confidence Limit (Chrysotile)	<	0.0090	Str/cc
Lower 95% Confidence Limit (Amphibole)		N/A	Str/cc
Upper 95% Confidence Limit (Amphibole)	<	0.0090	Str/cc
Concentration of Asbestos (total):	**<**	**0.0090**	**Str/cc**

Comments:
Particulate Loading 3-5%

Robyn Denton
Approved Signatory

Attention: Samantha Caruthers-Knight
Engineering/Remediation Resources Group
4585 Pacheco Blvd.
Suite 200
Martinez, CA 94553
Phone: (925) 969-0750
Project: 2011-149 Phillips Mine

Customer ID: ERRG25
Customer PO:
Received: 6/22/12 9:30 AM

EMSL Order: 041216273
Analysis Date:
Report Date: 07/18/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		041216273-0013	
Customer Sample #:		PA-ATV1-AA-06	
Date sampled:		6/17/2012	
Initials of Analyst:		DY	
Air volume:		512.28	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~10,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5.0	microns
Minimum width to be counted:		0.25	microns
Mean dimension of grid openings:		0.0130	mm²
Number of Grid Openings Analyzed:		30	
Analytical Sensitivity:		0.0019	Str/cc
Number of Primary Asbestos Structures Counted:		0	
Number of total asbestos structures counted:		0	
Number of Asbestos Structures > 5 microns:		0	
Number of Asbestos fibers and bundles > 5 microns:		0	
Number of PCM equivalent asbestos structures:		0	
Number of PCM equivalent asbestos fibers:		0	
Concentration of Chrysotile Asbestos:	<	0.0057	Str/cc
Concentration of Amphibole Asbestos:	<	0.0057	Str/cc
Lower 95% Confidence Limit (Chrysotile)		N/A	Str/cc
Upper 95% Confidence Limit (Chrysotile)	<	0.0057	Str/cc
Lower 95% Confidence Limit (Amphibole)		N/A	Str/cc
Upper 95% Confidence Limit (Amphibole)	<	0.0057	Str/cc
Concentration of Asbestos (total):	**<**	**0.0057**	**Str/cc**

Comments:
Particulate Loading 15-20%

Robyn Denton
Approved Signatory

Attention: Samantha Caruthers-Knight
Engineering/Remediation Resources Group
4585 Pacheco Blvd.
Suite 200
Martinez, CA 94553
Phone: (925) 969-0750
Project: 2011-149 Phillips Mine

Customer ID: ERRG25
Customer PO:
Received: 6/22/12 9:30 AM

EMSL Order: 041216273
Analysis Date: 7/6/2012
Report Date: 07/18/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		041216273-0014	
Customer Sample #:		PA-ATV1-AM-01	
Date sampled:		6/17/2012	
Initials of Analyst:		ES	
Air volume:		430.2	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~10,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5.0	microns
Minimum width to be counted:		0.25	microns
Mean dimension of grid openings:		0.0130	mm²
Number of Grid Openings Analyzed:		19	
Analytical Sensitivity:		0.0035	Str/cc
Number of Primary Asbestos Structures Counted:		0	
Number of total asbestos structures counted:		0	
Number of Asbestos Structures > 5 microns:		0	
Number of Asbestos fibers and bundles > 5 microns:		0	
Number of PCM equivalent asbestos structures:		0	
Number of PCM equivalent asbestos fibers:		0	
Concentration of Chrysotile Asbestos:	<	0.0105	Str/cc
Concentration of Amphibole Asbestos:	<	0.0105	Str/cc
Lower 95% Confidence Limit (Chrysotile)		N/A	Str/cc
Upper 95% Confidence Limit (Chrysotile)	<	0.0105	Str/cc
Lower 95% Confidence Limit (Amphibole)		N/A	Str/cc
Upper 95% Confidence Limit (Amphibole)	<	0.0105	Str/cc
Concentration of Asbestos (total):	**<**	**0.0105**	**Str/cc**

Comments:
Particulate Loading 5-10 %

Robyn Denton
Approved Signatory

Attention: Samantha Caruthers-Knight
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4585 Pacheco Blvd.
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Martinez, CA 94553
Phone: (925) 969-0750
Project: 2011-149 Phillips Mine

Customer ID: ERRG25
Customer PO:
Received: 6/22/12 9:30 AM

EMSL Order: 041216273
Analysis Date: 7/6/2012
Report Date: 07/18/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		041216273-0015	
Customer Sample #:		PA-ATV1-AM-02	
Date sampled:		6/17/2012	
Initials of Analyst:		ES	
Air volume:		403.2	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~10,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5.0	microns
Minimum width to be counted:		0.25	microns
Mean dimension of grid openings:		0.0130	mm²
Number of Grid Openings Analyzed:		20	
Analytical Sensitivity:		0.0036	Str/cc
Number of Primary Asbestos Structures Counted:		0	
Number of total asbestos structures counted:		0	
Number of Asbestos Structures > 5 microns:		0	
Number of Asbestos fibers and bundles > 5 microns:		0	
Number of PCM equivalent asbestos structures:		0	
Number of PCM equivalent asbestos fibers:		0	
Concentration of Chrysotile Asbestos:	<	0.0108	Str/cc
Concentration of Amphibole Asbestos:	<	0.0108	Str/cc
Lower 95% Confidence Limit (Chrysotile)		N/A	Str/cc
Upper 95% Confidence Limit (Chrysotile)	<	0.0108	Str/cc
Lower 95% Confidence Limit (Amphibole)		N/A	Str/cc
Upper 95% Confidence Limit (Amphibole)	<	0.0108	Str/cc
Concentration of Asbestos (total):	**<**	**0.0108**	**Str/cc**

Comments:
Particulate Loading 3-5 %

Robyn Denton
Approved Signatory

EMSL

Attention: Samantha Caruthers-Knight
Engineering/Remediation Resources Group
4585 Pacheco Blvd.
Suite 200
Martinez, CA 94553
Phone: (925) 969-0750
Project: 2011-149 Phillips Mine

Customer ID: ERRG25
Customer PO:
Received: 6/22/12 9:30 AM

EMSL Order: 041216273
Analysis Date: 7/20/2012
Report Date: 07/26/12

ISO 13794-Ambient Air - Determination of Asbestos Fibers Indirect Transfer Transmission Electron Microscopy

EMSL Sample #:		041216273-0016	
Customer Sample #:		PA-ATV1-AM-03	
Date sampled:		6/17/2012	
Initials of Analyst:		PH	
Air volume:		396.36	Liters
Area of collection filter:		385	mm^2
Area of analytical filter:		364.9	mm^2
Percent of filter Ashed:		100	%
Volume of water used for ash dispersal:		40	mL
Volume of dispersion applied to analytical filter:		5	mL
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~20,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5.0	microns
Minimum width to be counted:	>	0.25	microns
Mean dimension of grid openings:		0.0132	mm^2
Number of Grid Openings Analyzed:		10	
Analytical Sensitivity:		0.0558	Str/cc
Number of Primary Asbestos Structures Counted:		0	
Number of total asbestos structures counted:		0	
Number of Asbestos Structures > 5 microns:		0	
Number of Asbestos fibers and bundles > 5 microns:		0	
Number of PCM equivalent asbestos structures:		0	
Number of PCM equivalent asbestos fibers:		0	
Concentration of Chrysotile Asbestos:	<	0.1668	Str/cc
Concentration of Amphibole Asbestos:	<	0.1668	Str/cc
Lower 95% Confidence Limit (Chrysotile)		NA	Str/cc
Upper 95% Confidence Limit (Chrysotile)	<	0.1668	Str/cc
Lower 95% Confidence Limit (Amphibole)		NA	Str/cc
Upper 95% Confidence Limit (Amphibole)	<	0.1668	Str/cc
Concentration of Asbestos (total):	**<**	0.1668	**Str/cc**

Comments:
Indirect preparation
Revised 07/26/12

Robyn Denton
Approved Signatory

Attention: Samantha Caruthers-Knight
Engineering/Remediation Resources Group
4585 Pacheco Blvd.
Suite 200
Martinez, CA 94553
Phone: (925) 969-0750
Project: 2011-149 Phillips Mine

Customer ID: ERRG25
Customer PO:
Received: 6/22/12 9:30 AM

EMSL Order: 041216273
Analysis Date: 7/7/2012
Report Date: 08/03/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		041216273-0017	
Customer Sample #:		PA-ATV1-AM-04	
Date sampled:		6/17/2012	
Initials of Analyst:		JA	
Air volume:		381.6	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~10,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5.0	microns
Minimum width to be counted:		0.25	microns
Mean dimension of grid openings:		0.0130	mm²
Number of Grid Openings Analyzed:			
Analytical Sensitivity:		N/A	Str/cc
Number of Primary Asbestos Structures Counted:		N/A	
Number of total asbestos structures counted:		N/A	
Number of Asbestos Structures > 5 microns:		N/A	
Number of Asbestos fibers and bundles > 5 microns:		N/A	
Number of PCM equivalent asbestos structures:		N/A	
Number of PCM equivalent asbestos fibers:		N/A	
Concentration of Chrysotile Asbestos:		N/A	Str/cc
Concentration of Amphibole Asbestos:		N/A	Str/cc
Lower 95% Confidence Limit (Chrysotile)		N/A	Str/cc
Upper 95% Confidence Limit (Chrysotile)		N/A	Str/cc
Lower 95% Confidence Limit (Amphibole)		N/A	Str/cc
Upper 95% Confidence Limit (Amphibole)		N/A	Str/cc
		N/A	
Concentration of Asbestos (total):		N/A	**Str/cc**

Comments:
Particulate Loading 50-60 %. Sample overloaded with particulate and could not be analyzed

Robyn Denton
Approved Signatory

EMSL

Attention: Samantha Caruthers-Knight
Engineering/Remediation Resources Group
4585 Pacheco Blvd.
Suite 200
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Project: 2011-149 Phillips Mine

Customer ID: ERRG25
Customer PO:
Received: 6/22/12 9:30 AM

EMSL Order: 041216273
Analysis Date: 7/20/2012
Report Date: 07/26/12

ISO 13794-Ambient Air - Determination of Asbestos Fibers Indirect Transfer Transmission Electron Microscopy

EMSL Sample #:		041216273-0017	
Customer Sample #:		PA-ATV1-AM-04	
Date sampled:		6/17/2012	
Initials of Analyst:		PH	
Air volume:		381.6	Liters
Area of collection filter:		385	mm^2
Area of analytical filter:		364.9	mm^2
Percent of filter Ashed:		75	%
Volume of water used for ash dispersal:		40	mL
Volume of dispersion applied to analytical filter:		5	mL
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~20,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5.0	microns
Minimum width to be counted:	>	0.25	microns
Mean dimension of grid openings:		0.0132	mm^2
Number of Grid Openings Analyzed:		10	
Analytical Sensitivity:		0.0773	Str/cc
Number of Primary Asbestos Structures Counted:		1	
Number of total asbestos structures counted:		1	
Number of Asbestos Structures > 5 microns:		1	
Number of Asbestos fibers and bundles > 5 microns:		1	
Number of PCM equivalent asbestos structures:		1	
Number of PCM equivalent asbestos fibers:		1	
Concentration of Chrysotile Asbestos:	<	0.3664	Str/cc
Concentration of Amphibole Asbestos:	<	0.2311	Str/cc
Lower 95% Confidence Limit (Chrysotile)		NA	Str/cc
Upper 95% Confidence Limit (Chrysotile)	<	0.3664	Str/cc
Lower 95% Confidence Limit (Amphibole)		NA	Str/cc
Upper 95% Confidence Limit (Amphibole)	<	0.2311	Str/cc
Concentration of Asbestos (total):	**<**	**0.3664**	**Str/cc**

Comments:
Indirect preparation
Revised 7/26/2012

Robyn Denton
Approved Signatory

Attention: Samantha Caruthers-Knight
Engineering/Remediation Resources Group
4585 Pacheco Blvd.
Suite 200
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Phone: (925) 969-0750
Project: 2011-149 Phillips Mine

Customer ID: ERRG25
Customer PO:
Received: 6/22/12 9:30 AM

EMSL Order: 041216273
Analysis Date: 7/7/2012
Report Date: 07/18/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		041216273-0018	
Customer Sample #:		PA-MA-AA-01	
Date sampled:		6/17/2012	
Initials of Analyst:		JA	
Air volume:		374.94	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~10,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5.0	microns
Minimum width to be counted:		0.25	microns
Mean dimension of grid openings:		0.0130	mm²
Number of Grid Openings Analyzed:		40	
Analytical Sensitivity:		0.0019	Str/cc
Number of Primary Asbestos Structures Counted:		0	
Number of total asbestos structures counted:		0	
Number of Asbestos Structures > 5 microns:		0	
Number of Asbestos fibers and bundles > 5 microns:		0	
Number of PCM equivalent asbestos structures:		0	
Number of PCM equivalent asbestos fibers:		0	
Concentration of Chrysotile Asbestos:	<	0.0057	Str/cc
Concentration of Amphibole Asbestos:	<	0.0057	Str/cc
Lower 95% Confidence Limit (Chrysotile)		N/A	Str/cc
Upper 95% Confidence Limit (Chrysotile)	<	0.0057	Str/cc
Lower 95% Confidence Limit (Amphibole)		N/A	Str/cc
Upper 95% Confidence Limit (Amphibole)	<	0.0057	Str/cc
Concentration of Asbestos (total):	**<**	**0.0057**	**Str/cc**

Comments:
Particulate Loading 1-5 %

Robyn Denton
Approved Signatory

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Customer ID: ERRG25
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Received: 6/22/12 9:30 AM

EMSL Order: 041216273
Analysis Date: 7/7/2012
Report Date: 07/18/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		041216273-0018	
Customer Sample #:		PA-MA-AA-01	
Date sampled:		6/17/2012	
Initials of Analyst:		JA	
Air volume:		374.94	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~10,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5.0	microns
Minimum width to be counted:		0.25	microns
Mean dimension of grid openings:		0.0130	mm²
Number of Grid Openings Analyzed:		40	
Analytical Sensitivity:		0.0019	Str/cc
Number of Primary Asbestos Structures Counted:		0	
Number of total asbestos structures counted:		0	
Number of Asbestos Structures > 5 microns:		0	
Number of Asbestos fibers and bundles > 5 microns:		0	
Number of PCM equivalent asbestos structures:		0	
Number of PCM equivalent asbestos fibers:		0	
Concentration of Chrysotile Asbestos:	<	0.0057	Str/cc
Concentration of Amphibole Asbestos:	<	0.0057	Str/cc
Lower 95% Confidence Limit (Chrysotile)		N/A	Str/cc
Upper 95% Confidence Limit (Chrysotile)	<	0.0057	Str/cc
Lower 95% Confidence Limit (Amphibole)		N/A	Str/cc
Upper 95% Confidence Limit (Amphibole)	<	0.0057	Str/cc
Concentration of Asbestos (total):	**<**	**0.0057**	**Str/cc**

Comments:
Particulate Loading 1-5 %

Robyn Denton
Approved Signatory

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Customer ID: ERRG25
Customer PO:
Received: 6/22/12 9:30 AM

EMSL Order: 041216273
Analysis Date: 7/9/2012
Report Date: 07/18/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		041216273-0019	
Customer Sample #:		PA-MA-AA-02	
Date sampled:		6/17/2012	
Initials of Analyst:		GI	
Air volume:		375.84	Liters
Area of collection filter:		385	mm^2
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~10,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5.0	microns
Minimum width to be counted:		0.25	microns
Mean dimension of grid openings:		0.0130	mm^2
Number of Grid Openings Analyzed:		40	
Analytical Sensitivity:		0.0019	Str/cc
Number of Primary Asbestos Structures Counted:		0	
Number of total asbestos structures counted:		0	
Number of Asbestos Structures > 5 microns:		0	
Number of Asbestos fibers and bundles > 5 microns:		0	
Number of PCM equivalent asbestos structures:		0	
Number of PCM equivalent asbestos fibers:		0	
Concentration of Chrysotile Asbestos:	<	0.0057	Str/cc
Concentration of Amphibole Asbestos:	<	0.0057	Str/cc
Lower 95% Confidence Limit (Chrysotile)		N/A	Str/cc
Upper 95% Confidence Limit (Chrysotile)	<	0.0057	Str/cc
Lower 95% Confidence Limit (Amphibole)		N/A	Str/cc
Upper 95% Confidence Limit (Amphibole)	<	0.0057	Str/cc
Concentration of Asbestos (total):	**<**	**0.0057**	**Str/cc**

Comments:
Particulate Loading 1-2 %

Robyn Denton
Approved Signatory

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Customer ID: ERRG25
Customer PO:
Received: 6/22/12 9:30 AM

EMSL Order: 041216273
Analysis Date: 7/9/2012
Report Date: 07/18/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		041216273-0020	
Customer Sample #:		PA-MA-AM-01	
Date sampled:		6/17/2012	
Initials of Analyst:		GI	
Air volume:		430.2	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~10,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5.0	microns
Minimum width to be counted:		0.25	microns
Mean dimension of grid openings:		0.0130	mm²
Number of Grid Openings Analyzed:		19	
Analytical Sensitivity:		0.0036	Str/cc
Number of Primary Asbestos Structures Counted:		8	
Number of total asbestos structures counted:		8	
Number of Asbestos Structures > 5 microns:		8	
Number of Asbestos fibers and bundles > 5 microns:		8	
Number of PCM equivalent asbestos structures:		3	
Number of PCM equivalent asbestos fibers:		8	
Concentration of Chrysotile Asbestos:		0.0288	Str/cc
Concentration of Amphibole Asbestos:	<	0.0108	Str/cc
Lower 95% Confidence Limit (Chrysotile)		0.0124	Str/cc
Upper 95% Confidence Limit (Chrysotile)		0.0568	Str/cc
Lower 95% Confidence Limit (Amphibole)	<	N/A	Str/cc
Upper 95% Confidence Limit (Amphibole)	<	0.0108	Str/cc
Concentration of Asbestos (total):		0.0288	**Str/cc**

Comments:
Particulate Loading 3-5 %
Significant amount of non-countable asbestos observed.
Structures were not countable due to structure size.

Robyn Denton
Approved Signatory

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Customer ID: ERRG25
Customer PO:
Received: 6/22/12 9:30 AM

EMSL Order: 041216273
Analysis Date: 7/2/2012
Report Date: 07/18/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		041216273-0021	
Customer Sample #:		PA-MA-AM-02	
Date sampled:		6/17/2012	
Initials of Analyst:		GI	
Air volume:		458.82	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~10,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5.0	microns
Minimum width to be counted:		0.25	microns
Mean dimension of grid openings:		0.0130	mm²
Number of Grid Openings Analyzed:		18	
Analytical Sensitivity:		0.0035	Str/cc
Number of Primary Asbestos Structures Counted:		11	
Number of total asbestos structures counted:		11	
Number of Asbestos Structures > 5 microns:		11	
Number of Asbestos fibers and bundles > 5 microns:		11	
Number of PCM equivalent asbestos structures:		5	
Number of PCM equivalent asbestos fibers:		11	
Concentration of Chrysotile Asbestos:		0.0385	Str/cc
Concentration of Amphibole Asbestos:	<	0.0105	Str/cc
Lower 95% Confidence Limit (Chrysotile)		0.0192	Str/cc
Upper 95% Confidence Limit (Chrysotile)		0.0689	Str/cc
Lower 95% Confidence Limit (Amphibole)		N/A	Str/cc
Upper 95% Confidence Limit (Amphibole)	<	0.0105	Str/cc
		0.0105	
Concentration of Asbestos (total):		0.0385	**Str/cc**

Comments:
Particulate Loading 3-5 %
Significant amount of non-countable asbestos observed.
Structures were not countable due to structure size.

Robyn Denton
Approved Signatory

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Customer ID: ERRG25
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Received: 6/22/12 9:30 AM

EMSL Order: 041216273
Analysis Date: 7/9/2012
Report Date: 07/18/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		041216273-0022	
Customer Sample #:		PA-MA-AM-03	
Date sampled:		6/17/2012	
Initials of Analyst:		AF	
Air volume:		396.36	Liters
Area of collection filter:		385	mm^2
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~10,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5.0	microns
Minimum width to be counted:		0.25	microns
Mean dimension of grid openings:		0.0130	mm^2
Number of Grid Openings Analyzed:		20	
Analytical Sensitivity:		0.0037	Str/cc
Number of Primary Asbestos Structures Counted:		0	
Number of total asbestos structures counted:		0	
Number of Asbestos Structures > 5 microns:		0	
Number of Asbestos fibers and bundles > 5 microns:		0	
Number of PCM equivalent asbestos structures:		0	
Number of PCM equivalent asbestos fibers:		0	
Concentration of Chrysotile Asbestos:	<	0.0111	Str/cc
Concentration of Amphibole Asbestos:	<	0.0111	Str/cc
Lower 95% Confidence Limit (Chrysotile)		N/A	Str/cc
Upper 95% Confidence Limit (Chrysotile)	<	0.0111	Str/cc
Lower 95% Confidence Limit (Amphibole)		N/A	Str/cc
Upper 95% Confidence Limit (Amphibole)	<	0.0111	Str/cc
Concentration of Asbestos (total):	**<**	0.0111	**Str/cc**

Comments:
Particulate Loading 5-10 %
Significant amounts of non countable asbestos observed.
Structures were not counable due to structure size.

Robyn Denton
Approved Signatory

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Customer ID: ERRG25
Customer PO:
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EMSL Order: 041216273
Analysis Date: 7/9/2012
Report Date: 07/18/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		041216273-0023	
Customer Sample #:		PA-MA-AM-04	
Date sampled:		6/17/2012	
Initials of Analyst:		JA	
Air volume:		381.6	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~10,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5.0	microns
Minimum width to be counted:		0.25	microns
Mean dimension of grid openings:		0.0130	mm²
Number of Grid Openings Analyzed:		21	
Analytical Sensitivity:		0.0036	Str/cc
Number of Primary Asbestos Structures Counted:		2	
Number of total asbestos structures counted:		2	
Number of Asbestos Structures > 5 microns:		2	
Number of Asbestos fibers and bundles > 5 microns:		2	
Number of PCM equivalent asbestos structures:		2	
Number of PCM equivalent asbestos fibers:		2	
Concentration of Chrysotile Asbestos:	<	0.0227	Str/cc
Concentration of Amphibole Asbestos:	<	0.0108	Str/cc
Lower 95% Confidence Limit (Chrysotile)		N/A	Str/cc
Upper 95% Confidence Limit (Chrysotile)	<	0.0227	Str/cc
Lower 95% Confidence Limit (Amphibole)		N/A	Str/cc
Upper 95% Confidence Limit (Amphibole)	<	0.0108	Str/cc
Concentration of Asbestos (total):	**<**	**0.0227**	**Str/cc**

Comments:
Particulate Loading 5-10 %

Robyn Denton
Approved Signatory

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Project: 2011-149 Phillips Mine

Customer ID: ERRG25
Customer PO:
Received: 6/22/12 9:30 AM

EMSL Order: 041216273
Analysis Date: 7/10/2012
Report Date: 07/18/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		041216273-0024	
Customer Sample #:		PA-MA-AM-05	
Date sampled:		6/17/2012	
Initials of Analyst:		GI	
Air volume:		403.2	Liters
Area of collection filter:		385	mm^2
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~10,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5.0	microns
Minimum width to be counted:		0.25	microns
Mean dimension of grid openings:		0.0130	mm^2
Number of Grid Openings Analyzed:		20	
Analytical Sensitivity:		0.0036	Str/cc
Number of Primary Asbestos Structures Counted:		5	
Number of total asbestos structures counted:		5	
Number of Asbestos Structures > 5 microns:		5	
Number of Asbestos fibers and bundles > 5 microns:		5	
Number of PCM equivalent asbestos structures:		3	
Number of PCM equivalent asbestos fibers:		5	
Concentration of Chrysotile Asbestos:		0.0180	Str/cc
Concentration of Amphibole Asbestos:	<	0.0108	Str/cc
Lower 95% Confidence Limit (Chrysotile)		0.0058	Str/cc
Upper 95% Confidence Limit (Chrysotile)		0.0420	Str/cc
Lower 95% Confidence Limit (Amphibole)		N/A	Str/cc
Upper 95% Confidence Limit (Amphibole)	<	0.0108	Str/cc
Concentration of Asbestos (total):		0.0180	**Str/cc**

Comments:
Particulate Loading 3-5 %
Significant amount of non-countable asbestos observed.
Structures not countable due to structures size.

Robyn Denton
Approved Signatory

Attention: Samantha Caruthers-Knight
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Analysis Date: 7/10/2012
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ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		041216273-0025	
Customer Sample #:		PA-UW-AA-01	
Date sampled:		6/18/2012	
Initials of Analyst:		GI	
Air volume:		393.9	Liters
Area of collection filter:		385	mm^2
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~10,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5.0	microns
Minimum width to be counted:		0.25	microns
Mean dimension of grid openings:		0.0130	mm^2
Number of Grid Openings Analyzed:		39	
Analytical Sensitivity:		0.0018	Str/cc
Number of Primary Asbestos Structures Counted:		0	
Number of total asbestos structures counted:		0	
Number of Asbestos Structures > 5 microns:		0	
Number of Asbestos fibers and bundles > 5 microns:		0	
Number of PCM equivalent asbestos structures:		0	
Number of PCM equivalent asbestos fibers:		0	
Concentration of Chrysotile Asbestos:	<	0.0054	Str/cc
Concentration of Amphibole Asbestos:	<	0.0054	Str/cc
Lower 95% Confidence Limit (Chrysotile)		N/A	Str/cc
Upper 95% Confidence Limit (Chrysotile)	<	0.0054	Str/cc
Lower 95% Confidence Limit (Amphibole)		N/A	Str/cc
Upper 95% Confidence Limit (Amphibole)	<	0.0054	Str/cc
Concentration of Asbestos (total):	**<**	**0.0054**	**Str/cc**

Comments:
Particulate Loading 1-2 %

Robyn Denton
Approved Signatory

Attention: Samantha Caruthers-Knight
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Customer ID: ERRG25
Customer PO:
Received: 6/22/12 9:30 AM

EMSL Order: 041216273
Analysis Date: 7/10/2012
Report Date: 07/18/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		041216273-0026	
Customer Sample #:		PA-UW-AA-02	
Date sampled:		6/18/2012	
Initials of Analyst:		GI	
Air volume:		406.9	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~10,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5.0	microns
Minimum width to be counted:		0.25	microns
Mean dimension of grid openings:		0.0130	mm²
Number of Grid Openings Analyzed:		37	
Analytical Sensitivity:		0.0019	Str/cc
Number of Primary Asbestos Structures Counted:		0	
Number of total asbestos structures counted:		0	
Number of Asbestos Structures > 5 microns:		0	
Number of Asbestos fibers and bundles > 5 microns:		0	
Number of PCM equivalent asbestos structures:		0	
Number of PCM equivalent asbestos fibers:		0	
Concentration of Chrysotile Asbestos:	<	0.0057	Str/cc
Concentration of Amphibole Asbestos:	<	0.0057	Str/cc
Lower 95% Confidence Limit (Chrysotile)		N/A	Str/cc
Upper 95% Confidence Limit (Chrysotile)	<	0.0057	Str/cc
Lower 95% Confidence Limit (Amphibole)		N/A	Str/cc
Upper 95% Confidence Limit (Amphibole)	<	0.0057	Str/cc
Concentration of Asbestos (total):	**<**	**0.0057**	**Str/cc**

Comments:
Particulate Loading 1-2 %

Robyn Denton
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Received: 6/22/12 9:30 AM

EMSL Order: 041216273
Analysis Date: 7/10/2012
Report Date: 07/18/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		041216273-0027	
Customer Sample #:		PA-UW-AM-01	
Date sampled:		6/18/2012	
Initials of Analyst:		GI	
Air volume:		468.195	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~10,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5.0	microns
Minimum width to be counted:		0.25	microns
Mean dimension of grid openings:		0.0130	mm²
Number of Grid Openings Analyzed:		17	
Analytical Sensitivity:		0.0036	Str/cc
Number of Primary Asbestos Structures Counted:		2	
Number of total asbestos structures counted:		2	
Number of Asbestos Structures > 5 microns:		2	
Number of Asbestos fibers and bundles > 5 microns:		2	
Number of PCM equivalent asbestos structures:		1	
Number of PCM equivalent asbestos fibers:		1	
Concentration of Chrysotile Asbestos:	<	0.0227	Str/cc
Concentration of Amphibole Asbestos:	<	0.0108	Str/cc
Lower 95% Confidence Limit (Chrysotile)		N/A	Str/cc
Upper 95% Confidence Limit (Chrysotile)	<	0.0227	Str/cc
Lower 95% Confidence Limit (Amphibole)		N/A	Str/cc
Upper 95% Confidence Limit (Amphibole)	<	0.0108	Str/cc
Concentration of Asbestos (total):	<	0.0227	**Str/cc**

Comments:
Particulate Loading 3-5 %

Robyn Denton
Approved Signatory

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EMSL Order: 041216273
Analysis Date: 7/10/2012
Report Date: 07/18/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		041216273-0028	
Customer Sample #:		PA-UW-AM-02	
Date sampled:		6/18/2012	
Initials of Analyst:		AF	
Air volume:		423.54	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~10,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5.0	microns
Minimum width to be counted:		0.25	microns
Mean dimension of grid openings:		0.0130	mm²
Number of Grid Openings Analyzed:		19	
Analytical Sensitivity:		0.0036	Str/cc
Number of Primary Asbestos Structures Counted:		0	
Number of total asbestos structures counted:		0	
Number of Asbestos Structures > 5 microns:		0	
Number of Asbestos fibers and bundles > 5 microns:		0	
Number of PCM equivalent asbestos structures:		0	
Number of PCM equivalent asbestos fibers:		0	
Concentration of Chrysotile Asbestos:	<	0.0108	Str/cc
Concentration of Amphibole Asbestos:	<	0.0108	Str/cc
Lower 95% Confidence Limit (Chrysotile)		N/A	Str/cc
Upper 95% Confidence Limit (Chrysotile)	<	0.0108	Str/cc
Lower 95% Confidence Limit (Amphibole)		N/A	Str/cc
Upper 95% Confidence Limit (Amphibole)	<	0.0108	Str/cc
Concentration of Asbestos (total):	**<**	**0.0108**	**Str/cc**

Comments:
Particulate Loading 5-10 %

Robyn Denton
Approved Signatory

EMSL

Attention: Samantha Caruthers-Knight
Engineering/Remediation Resources Group
4585 Pacheco Blvd.
Suite 200
Martinez, CA 94553
Phone: (925) 969-0750
Project: 2011-149 Phillips Mine

Customer ID: ERRG25
Customer PO:
Received: 6/22/12 9:30 AM

EMSL Order: 041216273
Analysis Date: 7/10/2012
Report Date: 07/18/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		041216273-0029	
Customer Sample #:		PA-UW-AM-03	
Date sampled:		6/18/2012	
Initials of Analyst:		AF	
Air volume:		398.19	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~10,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5.0	microns
Minimum width to be counted:		0.25	microns
Mean dimension of grid openings:		0.0130	mm²
Number of Grid Openings Analyzed:		20	
Analytical Sensitivity:		0.0036	Str/cc
Number of Primary Asbestos Structures Counted:		1	
Number of total asbestos structures counted:		1	
Number of Asbestos Structures > 5 microns:		1	
Number of Asbestos fibers and bundles > 5 microns:		1	
Number of PCM equivalent asbestos structures:		1	
Number of PCM equivalent asbestos fibers:		1	
Concentration of Chrysotile Asbestos:	<	0.0171	Str/cc
Concentration of Amphibole Asbestos:	<	0.0108	Str/cc
Lower 95% Confidence Limit (Chrysotile)		N/A	Str/cc
Upper 95% Confidence Limit (Chrysotile)	<	0.0171	Str/cc
Lower 95% Confidence Limit (Amphibole)		N/A	Str/cc
Upper 95% Confidence Limit (Amphibole)	<	0.0108	Str/cc
Concentration of Asbestos (total):	**<**	0.0171	**Str/cc**

Comments:
Particulate Loading 3-5 %

Robyn Denton
Approved Signatory

Attention: Samantha Caruthers-Knight
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Customer ID: ERRG25
Customer PO:
Received: 6/22/12 9:30 AM

EMSL Order: 041216273
Analysis Date: 7/10/2012
Report Date: 08/03/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		041216273-0030	
Customer Sample #:		PA-UW-AM-04	
Date sampled:		6/18/2012	
Initials of Analyst:		GI	
Air volume:		456.69	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~10,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5.0	microns
Minimum width to be counted:		0.25	microns
Mean dimension of grid openings:		0.0130	mm²
Number of Grid Openings Analyzed:		18	
Analytical Sensitivity:		0.0035	Str/cc
Number of Primary Asbestos Structures Counted:		5	
Number of total asbestos structures counted:		5	
Number of Asbestos Structures > 5 microns:		5	
Number of Asbestos fibers and bundles > 5 microns:		5	
Number of PCM equivalent asbestos structures:		1	
Number of PCM equivalent asbestos fibers:		5	
Concentration of Chrysotile Asbestos:		0.0175	Str/cc
Concentration of Amphibole Asbestos:	<	0.0105	Str/cc
Lower 95% Confidence Limit (Chrysotile)		0.0057	Str/cc
Upper 95% Confidence Limit (Chrysotile)		0.0408	Str/cc
Lower 95% Confidence Limit (Amphibole)		N/A	Str/cc
Upper 95% Confidence Limit (Amphibole)	<	0.0105	Str/cc
Concentration of Asbestos (total):		**0.0175**	**Str/cc**

Comments:
Particulate Loading 7-10 %

Robyn Denton
Approved Signatory

Attention: Samantha Caruthers-Knight
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Customer ID: ERRG25
Customer PO:
Received: 6/22/12 9:30 AM

EMSL Order: 041216273
Analysis Date: 7/10/2012
Report Date: 07/18/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		041216273-0031	
Customer Sample #:		PA-UW-AM-05	
Date sampled:		6/18/2012	
Initials of Analyst:		AF	
Air volume:		503.295	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~10,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5.0	microns
Minimum width to be counted:		0.25	microns
Mean dimension of grid openings:		0.0130	mm²
Number of Grid Openings Analyzed:		16	
Analytical Sensitivity:		0.0036	Str/cc
Number of Primary Asbestos Structures Counted:		0	
Number of total asbestos structures counted:		0	
Number of Asbestos Structures > 5 microns:		0	
Number of Asbestos fibers and bundles > 5 microns:		0	
Number of PCM equivalent asbestos structures:		0	
Number of PCM equivalent asbestos fibers:		0	
Concentration of Chrysotile Asbestos:	<	0.0108	Str/cc
Concentration of Amphibole Asbestos:	<	0.0108	Str/cc
Lower 95% Confidence Limit (Chrysotile)		N/A	Str/cc
Upper 95% Confidence Limit (Chrysotile)	<	0.0108	Str/cc
Lower 95% Confidence Limit (Amphibole)		N/A	Str/cc
Upper 95% Confidence Limit (Amphibole)	<	0.0108	Str/cc
Concentration of Asbestos (total):	**<**	**0.0108**	**Str/cc**

Comments:
Particulate Loading 5-10 %

Robyn Denton
Approved Signatory

Attention: Samantha Caruthers-Knight
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Customer ID: ERRG25
Customer PO:
Received: 6/22/12 9:30 AM

EMSL Order: 041216273
Analysis Date: 07/10/12
Report Date: 07/18/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		041216273-0032	
Customer Sample #:		PA-ATV2-AA-01	
Date sampled:		6/18/2012	
Initials of Analyst:		AF	
Air volume:		424.2	Liters
Area of collection filter:		385	mm^2
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~10,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5.0	microns
Minimum width to be counted:		0.25	microns
Mean dimension of grid openings:		0.0130	mm^2
Number of Grid Openings Analyzed:		36	
Analytical Sensitivity:		0.0019	Str/cc
Number of Primary Asbestos Structures Counted:		0	
Number of total asbestos structures counted:		0	
Number of Asbestos Structures > 5 microns:		0	
Number of Asbestos fibers and bundles > 5 microns:		0	
Number of PCM equivalent asbestos structures:		0	
Number of PCM equivalent asbestos fibers:		0	
Concentration of Chrysotile Asbestos:	<	0.0057	Str/cc
Concentration of Amphibole Asbestos:	<	0.0057	Str/cc
Lower 95% Confidence Limit (Chrysotile)		N/A	Str/cc
Upper 95% Confidence Limit (Chrysotile)	<	0.0057	Str/cc
Lower 95% Confidence Limit (Amphibole)		N/A	Str/cc
Upper 95% Confidence Limit (Amphibole)	<	0.0057	Str/cc
Concentration of Asbestos (total):	**<**	**0.0057**	**Str/cc**

Comments:
Particulate Loading 5-7 %

Robyn Denton
Approved Signatory

Attention: Samantha Caruthers-Knight
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Customer ID: ERRG25
Customer PO:
Received: 6/22/12 9:30 AM

EMSL Order: 041216273
Analysis Date: 7/10/2012
Report Date: 07/18/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		041216273-0033	
Customer Sample #:		PA-ATV2-AA-02	
Date sampled:		6/18/2012	
Initials of Analyst:		ES	
Air volume:		438.27	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~10,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5.0	microns
Minimum width to be counted:		0.25	microns
Mean dimension of grid openings:		0.0130	mm²
Number of Grid Openings Analyzed:		35	
Analytical Sensitivity:		0.0019	Str/cc
Number of Primary Asbestos Structures Counted:		0	
Number of total asbestos structures counted:		0	
Number of Asbestos Structures > 5 microns:		0	
Number of Asbestos fibers and bundles > 5 microns:		0	
Number of PCM equivalent asbestos structures:		0	
Number of PCM equivalent asbestos fibers:		0	
Concentration of Chrysotile Asbestos:	<	0.0057	Str/cc
Concentration of Amphibole Asbestos:	<	0.0057	Str/cc
Lower 95% Confidence Limit (Chrysotile)		N/A	Str/cc
Upper 95% Confidence Limit (Chrysotile)	<	0.0057	Str/cc
Lower 95% Confidence Limit (Amphibole)		N/A	Str/cc
Upper 95% Confidence Limit (Amphibole)	<	0.0057	Str/cc
Concentration of Asbestos (total):	**<**	0.0057	**Str/cc**

Comments:
Particulate Loading 1-3 %

Robyn Denton
Approved Signatory

Attention: Samantha Caruthers-Knight
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Customer ID: ERRG25
Customer PO:
Received: 6/22/12 9:30 AM

EMSL Order: 041216273
Analysis Date: 7/10/2012
Report Date: 07/18/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		041216273-0034	
Customer Sample #:		PA-ATV2-AA-03	
Date sampled:		6/18/2012	
Initials of Analyst:		ES	
Air volume:		396.8	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~10,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5.0	microns
Minimum width to be counted:		0.25	microns
Mean dimension of grid openings:		0.0130	mm²
Number of Grid Openings Analyzed:		38	
Analytical Sensitivity:		0.0019	Str/cc
Number of Primary Asbestos Structures Counted:		0	
Number of total asbestos structures counted:		0	
Number of Asbestos Structures > 5 microns:		0	
Number of Asbestos fibers and bundles > 5 microns:		0	
Number of PCM equivalent asbestos structures:		0	
Number of PCM equivalent asbestos fibers:		0	
Concentration of Chrysotile Asbestos:	<	0.0057	Str/cc
Concentration of Amphibole Asbestos:	<	0.0057	Str/cc
Lower 95% Confidence Limit (Chrysotile)		N/A	Str/cc
Upper 95% Confidence Limit (Chrysotile)	<	0.0057	Str/cc
Lower 95% Confidence Limit (Amphibole)		N/A	Str/cc
Upper 95% Confidence Limit (Amphibole)	<	0.0057	Str/cc
Concentration of Asbestos (total):	**<**	**0.0057**	**Str/cc**

Comments:
Particulate Loading 1-3 %

Robyn Denton
Approved Signatory

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Customer ID: ERRG25
Customer PO:
Received: 6/22/12 9:30 AM

EMSL Order: 041216273
Analysis Date: 7/11/2012
Report Date: 07/18/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		041216273-0035	
Customer Sample #:		PA-ATV2-AA-04	
Date sampled:		6/18/2012	
Initials of Analyst:		GI	
Air volume:		425	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~10,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5.0	microns
Minimum width to be counted:		0.25	microns
Mean dimension of grid openings:		0.0130	mm²
Number of Grid Openings Analyzed:		36	
Analytical Sensitivity:		0.0019	Str/cc
Number of Primary Asbestos Structures Counted:		0	
Number of total asbestos structures counted:		0	
Number of Asbestos Structures > 5 microns:		0	
Number of Asbestos fibers and bundles > 5 microns:		0	
Number of PCM equivalent asbestos structures:		0	
Number of PCM equivalent asbestos fibers:		0	
Concentration of Chrysotile Asbestos:	<	0.0057	Str/cc
Concentration of Amphibole Asbestos:	<	0.0057	Str/cc
Lower 95% Confidence Limit (Chrysotile)		N/A	Str/cc
Upper 95% Confidence Limit (Chrysotile)	<	0.0057	Str/cc
Lower 95% Confidence Limit (Amphibole)		N/A	Str/cc
Upper 95% Confidence Limit (Amphibole)	<	0.0057	Str/cc
Concentration of Asbestos (total):	**<**	0.0057	**Str/cc**

Comments:
Particulate Loading 3-5 %

Robyn Denton
Approved Signatory

Attention: Samantha Caruthers-Knight
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Project: 2011-149 Phillips Mine

Customer ID: ERRG25
Customer PO:
Received: 6/22/12 9:30 AM

EMSL Order: 041216273
Analysis Date:
Report Date: 08/03/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		041216273-0036	
Customer Sample #:		PA-ATV2-AA-05	
Date sampled:		6/18/2012	
Initials of Analyst:		GI	
Air volume:		513.36	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~10,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5.0	microns
Minimum width to be counted:		0.25	microns
Mean dimension of grid openings:		0.0130	mm²
Number of Grid Openings Analyzed:		30	
Analytical Sensitivity:		0.0019	Str/cc
Number of Primary Asbestos Structures Counted:		0	
Number of total asbestos structures counted:		0	
Number of Asbestos Structures > 5 microns:		0	
Number of Asbestos fibers and bundles > 5 microns:		0	
Number of PCM equivalent asbestos structures:		0	
Number of PCM equivalent asbestos fibers:		0	
Concentration of Chrysotile Asbestos:	<	0.0057	Str/cc
Concentration of Amphibole Asbestos:	<	0.0057	Str/cc
Lower 95% Confidence Limit (Chrysotile)		N/A	Str/cc
Upper 95% Confidence Limit (Chrysotile)	<	0.0057	Str/cc
Lower 95% Confidence Limit (Amphibole)		N/A	Str/cc
Upper 95% Confidence Limit (Amphibole)	<	0.0057	Str/cc
Concentration of Asbestos (total):	**<**	**0.0057**	**Str/cc**

Comments:
Particulate Loading 1- 3 %

Robyn Denton
Approved Signatory

Attention: Samantha Caruthers-Knight
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Project: 2011-149 Phillips Mine

Customer ID: ERRG25
Customer PO:
Received: 6/22/12 9:30 AM

EMSL Order: 041216273
Analysis Date: 7/11/2012
Report Date: 07/18/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		041216273-0037	
Customer Sample #:		PA-ATV2-AM-01	
Date sampled:		6/18/2012	
Initials of Analyst:		GI	
Air volume:		432.18	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~10,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5.0	microns
Minimum width to be counted:		0.25	microns
Mean dimension of grid openings:		0.0130	mm²
Number of Grid Openings Analyzed:		19	
Analytical Sensitivity:		0.0036	Str/cc
Number of Primary Asbestos Structures Counted:		0	
Number of total asbestos structures counted:		0	
Number of Asbestos Structures > 5 microns:		0	
Number of Asbestos fibers and bundles > 5 microns:		0	
Number of PCM equivalent asbestos structures:		0	
Number of PCM equivalent asbestos fibers:		0	
Concentration of Chrysotile Asbestos:	<	0.0108	Str/cc
Concentration of Amphibole Asbestos:	<	0.0108	Str/cc
Lower 95% Confidence Limit (Chrysotile)		N/A	Str/cc
Upper 95% Confidence Limit (Chrysotile)	<	0.0108	Str/cc
Lower 95% Confidence Limit (Amphibole)		N/A	Str/cc
Upper 95% Confidence Limit (Amphibole)	<	0.0108	Str/cc
Concentration of Asbestos (total):	**<**	**0.0108**	**Str/cc**

Comments:
Particulate Loading 1-3 %

Robyn Denton
Approved Signatory

Attention: Samantha Caruthers-Knight
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Project: 2011-149 Phillips Mine

Customer ID: ERRG25
Customer PO:
Received: 6/22/12 9:30 AM

EMSL Order: 041216273
Analysis Date: 7/11/2012
Report Date: 07/18/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		041216273-0038	
Customer Sample #:		PA-ATV2-AM-02	
Date sampled:		6/18/2012	
Initials of Analyst:		GI	
Air volume:		390.96	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~10,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5.0	microns
Minimum width to be counted:		0.25	microns
Mean dimension of grid openings:		0.0130	mm²
Number of Grid Openings Analyzed:		20	
Analytical Sensitivity:		0.0037	Str/cc
Number of Primary Asbestos Structures Counted:		2	
Number of total asbestos structures counted:		2	
Number of Asbestos Structures > 5 microns:		2	
Number of Asbestos fibers and bundles > 5 microns:		2	
Number of PCM equivalent asbestos structures:		2	
Number of PCM equivalent asbestos fibers:		2	
Concentration of Chrysotile Asbestos:	<	0.0233	Str/cc
Concentration of Amphibole Asbestos:	<	0.0111	Str/cc
Lower 95% Confidence Limit (Chrysotile)		N/A	Str/cc
Upper 95% Confidence Limit (Chrysotile)	<	0.0233	Str/cc
Lower 95% Confidence Limit (Amphibole)		N/A	Str/cc
Upper 95% Confidence Limit (Amphibole)	<	0.0111	Str/cc
Concentration of Asbestos (total):	**<**	0.0233	**Str/cc**

Comments:
Particulate Loading 3-5 %

Robyn Denton
Approved Signatory

Attention: Samantha Caruthers-Knight
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Project: 2011-149 Phillips Mine

Customer ID: ERRG25
Customer PO:
Received: 6/22/12 9:30 AM

EMSL Order: 041216273
Analysis Date: 7/11/2012
Report Date: 07/18/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		041216273-0039	
Customer Sample #:		PA-ATV2-AM-03	
Date sampled:		6/18/2012	
Initials of Analyst:		GI	
Air volume:		367.56	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~10,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5.0	microns
Minimum width to be counted:		0.25	microns
Mean dimension of grid openings:		0.0130	mm²
Number of Grid Openings Analyzed:		22	
Analytical Sensitivity:		0.0036	Str/cc
Number of Primary Asbestos Structures Counted:		0	
Number of total asbestos structures counted:		0	
Number of Asbestos Structures > 5 microns:		0	
Number of Asbestos fibers and bundles > 5 microns:		0	
Number of PCM equivalent asbestos structures:		0	
Number of PCM equivalent asbestos fibers:		0	
Concentration of Chrysotile Asbestos:	<	0.0108	Str/cc
Concentration of Amphibole Asbestos:	<	0.0108	Str/cc
Lower 95% Confidence Limit (Chrysotile)		N/A	Str/cc
Upper 95% Confidence Limit (Chrysotile)	<	0.0108	Str/cc
Lower 95% Confidence Limit (Amphibole)		N/A	Str/cc
Upper 95% Confidence Limit (Amphibole)	<	0.0108	Str/cc
Concentration of Asbestos (total):	**<**	**0.0108**	**Str/cc**

Comments:
Particulate Loading 10-15 %

Robyn Denton
Approved Signatory

EMSL

Attention: Samantha Caruthers-Knight
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Customer ID: ERRG25
Customer PO:
Received: 6/22/12 9:30 AM

EMSL Order: 041216273
Analysis Date: 7/20/2012
Report Date: 07/26/12

ISO 13794-Ambient Air - Determination of Asbestos Fibers Indirect Transfer Transmission Electron Microscopy

EMSL Sample #:		041216273-0040	
Customer Sample #:		PA-ATV2-AM-04	
Date sampled:		6/18/2012	
Initials of Analyst:		PH	
Air volume:		421.56	Liters
Area of collection filter:		385	mm^2
Area of analytical filter:		364.9	mm^2
Percent of filter Ashed:		100	%
Volume of water used for ash dispersal:		40	mL
Volume of dispersion applied to analytical filter:		5	mL
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~20,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5.0	microns
Minimum width to be counted:	>	0.25	microns
Mean dimension of grid openings:		0.0132	mm^2
Number of Grid Openings Analyzed:		10	
Analytical Sensitivity:		0.0525	Str/cc
Number of Primary Asbestos Structures Counted:		0	
Number of total asbestos structures counted:		0	
Number of Asbestos Structures > 5 microns:		0	
Number of Asbestos fibers and bundles > 5 microns:		0	
Number of PCM equivalent asbestos structures:		0	
Number of PCM equivalent asbestos fibers:		0	
Concentration of Chrysotile Asbestos:	<	0.1570	Str/cc
Concentration of Amphibole Asbestos:	<	0.1570	Str/cc
Lower 95% Confidence Limit (Chrysotile)		NA	Str/cc
Upper 95% Confidence Limit (Chrysotile)	<	0.1570	Str/cc
Lower 95% Confidence Limit (Amphibole)		NA	Str/cc
Upper 95% Confidence Limit (Amphibole)	<	0.1570	Str/cc
Concentration of Asbestos (total):	**<**	0.1570	**Str/cc**

Comments:
Indirect preparation
Revised 7/26/2012

Robyn Denton
Approved Signatory

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Martinez, CA 94553
Phone: (925) 969-0750
Project: 2011-149 Phillips Mine

Customer ID: ERRG25
Customer PO:
Received: 6/22/12 9:30 AM

EMSL Order: 041216273
Analysis Date:
Report Date: 07/18/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		041216273-0041	
Customer Sample #:		PA-ATV2-AM-05	
Date sampled:		6/18/2011	
Initials of Analyst:		DY	
Air volume:		464.58	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~10,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5.0	microns
Minimum width to be counted:		0.25	microns
Mean dimension of grid openings:		0.0130	mm²
Number of Grid Openings Analyzed:		17	
Analytical Sensitivity:		0.0037	Str/cc
Number of Primary Asbestos Structures Counted:		0	
Number of total asbestos structures counted:		0	
Number of Asbestos Structures > 5 microns:		0	
Number of Asbestos fibers and bundles > 5 microns:		0	
Number of PCM equivalent asbestos structures:		0	
Number of PCM equivalent asbestos fibers:		0	
Concentration of Chrysotile Asbestos:	<	0.0111	Str/cc
Concentration of Amphibole Asbestos:	<	0.0111	Str/cc
Lower 95% Confidence Limit (Chrysotile)		N/A	Str/cc
Upper 95% Confidence Limit (Chrysotile)	<	0.0111	Str/cc
Lower 95% Confidence Limit (Amphibole)		N/A	Str/cc
Upper 95% Confidence Limit (Amphibole)	<	0.0111	Str/cc
Concentration of Asbestos (total):	**<**	**0.0111**	**Str/cc**

Comments:
Particulate Loading 7-10 %

Robyn Denton
Approved Signatory

Attention: Samantha Caruthers-Knight
Engineering/Remediation Resources Group
4585 Pacheco Blvd.
Suite 200
Martinez, CA 94553
Phone: (925) 969-0750
Project: 2011-149 Phillips Mine

Customer ID: ERRG25
Customer PO:
Received: 6/22/12 9:30 AM

EMSL Order: 041216273
Analysis Date: 7/11/2012
Report Date: 07/18/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		041216273-0042	
Customer Sample #:		PA-BG-AM-01	
Date sampled:		6/19/2012	
Initials of Analyst:		DY	
Air volume:		372.96	Liters
Area of collection filter:		385	mm^2
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~10,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5.0	microns
Minimum width to be counted:		0.25	microns
Mean dimension of grid openings:		0.0130	mm^2
Number of Grid Openings Analyzed:		21	
Analytical Sensitivity:		0.0038	Str/cc
Number of Primary Asbestos Structures Counted:		0	
Number of total asbestos structures counted:		0	
Number of Asbestos Structures > 5 microns:		0	
Number of Asbestos fibers and bundles > 5 microns:		0	
Number of PCM equivalent asbestos structures:		0	
Number of PCM equivalent asbestos fibers:		0	
Concentration of Chrysotile Asbestos:	<	0.0114	Str/cc
Concentration of Amphibole Asbestos:	<	0.0114	Str/cc
Lower 95% Confidence Limit (Chrysotile)		N/A	Str/cc
Upper 95% Confidence Limit (Chrysotile)	<	0.0114	Str/cc
Lower 95% Confidence Limit (Amphibole)		N/A	Str/cc
Upper 95% Confidence Limit (Amphibole)	<	0.0114	Str/cc
Concentration of Asbestos (total):	**<**	**0.0114**	**Str/cc**

Comments:
Particulate Loading 7-10 %

Robyn Denton
Approved Signatory

Attention: Samantha Caruthers-Knight
Engineering/Remediation Resources Group
4585 Pacheco Blvd.
Suite 200
Martinez, CA 94553
Phone: (925) 969-0750
Project: 2011-149 Phillips Mine

Customer ID: ERRG25
Customer PO:
Received: 6/22/12 9:30 AM

EMSL Order: 041216273
Analysis Date:
Report Date: 07/18/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		041216273-0043	
Customer Sample #:		PA-BG-AM-02	
Date sampled:		6/19/2012	
Initials of Analyst:		GI	
Air volume:		363.78	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~10,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5.0	microns
Minimum width to be counted:		0.25	microns
Mean dimension of grid openings:		0.0130	mm²
Number of Grid Openings Analyzed:		22	
Analytical Sensitivity:		0.0037	Str/cc
Number of Primary Asbestos Structures Counted:		1	
Number of total asbestos structures counted:		1	
Number of Asbestos Structures > 5 microns:		1	
Number of Asbestos fibers and bundles > 5 microns:		1	
Number of PCM equivalent asbestos structures:		0	
Number of PCM equivalent asbestos fibers:		1	
Concentration of Chrysotile Asbestos:	<	0.0175	Str/cc
Concentration of Amphibole Asbestos:	<	0.0175	Str/cc
Lower 95% Confidence Limit (Chrysotile)		N/A	Str/cc
Upper 95% Confidence Limit (Chrysotile)	<	0.0175	Str/cc
Lower 95% Confidence Limit (Amphibole)		N/A	Str/cc
Upper 95% Confidence Limit (Amphibole)	<	0.0175	Str/cc
Concentration of Asbestos (total):	**<**	0.0175	**Str/cc**

Comments:
Particulate Loading 3-5 %

Robyn Denton
Approved Signatory

Attention: Samantha Caruthers-Knight
Engineering/Remediation Resources Group
4585 Pacheco Blvd.
Suite 200
Martinez, CA 94553
Phone: (925) 969-0750
Project: 2011-149 Phillips Mine

Customer ID: ERRG25
Customer PO:
Received: 6/22/12 9:30 AM

EMSL Order: 041216273
Analysis Date: 7/11/2012
Report Date: 07/18/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		041216273-0044	
Customer Sample #:		PA-BG-AM-03	
Date sampled:		6/19/2012	
Initials of Analyst:		GI	
Air volume:		361.08	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~10,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5.0	microns
Minimum width to be counted:		0.25	microns
Mean dimension of grid openings:		0.0130	mm²
Number of Grid Openings Analyzed:		22	
Analytical Sensitivity:		0.0037	Str/cc
Number of Primary Asbestos Structures Counted:		0	
Number of total asbestos structures counted:		0	
Number of Asbestos Structures > 5 microns:		0	
Number of Asbestos fibers and bundles > 5 microns:		0	
Number of PCM equivalent asbestos structures:		0	
Number of PCM equivalent asbestos fibers:		0	
Concentration of Chrysotile Asbestos:	<	0.0111	Str/cc
Concentration of Amphibole Asbestos:	<	0.0111	Str/cc
Lower 95% Confidence Limit (Chrysotile)		N/A	Str/cc
Upper 95% Confidence Limit (Chrysotile)	<	0.0111	Str/cc
Lower 95% Confidence Limit (Amphibole)		N/A	Str/cc
Upper 95% Confidence Limit (Amphibole)	<	0.0111	Str/cc
Concentration of Asbestos (total):	**<**	**0.0111**	**Str/cc**

Comments:
Particulate Loading 1-3 %

Robyn Denton
Approved Signatory

EMSL

Attention: Samantha Caruthers-Knight
Engineering/Remediation Resources Group
4585 Pacheco Blvd.
Suite 200
Martinez, CA 94553
Phone: (925) 969-0750
Project: 2011-149 Phillips Mine

Customer ID: ERRG25
Customer PO:
Received: 6/22/12 9:30 AM

EMSL Order: 041216273
Analysis Date: 6/26/12
Report Date: 08/03/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		041216273-0045	
Customer Sample #:		PA-BG-AM-04	
Date sampled:		6/19/2012	
Initials of Analyst:		PH	
Air volume:		512.28	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~10,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5.0	microns
Minimum width to be counted:		0.25	microns
Mean dimension of grid openings:		0.013	mm²
Number of Grid Openings Analyzed:		15	
Analytical Sensitivity:		0.0039	Str/cc
Number of Primary Asbestos Structures Counted:		0	
Number of total asbestos structures counted:		0	
Number of Asbestos Structures > 5 microns:		0	
Number of Asbestos fibers and bundles > 5 microns:		0	
Number of PCM equivalent asbestos structures:		0	
Number of PCM equivalent asbestos fibers:		0	
Concentration of Chrysotile Asbestos:	<	0.0117	Str/cc
Concentration of Amphibole Asbestos:	<	0.0117	Str/cc
Lower 95% Confidence Limit (Chrysotile)		N/A	Str/cc
Upper 95% Confidence Limit (Chrysotile)	<	0.0117	Str/cc
Lower 95% Confidence Limit (Amphibole)		N/A	Str/cc
Upper 95% Confidence Limit (Amphibole)	<	0.0117	Str/cc
Concentration of Asbestos (total):	**<**	0.0117	**Str/cc**

Comments:
Particulate Loading 3-5 %

Robyn Denton
Approved Signatory

Attention: Samantha Caruthers-Knight
Engineering/Remediation Resources Group
4585 Pacheco Blvd.
Suite 200
Martinez, CA 94553
Phone: (925) 969-0750
Project: 2011-149 Phillips Mine

Customer ID: ERRG25
Customer PO:
Received: 6/22/12 9:30 AM

EMSL Order: 041216273
Analysis Date: 7/11/2012
Report Date: 07/18/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		041216273-0046	
Customer Sample #:		PA-BG-AA-01	
Date sampled:		6/19/2012	
Initials of Analyst:		JA	
Air volume:		429.3	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~10,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5.0	microns
Minimum width to be counted:		0.25	microns
Mean dimension of grid openings:		0.0130	mm²
Number of Grid Openings Analyzed:		36	
Analytical Sensitivity:		0.0019	Str/cc
Number of Primary Asbestos Structures Counted:		0	
Number of total asbestos structures counted:		0	
Number of Asbestos Structures > 5 microns:		0	
Number of Asbestos fibers and bundles > 5 microns:		0	
Number of PCM equivalent asbestos structures:		0	
Number of PCM equivalent asbestos fibers:		0	
Concentration of Chrysotile Asbestos:	<	0.0057	Str/cc
Concentration of Amphibole Asbestos:	<	0.0057	Str/cc
Lower 95% Confidence Limit (Chrysotile)		N/A	Str/cc
Upper 95% Confidence Limit (Chrysotile)	<	0.0057	Str/cc
Lower 95% Confidence Limit (Amphibole)		N/A	Str/cc
Upper 95% Confidence Limit (Amphibole)	<	0.0057	Str/cc
Concentration of Asbestos (total):	**<**	**0.0057**	**Str/cc**

Comments:
Particulate Loading 1-3 %

Robyn Denton
Approved Signatory

Attention: Samantha Caruthers-Knight
Engineering/Remediation Resources Group
4585 Pacheco Blvd.
Suite 200
Martinez, CA 94553
Phone: (925) 969-0750
Project: 2011-149 Phillips Mine

Customer ID: ERRG25
Customer PO:
Received: 6/22/12 9:30 AM

EMSL Order: 041216273
Analysis Date: 7/11/2012
Report Date: 07/18/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		041216273-0047	
Customer Sample #:		PA-BG-AA-02	
Date sampled:		6/19/2012	
Initials of Analyst:		JA	
Air volume:		492.48	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~10,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5.0	microns
Minimum width to be counted:		0.25	microns
Mean dimension of grid openings:		0.0130	mm²
Number of Grid Openings Analyzed:		31	
Analytical Sensitivity:		0.0019	Str/cc
Number of Primary Asbestos Structures Counted:		0	
Number of total asbestos structures counted:		0	
Number of Asbestos Structures > 5 microns:		0	
Number of Asbestos fibers and bundles > 5 microns:		0	
Number of PCM equivalent asbestos structures:		0	
Number of PCM equivalent asbestos fibers:		0	
Concentration of Chrysotile Asbestos:	<	0.0057	Str/cc
Concentration of Amphibole Asbestos:	<	0.0057	Str/cc
Lower 95% Confidence Limit (Chrysotile)		N/A	Str/cc
Upper 95% Confidence Limit (Chrysotile)	<	0.0057	Str/cc
Lower 95% Confidence Limit (Amphibole)		N/A	Str/cc
Upper 95% Confidence Limit (Amphibole)	<	0.0057	Str/cc
Concentration of Asbestos (total):	**<**	**0.0057**	**Str/cc**

Comments:
Particulate Loading 1-3 %

Robyn Denton
Approved Signatory

Attention: Samantha Caruthers-Knight
Engineering/Remediation Resources Group
4585 Pacheco Blvd.
Suite 200
Martinez, CA 94553
Phone: (925) 969-0750
Project: 2011-149 Phillips Mine

Customer ID: ERRG25
Customer PO:
Received: 6/22/12 9:30 AM

EMSL Order: 041216273
Analysis Date: 7/11/2012
Report Date: 07/18/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		041216273-0048	
Customer Sample #:		PA-BC-AA-01	
Date sampled:		6/20/2012	
Initials of Analyst:		JA	
Air volume:		0	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~10,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5.0	microns
Minimum width to be counted:		0.25	microns
Mean dimension of grid openings:		0.0130	mm²
Number of Grid Openings Analyzed:		11	
Analytical Sensitivity:		6.99	Str/mm²
Number of Primary Asbestos Structures Counted:		0	
Number of total asbestos structures counted:		0	
Number of Asbestos Structures > 5 microns:		0	
Number of Asbestos fibers and bundles > 5 microns:		0	
Number of PCM equivalent asbestos structures:		0	
Number of PCM equivalent asbestos fibers:		0	
Concentration of Chrysotile Asbestos:	<	20.9001	Str/mm²
Concentration of Amphibole Asbestos:	<	20.9001	Str/mm²
Lower 95% Confidence Limit (Chrysotile)		N/A	Str/mm²
Upper 95% Confidence Limit (Chrysotile)	<	20.9001	Str/mm²
Lower 95% Confidence Limit (Amphibole)		N/A	Str/mm²
Upper 95% Confidence Limit (Amphibole)	<	20.9001	Str/mm²
Concentration of Asbestos (total):	**<**	**20.9001**	**Str/mm²**

Comments:
Field Blank

Robyn Denton
Approved Signatory

3. Worksheets/Benchsheets

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID:	**041216273-0001**	Volume (L):	791.1	Scope:	03-01
Customer Sample:	PA-MC-AA-01	Prepped By:	A. Folgar	GO area (mm²):	0.0130
Sample Description:	Ambient	Prepped Date:	7/~~8~~/12	Magnification:	10,000 X
Pore Size (micron):	0.45	Grid Box :	0312-ERRG-01	Analyzed By:	D. Young
EFA (mm²):	385	Grid Location:	B (1-3)	Analysis Date:	7/5/12

Analysis Information

Target Sensitivity:	**0.002**	s/cc	Minimum Aspect Ratio: (circle one)			***Comments:***
GO Required:	~~19~~ 20		none	**3:1**	5:1	
GO Analyzed:	~~19~~ 20					
Level of Analysis Chrysotile:	**CD**		Min Length:	**>5**	micron	
Level of Analysis Amphibole:	**ADX**		Min Width:	**0.25**	micron	

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
B1	B2	ND									
	B4	↓									
	B6										
	B8										
	B10										
	D9										
	D7										
	D5										
	D3										
	D1										

ND= None Detected

NAM= Non Asbestos Material

Transverse Direction: Vertical
Particulate Loading: 1-5%

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID: 041216273-0001

Customer Sample ID: PA-MC-AA-01

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
B2	G10	ND									
	G8	F	Ø	Ø	3.25	0.275	ADX	Actinolite ~~Tremolite~~ DY 7/5/17	*	#63115 (D)	YES
	G6	ND									
	G4	↓									
	G2	↓									
	D1	↓									
	D3	↓									
	D5	↓									
	D7	↓									
	D9	↓									

ND = None Detected

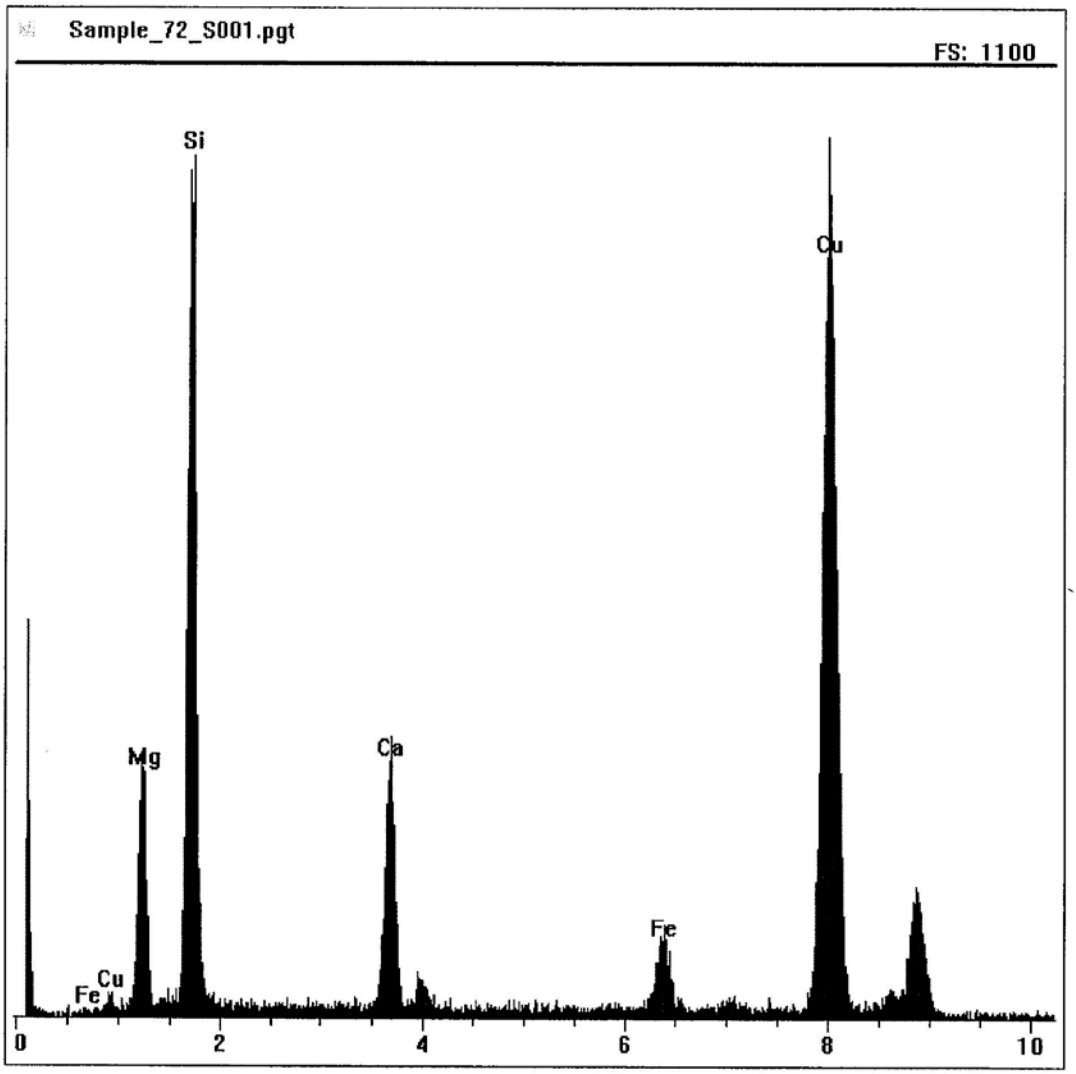
NAM = Non Asbestos Material

Energy Dispersive X-Ray Analysis
Qualitative Spectrum

EMSL ANALYTICAL, INC.

File: 041216273-01 PA-MC-AA-01 B2 G8 ACTINOLITE
Collected: July 06, 2012 13:58:43

Live Time:	233.30	Count Rate:	454	Dead Time:	11.81 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00



EMSL Analytical Inc. 307 West 38th Street, New York, NY, 10118
TEL: (212) 290-0051 • FAX: (212) 290-0058 • www.EMSL.com
Locally Focused ... Nationally Recognized

AMPHIBOLE SAED INDEXING FORM

EMSL Order ID : 041216273 DATE: 07/10/12

Indexing of negative number: 63115 SCOPE # 03-01

Reference / Sample Number: PA-MC-AA-01

Preliminary ID: ACTINOLITE By: DY

Using Camera Constant of: 21.89 mm Angstroms

Determined from negative number: 63094

Measured Inter-row spacing: 4.178571429 mm
Mean Distance between spots on Center row (d2): 2.45 mm
Mean distance between spots on slant vector (d1): 4.7 mm

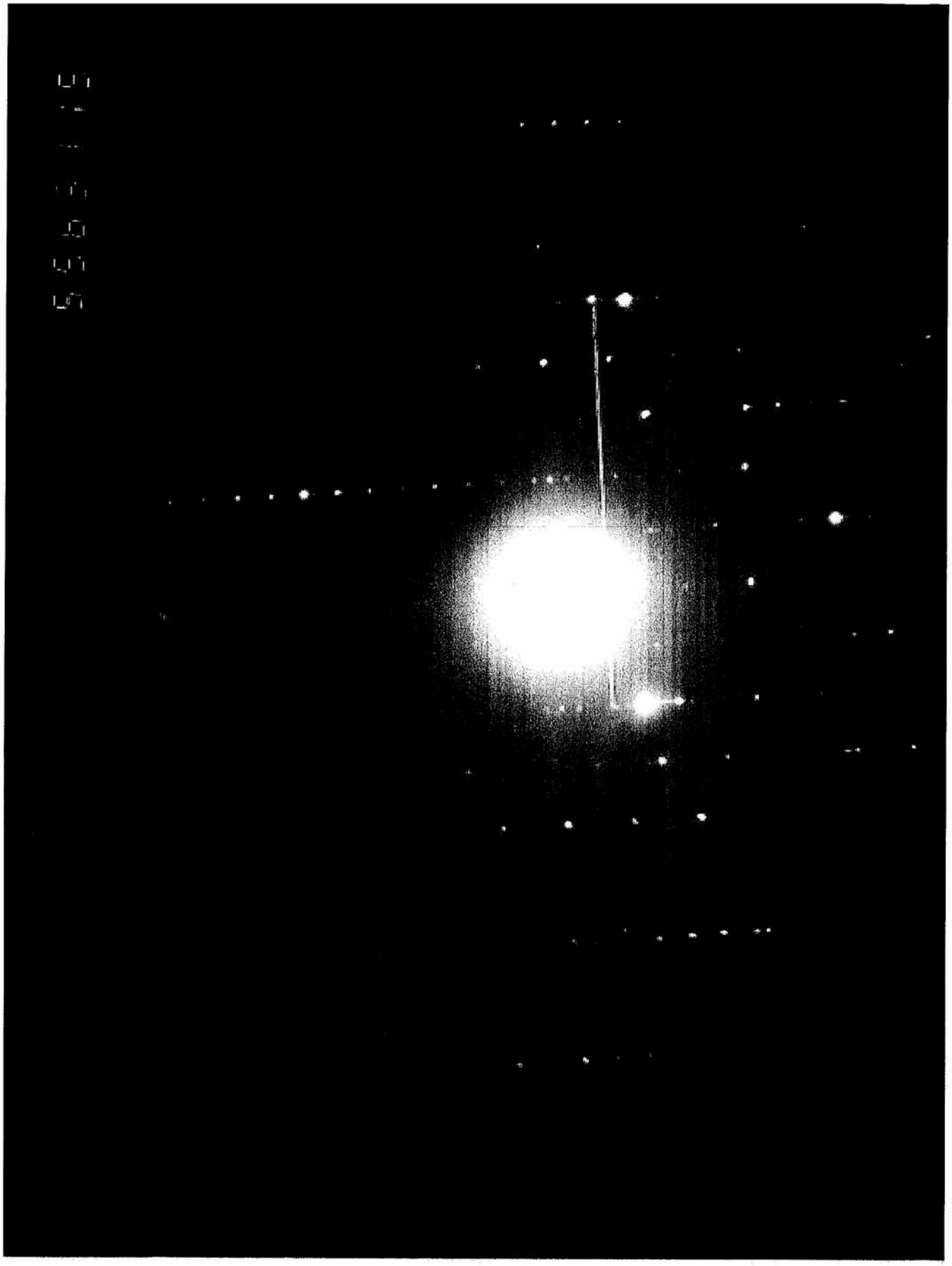
	Calculated	Ref	- 5%	+ 5%
Inter-row spacing (Ångstroms)	**5.24**	5.160	**4.902**	**5.418**
d2 or hk0 (Camera K/zero row dist.)	**8.93**	9.050	**8.598**	**9.503**
d1 or hk1 (Camera K/slant vector dist.)	**4.66**	4.482	**4.258**	**4.706**
Ratio of hk0/hk1	**1.92**	2.02	**1.919**	**2.121**
Angle of Slant Vector (Measured)	61.0	60.3	**57.285**	**63.315**

From SAED Reference Book, "unknown" diffraction pattern was found to be that of: Actinolite By: DY
With a Zone Axis of: [1 0 0]

Preliminary Identification was: [X] CORRECT

[ ] INCORRECT

percent accuracy to date: 100



TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID:	041216273-0002	Volume (L):	709.155	Scope:	03-01
Customer Sample:	PA-MC-AA-03	Prepped By:	A. Folgar	GO area (mm²):	0.0130
Sample Description:	Ambient	Prepped Date:	7/2/12	Magnification:	10,000X
Pore Size (micron):	0.45	Grid Box :	0312-ERRG-01	Analyzed By:	D. Young
EFA (mm²):	385	Grid Location:	C(1-3)	Analysis Date:	7/5/12

Analysis Information

Target Sensitivity:	0.002	s/cc	Minimum Aspect Ratio: (circle one)		
GO Required:	~~21~~ 22		none	**3:1**	5:1
GO Analyzed:	~~21~~ 22				
Level of Analysis Chrysotile:	CD		Min Length:	>5	micron
Level of Analysis Amphibole:	ADX		Min Width:	0.25	micron

Comments:

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
C1	B10	ND									
	B8	↓									
	B6	↓									
	B4	↓									
	B2	↓									
	E1	↓									
	E3	↓									
	E5	↓									
	E7	↓									
	E9	↓									

ND= None Detected

NAM= Non Asbestos Material

EMSL Analytical, Inc

Traverse Direction: Vertical

Particulate Loading: 1-5%

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID: 041216273-0002

Customer Sample ID: PA-MC-AA-03

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
C2	d1	ND									
	d3										
	d5										
	d7										
	d9										
	E10										
	E8										
	E6										
	E4										
	E2										
	G1										
	G3	ND									

ND = None Detected

NAM = Non Asbestos Material

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID:	041216273-0003	Volume (L):	483.975	Scope:	JEOL 1200 EX (04-03)
Customer Sample:	PA-MC-AM-04	Prepped By:	SM	GO area (mm²):	0.0130
Sample Description:	ABS	Prepped Date:	6.25.12	Magnification:	20,000x
Pore Size (micron):	0.45	Grid Box :	Special Project	Analyzed By:	P Harrison
EFA (mm²):	385	Grid Location:	B	Analysis Date:	6/26/12

Analysis Information

Target Sensitivity:	0.004	s/cc	Minimum Aspect Ratio: (circle one)		
GO Required:	16		none	**3:1**	5:1
GO Analyzed:	16				
Level of Analysis Chrysotile:	CD		Min Length:	>5	micron
Level of Analysis Amphibole:	ADX		Min Width:	0.2	micron

Comments: 8% particulate loading vertical traverse

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
B1	B6	ND									
	H7										
	A9										
	E7										
	F5										
	J9										
B2	J5										
	C5										
	I3										
	F2										

ND= None Detected

NAM= Non Asbestos Material

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID: 041216273-0003

Customer Sample ID: PA-MC-AM-04

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
B2	D1	ND									
B3	I8										
	D4										
	F4										
	E2										
	A4										

ND = None Detected

NAM = Non Asbestos Material

National Asbestos Data Entry Spreadsheet (NADES) for Air & Dust Analysis by Superfund TEM

SAMPLE/ANALYSIS INFORMATION

version 12i-DRAFT

Enter Site or Project Name Here:	2011-149 Phillips Mine
State/Federal Site or Project Identifier:	

Site/Project Identifier Code:	2011-149

Laboratory name:		EMSL04
Instrument:		JEOL 1200 EX
Voltage (kV):		100
Magnification: Enter one or more (a)		20,000x
Grid opening area (mm²):		0.0130
	High Mag:	Low Mag:
Scale: 1L =	1.000	1.000
Scale: 1D =	1.000	1.000
Filter Size (mm):		
Filter Pore Size (um):		
Method SOP (Revision No.):		
Grid Storage Location:		
Archive filter(s) storage location:		Cinnaminson

Client Sample Number:	PA-MC-AM-04
Date received by lab:	06/22/12
Lab Job Number:	041216273
Lab Sample Number:	041216273-0001 x3
Chain of Custody Number:	RD 6-27-12

Sample Type: (FS=Field Sample, FB=Field Blank, LT=Lot Blank, QC=Lab QC)	FS
QC Sample Type: (Not QC, LB=Lab Blank, RS=Recount Same, RD, Recount Diff., RP=Reprep., VA=Verified Analysis, IL=Interlab)	Not QC
Media: (Air, Dust, Dustfall, N/A)	Air
Air volume (L), dust area (cm²), or dustfall container area (cm²):	484

Number of grids prepared:	3
Prepared by:	
Preparation date:	
Preparation Type: (D=Direct, I=Indirect, IA=Indirect, ashed)	
If sample type = air, is there loose material or debris in the cowl? (Y/N)	
Primary Filter Area (mm²):	385
Secondary Filter Area (mm²):	
F- factor:	
Filter Status: (A=Analyzed, O=Overloaded, D=Damaged, M=Missing, C=Cancelled)	A
Analyzed by:	P Harrison
Analysis date:	6/26/12

F-factor Input Parameters:

Indirect Prep Inputs

	Fraction of primary filter used for indirect prep or ashing [For dust and dustfall, enter 1.0]
	First resuspension volume or rinsate volume (mL)
	Volume applied to secondary filter (mL) or used for serial dilution

Inputs for Serial Dilutions

	Second resuspension volume (mL)
	Volume applied to secondary filter (mL) or used for serial dilution
	Third resuspension volume (mL)
	Volume applied to secondary filter (mL)

Input for Ashing of Secondary Filter:

	Fraction of secondary filter used for ashing

Project Stopping Rules:

Maximum Area Examined (mm²):	
Total Number of Asbestos Structures Observed Equals:	
Analytical Sensitivity is at least:	0.004

Project Recording Rules:

Minimum Aspect Ratio:	3:1
Minimum Length (µm):	>5.0
Minimum Width (µm):	>0.25

COMMENTS

8% particulate loading

(a) Enter one or both magnifications (high and/or low) in this box. Examples: 20,000x OR 5,000x OR 20,000/5,000x

If sample was analyzed using more than one TEM instrument, enter TEM Instrument details below.

	Instrument #2	Instrument #3
Instrument:		
Voltage (KV):		
Magnification:		

If sample was analyzed by more than one analyst or across multiple analysis dates, enter analysis details below.

	Analyst #2	Analyst #3
Analyzed by:		
Analysis date:		

IMPORTANT NOTE: If this sample was analyzed using more than one instrument, by more than one analyst, or across multiple analysis dates, be sure to complete the column labeled "Multiple" when entering raw structure results for each grid opening.

National Asbestos Data Entry Spreadsheet (NADES) for Air & Dust Analysis by Superfund TEM

STRUCTURE INFORMATION

Client Sample No.:	PA-MC-AM-04	Sample Type	FS	Preparation Type	
Lab Sample No.:	041216273-0001	QC Sample Type	Not QC	Analysis Date	6/26/12

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (a)		Identification Code (b)	Mineral Type (c)	Other Mineral Description	1 = yes, blank = no			Multiple (d)	Low Mag	Comments
			Primary	Total	Length	Width				Sketch	Photo	EDS			
B1	B6	ND													
	H7	ND													
	A9	ND													
	E7	ND													
	F5	ND													
	J9	ND													
B2	J5	ND													
	C5	ND													
	I3	ND													
	F2	ND													
	D1	ND													
B3	I8	ND													
	D4	ND													
	F4	ND													
	E2	ND													
	A4	ND													

PH 6/26/12

(a) Enter dimensions either in absolute units (um) or in screen units. If reported as screen units, confirm that the Length & Dimension Scales are set as appropriate.
(b) See Annex D of ISO 10312 for identification codes.
(c) Valid Mineral Types:

AC	actinolite	CH	chrysotile	LA	Libby amphibole	OM	other mineral type (specify in "other mineral description" field)
AM	amosite	CR	crocidolite	OA	other amphibole	Amosite	Solid solution series: Amosite, cummingtonite-grunerite
AN	anthophyllite	TR	tremolite	NAM	non-asbestos material	Trem-Act	Solid solution series: Tremolite-Actinolite

(d) Populate this field only if sample was analyzed using more than one instrument, by more than one analyst, or across multiple analysis dates.
(e) If the analyst changes to low magnification, populate this field with a numerical value for what the analysts has chosen.

Grid opening traverse direction (circle one):
H Horizontal
V Vertical

Are prepped grids acceptable for analysis? (circle one) Yes No
If No, explain:

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID:	041216273-0004	Volume (L):	641.325	Scope:	03-01
Customer Sample:	PA-MC-AA-02	Prepped By:	A. Folgar	GO area (mm²):	0.0130
Sample Description:	Ambient	Prepped Date:	7/2/12	Magnification:	10,000x
Pore Size (micron):	0.45	Grid Box :	0312-ERRG-01	Analyzed By:	D. Young
EFA (mm²):	385	Grid Location:	D(1-3)	Analysis Date:	7/5/12

Analysis Information

Target Sensitivity:	0.002 s/cc	Minimum Aspect Ratio: (circle one)			***Comments:***
GO Required:	~~23~~ 24	none	**3:1**	5:1	
GO Analyzed:	~~23~~ 24				
Level of Analysis Chrysotile:	CD	Min Length:	>5	micron	
Level of Analysis Amphibole:	ADX	Min Width:	0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
D1	G1	ND									
	G3	↓									
	G5	↓									
	G7	↓									
	G9	↓									
	D10	↓									
	D8	↓									
	D6	↓									
	D4	↓									
	D2	↓									

ND= None Detected

NAM= Non Asbestos Material

Transverse Direction: Vertical

Particulate Loading: 1-5%

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID: 041216273-0004

Customer Sample ID: PA-MC-AA-02

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
D2	H2	ND									
	H4										
	H6										
	H8										
	H10										
	E10										
	E8										
	E6										
	E4										
	E2										
	C1										
	C3										
	C5										
	C7										

ND = None Detected

NAM = Non Asbestos Material

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID:	041216273-0005	Volume (L):	487.575	Scope:	JEOL 1200 EX 04-03
Customer Sample:	PA-MC-AM-01	Prepped By:	SM	GO area (mm²):	0.0130
Sample Description:	ABS	Prepped Date:	6.25.12	Magnification:	20,000x
Pore Size (micron):	0.45	Grid Box :	Special Project	Analyzed By:	P Harrison
EFA (mm²):	385	Grid Location:	B	Analysis Date:	6/26/12

Analysis Information

Target Sensitivity:	0.004	s/cc	Minimum Aspect Ratio: (circle one)		
GO Required:	16		none	**3:1**	5:1
GO Analyzed:	16				
Level of Analysis Chrysotile:	CD		Min Length:	>5	micron
Level of Analysis Amphibole:	ADX		Min Width:	0.2	micron

Comments:
3% particulate loading
vertical transverse direction

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
B4	A5	ND									
	C7										
	E9										
	F6										
	G4										
	I7										
B5	C4										
	D6										
	G8										
	H5										

ND= None Detected NAM= Non Asbestos Material

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID: 041216273-0005

Customer Sample ID: PA-MC-AM-01

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
B5	J7	ND									
B6	J1										
	I4										
	H5										
	F2										
	D5										
						PH 6/28/12					

ND = None Detected

NAM = Non Asbestos Material

National Asbestos Data Entry Spreadsheet (NADES) for Air & Dust Analysis by Superfund TEM
SAMPLE/ANALYSIS INFORMATION

Enter Site or Project Name Here:	2011-149 Phillips Mine
State/Federal Site or Project Identifier:	

Site/Project Identifier Code:	2011-149

Laboratory name:		EMSL04
Instrument:		JEOL 1200 EX
Voltage (kV):		100
Magnification: Enter one or more (a)		20,000 X
Grid opening area (mm²):		0.0130
	High Mag:	Low Mag:
Scale: 1L =	1.000	1.000
Scale: 1D =	1.000	1.000
Filter Size (mm):		
Filter Pore Size (um):		
Method SOP (Revision No.):		
Grid Storage Location:		
Archive filter(s) storage location:		Cinnaminson

Client Sample Number:	PA-MC-AM-01
Date received by lab:	06/22/12
Lab Job Number:	041216273
Lab Sample Number:	041216273-0025
Chain of Custody Number:	RD 6/27/12
Sample Type: (FS=Field Sample, FB=Field Blank, LT=Lot Blank, QC=Lab QC)	FS
QC Sample Type: (Not QC, LB=Lab Blank, RS=Recount Same, RD, Recount Diff., RP=Reprep., VA=Verified Analysis, IL=Interlab)	Not QC
Media: (Air, Dust, Dustfall, N/A)	Air
Air volume (L), dust area (cm²), or dustfall container area (cm²):	488

Number of grids prepared:	3
Prepared by:	
Preparation date:	
Preparation Type: (D=Direct, I=Indirect, IA=Indirect, ashed)	
If sample type = air, is there loose material or debris in the cowl? (Y/N)	
Primary Filter Area (mm²):	385
Secondary Filter Area (mm²):	
F- factor:	
Filter Status: (A=Analyzed, O=Overloaded, D=Damaged, M=Missing, C=Cancelled)	A
Analyzed by:	P Harrison
Analysis date:	6/26/12

F-factor Input Parameters:

Indirect Prep Inputs

	Fraction of primary filter used for indirect prep or ashing [For dust and dustfall, enter 1.0]
	First resuspension volume or rinsate volume (mL)
	Volume applied to secondary filter (mL) or used for serial dilution

Inputs for Serial Dilutions

	Second resuspension volume (mL)
	Volume applied to secondary filter (mL) or used for serial dilution
	Third resuspension volume (mL)
	Volume applied to secondary filter (mL)

Input for Ashing of Secondary Filter:

	Fraction of secondary filter used for ashing

Project Stopping Rules:

Maximum Area Examined (mm²):	
Total Number of Asbestos Structures Observed Equals:	
Analytical Sensitivity is at least:	0.004

Project Recording Rules:

Minimum Aspect Ratio:	3:1
Minimum Length (µm):	>5.0
Minimum Width (µm):	>0.25

COMMENTS

3% particulate loading

(a) Enter one or both magnifications (high and/or low) in this box. Examples: 20,000x OR 5,000x OR 20,000/5,000x

If sample was analyzed using more than one TEM instrument, enter TEM Instrument details below.

	Instrument #2	Instrument #3
Instrument:		
Voltage (KV):		
Magnification:		

If sample was analyzed by more than one analyst or across multiple analysis dates, enter analysis details below.

	Analyst #2	Analyst #3
Analyzed by:		
Analysis date:		

IMPORTANT NOTE: If this sample was analyzed using more than one instrument, by more than one analyst, or across multiple analysis dates, be sure to complete the column labeled "Multiple" when entering raw structure results for each grid opening.

National Asbestos Data Entry Spreadsheet (NADES) for Air & Dust Analysis by Superfund TEM

STRUCTURE INFORMATION

Client Sample No.:	PA-MC-AM-01	Sample Type	FS	Preparation Type	
Lab Sample No.:	041216273-0002	QC Sample Type	Not QC	Analysis Date	6/26/12

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (a)		Identification Code (b)	Mineral Type (c)	Other Mineral Description	1 = yes, blank = no			Multiple (d)	Low Mag	Comments
			Primary	Total	Length	Width				Sketch	Photo	EDS			
B4	A5	ND													
	C7	ND													
	E9	ND													
	F6	ND													
	G4	ND													
	I7	ND													
B5	C4	ND													
	D6	ND													
	G8	ND													
	H5	ND													
	J7	ND													
B6	J1	ND													
	I4	ND													
	H5	ND													
	F2	ND													
	D5	ND													
						PH 6/26/12									

(a) Enter dimensions either in absolute units (um) or in screen units. If reported as screen units, confirm that the Length & Dimension Scales are set as appropriate.
(b) See Annex D of ISO 10312 for identification codes.
(c) Valid Mineral Types:

AC	actinolite	CH	chrysotile	LA	Libby amphibole	OM	other mineral type (specify in "other mineral description" field)
AM	amosite	CR	crocidolite	OA	other amphibole	Amosite	Solid solution series: Amosite, cummingtonite-grunerite
AN	anthophyllite	TR	tremolite	NAM	non-asbestos material	Trem-Act	Solid solution series: Tremolite-Actinolite

(d) Populate this field only if sample was analyzed using more than one instrument, by more than one analyst, or across multiple analysis dates.
(e) If the analyst changes to low magnification, populate this field with a numerical value for what the analysts has chosen.

Grid opening traverse direction (circle one):
H Horizontal
(V) Vertical

Are prepped grids acceptable for analysis? (circle one) (Yes) No
If No, explain:

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID:	041216273-0006	Volume (L):	561.6	Scope:	03-01
Customer Sample:	PA-MC-AM-03	Prepped By:	DYoung / A. Foljar	GO area (mm²):	0.013
Sample Description:	ABS	Prepped Date:	7/2/12	Magnification:	10,000
Pore Size (micron):	0.45	Grid Box:	0312 ERRG -01	Analyzed By:	Gerald Lunnstrom
EFA (mm²):	385	Grid Location:	E 1-3	Analysis Date:	7/5/12

Analysis Information

Target Sensitivity:	0.004	s/cc	Minimum Aspect Ratio: (circle one)		
GO Required:	~~14~~ 15		none	**3:1**	5:1
GO Analyzed:	~~27~~ 19.4 15				
Level of Analysis Chrysotile:	CD		Min Length:	>5	micron
Level of Analysis Amphibole:	ADX		Min Width:	0.25	micron

Comments:
$X^2 = 17.789$ = Random

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
E1	H9	ND									
	H7	ND									
	H5	F	Ø	Ø	5.35	1.25	NAM	NAM			YES
	D8	ND									
	D6	F	1	1	14.58	2.43	~~CD~~ ~~CH12~~ 7/5	~~CH~~ ~~CH12~~ 7/5		63113 63114 ~~63115~~ DY 7/5/12	YES
	D4	ND									
E2	F2	ND									
	F4	ND									
	F6	ND									
	H3	ND									

ND= None Detected NAM= Non Asbestos Material

EMSL Analytical, Inc

Particulate: 10%
Transverse Direction: Vertical

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID: 041216273-0006

Customer Sample ID: PA-MC-AM-03

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
	H5	ND									
	H7	ND									
E3	G9	ND									
	G7	ND									
	G5	ND									

ND = None Detected

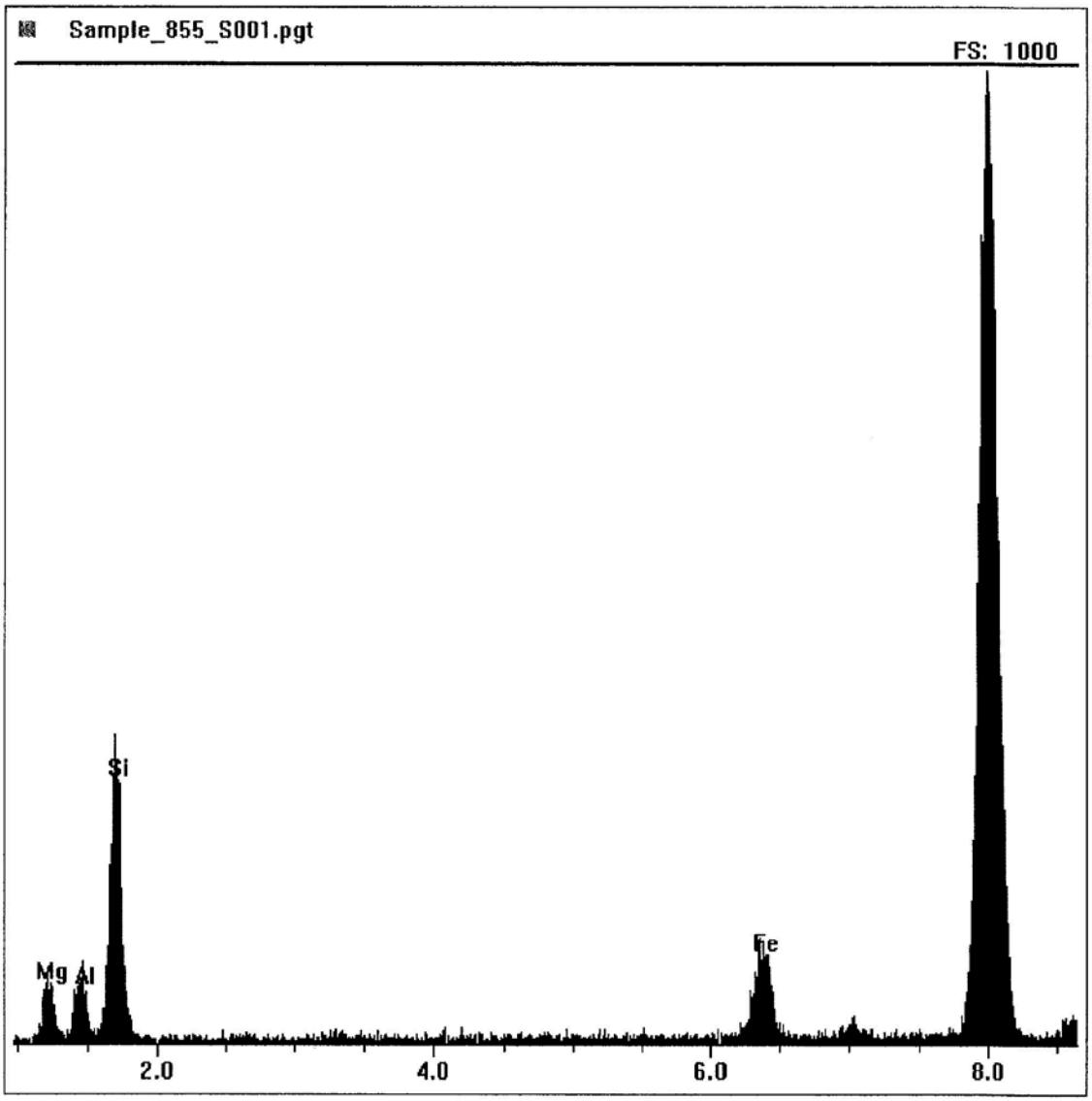
NAM = Non Asbestos Material

Energy Dispersive X-Ray Analysis
Qualitative Spectrum

EMSL ANALYTICAL, INC.

File: 041216273 PA-MC-AM-03 E1 H5 NAM
Collected: July 05, 2012 16:12:12

Live Time:	21.72	Count Rate:	3087	Dead Time:	50.99 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00



EMSL Analytical Inc. 307 West 38th Street, New York, NY, 10118
TEL: (212) 290-0051 • FAX: (212) 290-0058 • www.EMSL.com
Locally Focused ... Nationally Recognized

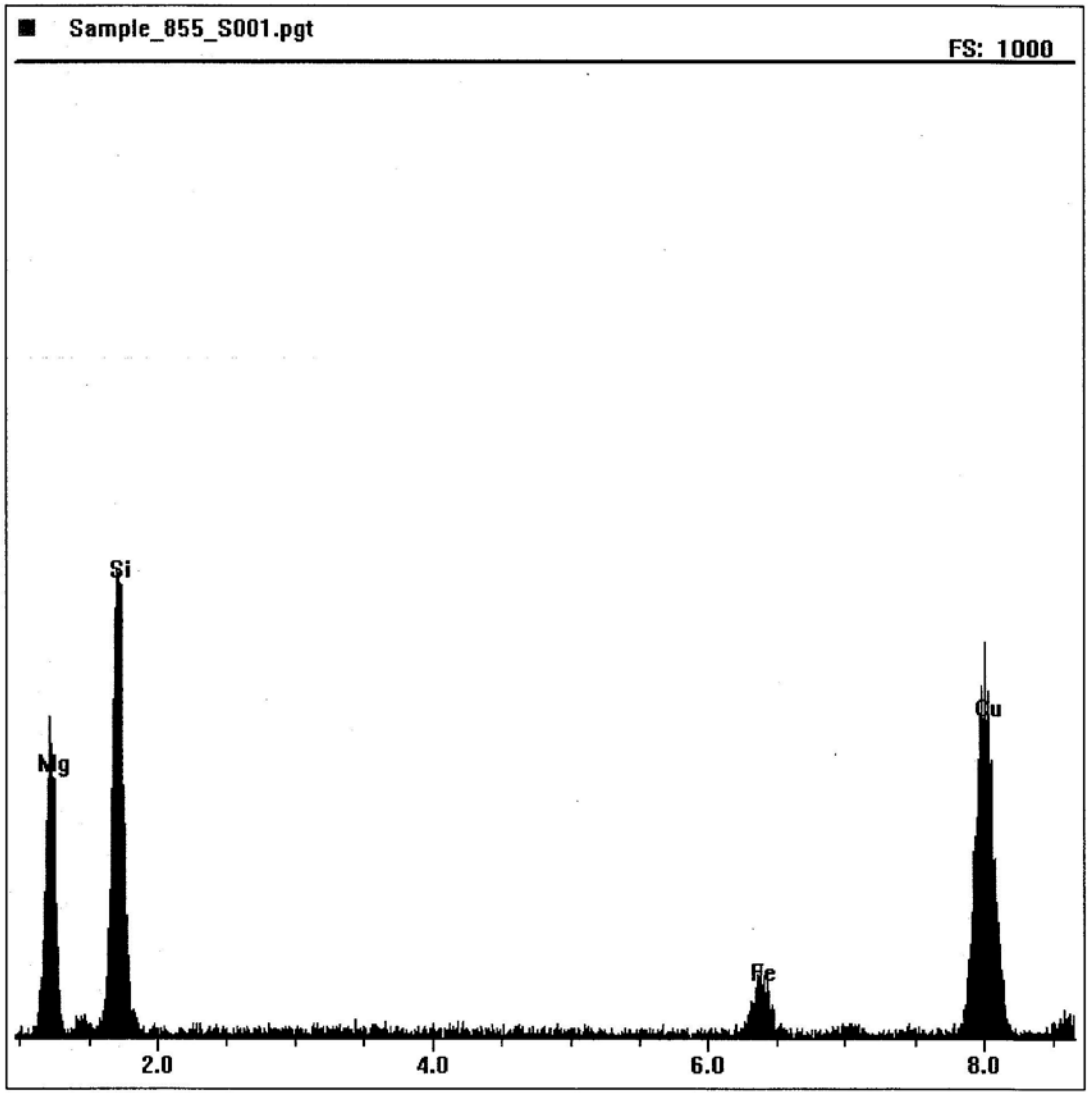
Energy Dispersive X-Ray Analysis
Qualitative Spectrum

DB 7/10/12

EMSL ANALYTICAL, INC.

File: 041216273 PA-MC-AM-03 E1 D6 CHRYSOTILE
Collected: July 05, 2012 16:12:12

Live Time:	53.13	Count Rate:	884	Dead Time:	18.26 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00



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CHRYSOTILE SAED INDEXING FORM

EMSL Order ID : 041216273 DATE: 07/10/12

Indexing of negative number: 63114 SCOPE #: 03-01

Reference / Sample Number: PA-MC-AM-03

Preliminary ID: Chrysotile By: GI

Using Camera Constant of: 21.89 mm Angstroms

Determined from negative number: 63094

Quick Check

Measured Inter-row spacing: 4 mm

110 reflections present? Enter Yes or No Yes

200 doublets present? Enter Yes or No Yes

Full Index

Measured distance, center spot to closest hk0 spot (002):	3.00	mm
Measured distance, center spot to closest hk1 spot (110):	4.85	mm

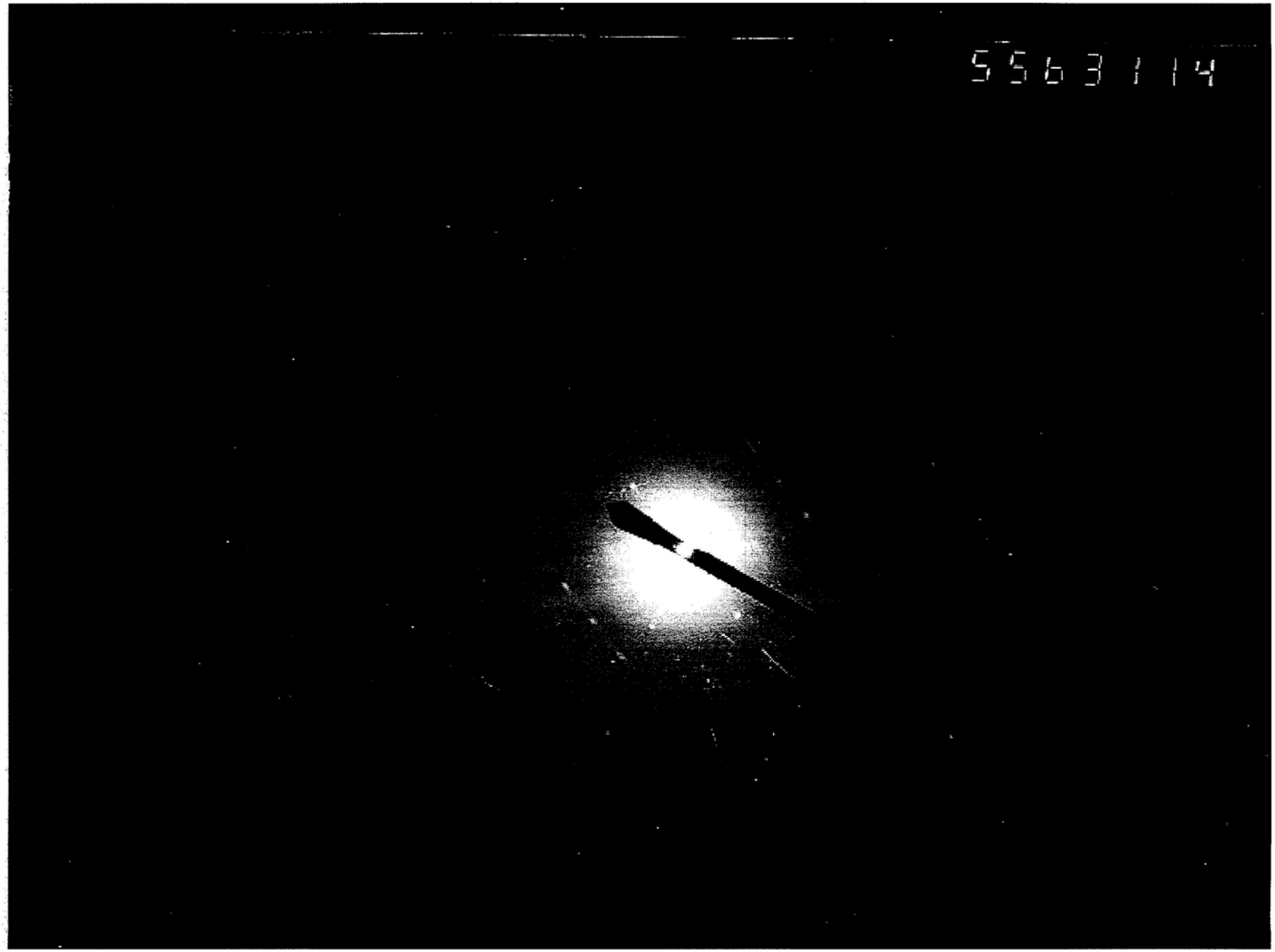
	Calculated	Ref	-5%	+5%
Inter-row spacing (Ångstroms)	**5.47**	**5.30**	**5.035**	**5.565**
Angle to 110 reflection (Measured °)	58	**60.0**	**57.0**	**63.0**
d2 or d hk 0 (002) (Angstroms)	**7.30**	**7.32**	**6.954**	**7.686**
d1 or d hk 1 (110) (Angstroms)	**4.51**	**4.58**	**4.351**	**4.809**

From SAED Reference Book, "unknown" diffraction pattern was found to be that of: Chrysotile By: DY

Preliminary Identification was: [X] CORRECT

[ ] INCORRECT

percent accuracy to date: 100


5563114

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID:	041216273-0007	Volume (L):	584.55	Scope:	03-01
Customer Sample:	PA-MC-AM-02	Prepped By:	A. Folgar	GO area (mm²):	.013
Sample Description:	ABS	Prepped Date:	7/02/2012	Magnification:	10,000 X
Pore Size (micron):	0.45	Grid Box:	0312-ERRG-01	Analyzed By:	Alicia Folgar
EFA (mm²):	385	Grid Location:	F(1-3)	Analysis Date:	7/6/2012

Analysis Information

Target Sensitivity:	0.004	s/cc	Minimum Aspect Ratio: (circle one)			**Comments:**
GO Required:	~~13~~ 14		none	**3:1**	5:1	
GO Analyzed:	~~13~~ 14					
Level of Analysis Chrysotile:	CD		Min Length:	>5	micron	
Level of Analysis Amphibole:	ADX		Min Width:	0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
F1	H9	ND									
	H7	ND									
	H5	ND									
	H3	ND									
	H1	ND									
	C6	ND									
	C3	ND									
F2	G10	ND									
	G8	ND									
	G6	ND									

ND= None Detected

NAM= Non Asbestos Material

EMSL Analytical, Inc

Particulate Loading: 5-10%
Traverse Direction: Vertical

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID: 041216273-0007

Customer Sample ID: PA-MC-AM-02

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
F2	G4	ND									
	G2	ND									
	B5	ND									
	B3	ND									

ND = None Detected

NAM = Non Asbestos Material

EMSL Analytical, Inc

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID:	041216273-0008	Volume (L):	493.2	Scope:	~~03-02~~ 03-01 AF 7/16
Customer Sample:	PA-ATV1-AA-01	Prepped By:	A. FOIGAR	GO area (mm²):	0.013
Sample Description:	Ambient	Prepped Date:	7/2/12	Magnification:	10,000 X
Pore Size (micron):	0.45	Grid Box :	0312-ERRG-01	Analyzed By:	A. FOIGAR
EFA (mm²):	385	Grid Location:	G (1-3)	Analysis Date:	7/6/12

Analysis Information

Target Sensitivity:	0.002	s/cc	Minimum Aspect Ratio: (circle one)			***Comments:***
GO Required:	~~30~~ 31		none	**3:1**	5:1	
GO Analyzed:	~~30~~ 31					
Level of Analysis Chrysotile:	CD		Min Length:	>5	micron	
Level of Analysis Amphibole:	ADX		Min Width:	0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
G2	B1	ND									
	B3	ND									
	B5	ND									
	B7	ND									
	B9	ND									
	F2										
	F4										
	F6										
	F8										
	F10										

ND= None Detected NAM= Non Asbestos Material

Particulate Loading: 10-15%
Traverse Direction: Vertical

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID: 041216273-0008

Customer Sample ID: PA-ATV1-AA-01

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
G2	I1	ND									
	I3	ND									
	J4	ND									
	J6	ND									
	J8	ND									
G3	f10	ND									
	f8										
	f6										
	f4										
	f2										
	A1										
	A3										
	A5										
	A7										
	A9										

ND = None Detected

NAM = Non Asbestos Material

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID: 041216273-0008

Customer Sample ID: PA-ATV1-AA-01

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
G3	C2	ND									
	C4	↓									
	C6	↓									
	C8	↓									
	C10	↓									
	G7	ND									

ND = None Detected

NAM = Non Asbestos Material

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID:	041216273-0009	Volume (L):	374.94	Scope:	~~03-02~~ 03-01 AF 7/16
Customer Sample:	PA-ATV1-AA-02	Prepped By:	A. FOLGAR	GO area (mm²):	.013
Sample Description:	Ambient	Prepped Date:	7/2/12	Magnification:	10,000 X
Pore Size (micron):	0.45	Grid Box :	0312-ERRG-01	Analyzed By:	A. FOLGAR
EFA (mm²):	385	Grid Location:	H (1-3)	Analysis Date:	7/6/12

Analysis Information

Target Sensitivity:	0.002	s/cc	Minimum Aspect Ratio: (circle one)		
GO Required:	~~39~~ 40		none	**3:1**	5:1
GO Analyzed:	~~39~~ 40				
Level of Analysis Chrysotile:	CD		Min Length:	>5	micron
Level of Analysis Amphibole:	ADX		Min Width:	0.25	micron

Comments:

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
H1	B2	ND									
	B4										
	B6										
	B8										
	B10										
	D1										
	D3										
	D5										
	D7										
	D9										

ND= None Detected

NAM= Non Asbestos Material

Particulate Loading: 10-15%
Traverse Direction: Vertical

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID: 041216273-0009

Customer Sample ID: PA-ATV1-AA-02

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
H1	G1	ND									
	G3	↓									
	G5	↓									
	H2	↓									
	H4	F	0	0	10.5	1.5	NAM	NAM	AC Present		✓
	H6	ND									
	H8	↓									
	H10	↓									
	J4	↓									
	J6	↓									
H2	I10	ND									
	I8	↓									
	I6	↓									
	I4	↓									
	I2	↓									

ND = None Detected

NAM = Non Asbestos Material

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID: 041216273-0009

Customer Sample ID: PA-ATV1-AA-02

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
H2	G9	ND									
	G7										
	G5										
	G3										
	G1										
	D10										
	D8										
	D6										
	D4										
	D2										
	B9										
	B7										
	B5										
	B3										
	f8	ND									

ND = None Detected

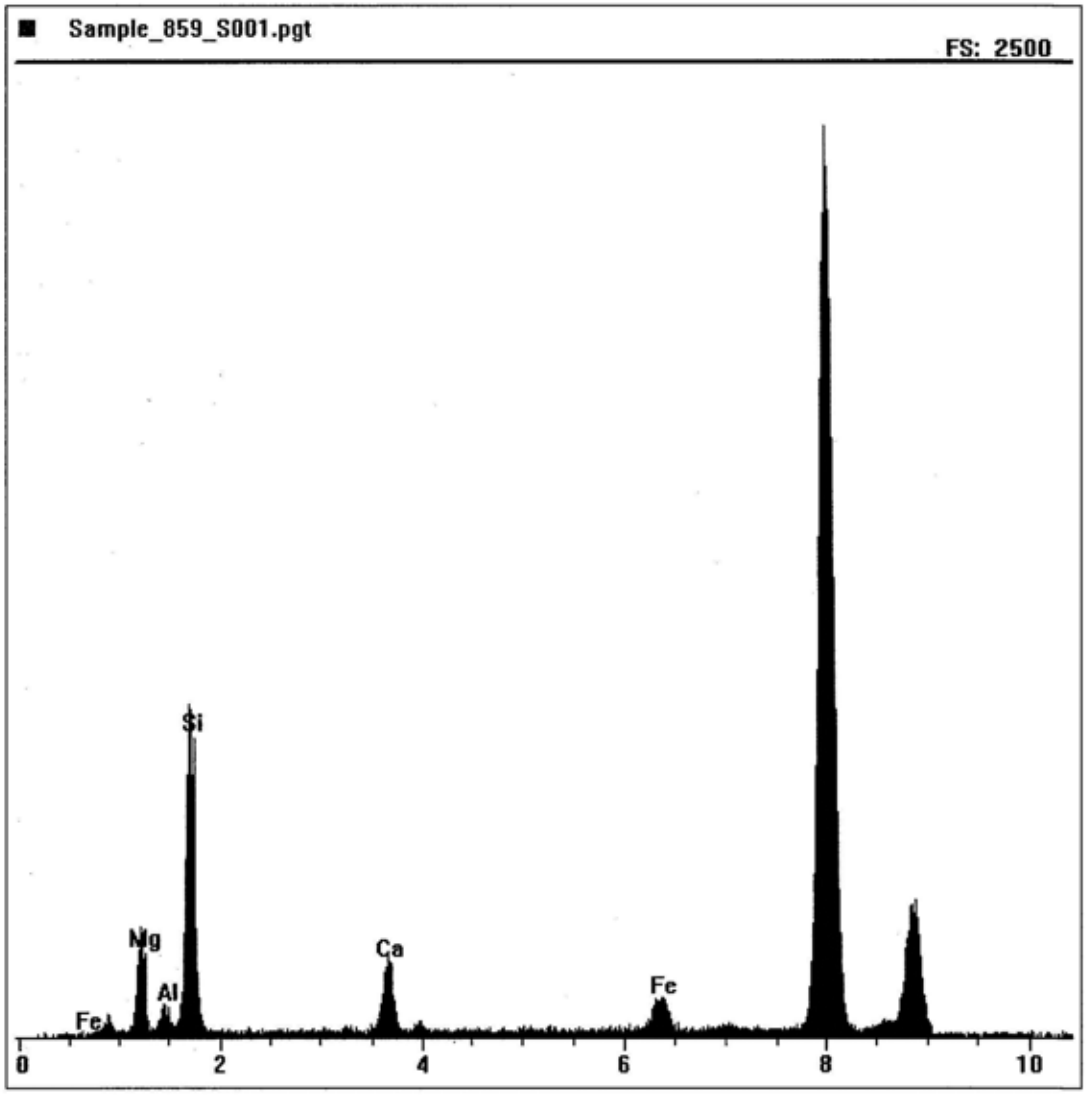
NAM = Non Asbestos Material

Energy Dispersive X-Ray Analysis
Qualitative Spectrum

EMSL ANALYTICAL, INC.

File: 041216273-~~009~~ 014 PA-ATV1-AA-02 H1 H4 NAM
Collected: July 06, 2012 13:18:48

Live Time:	40.36	Count Rate:	4058	Dead Time:	61.89 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00



TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID:	041216273-0010	Volume (L):	375.85	Scope:	~~03-03~~ 0301 AF 7/16
Customer Sample:	PA-ATV1-AA-03	Prepped By:	A. FOLGAR	GO area (mm²):	.013
Sample Description:	Ambient	Prepped Date:	7/2/12	Magnification:	10,000X
Pore Size (micron):	0.45	Grid Box :	0312-ERRG-01	Analyzed By:	A. FOLGAR
EFA (mm²):	385	Grid Location:	I (1-3)	Analysis Date:	7/6/12

Analysis Information

Target Sensitivity:	**0.002**	s/cc	Minimum Aspect Ratio: (circle one)		***Comments:***
GO Required:	~~39~~ 40		none	**3:1**	5:1
GO Analyzed:	~~39~~ 40				
Level of Analysis Chrysotile:	**CD**		Min Length:	**>5**	micron
Level of Analysis Amphibole:	**ADX**		Min Width:	**0.25**	micron

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
I1	I9	ND									
	I7										
	I5										
	I3										
	I1										
	G9										
	G7										
	G5										
	G3										
	G1										

ND= None Detected

NAM= Non Asbestos Material

EMSL Analytical, Inc

Particulate loading: 1-5%
Traverse Direction: Vertical.

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID: 041216273-0010

Customer Sample ID: PA-ATV1-AA-03

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
I1	E9	ND									
	E7										
	E5										
	E3										
	E1										
	C9										
	C7										
	C5										
	C3										
	C1										
I2	A2										
	A4										
	A6										
	A8										
	A10										

ND = None Detected

NAM = Non Asbestos Material

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID: 041216273-0010

Customer Sample ID: PA-ATV1-AA-03

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
I2	C2	ND									
	C4										
	C6										
	C8										
	C10										
	f2										
	f4										
	f6										
	f8										
	f10										
	I4										
	I6										
	I8										
	I10										
	B5	ND									

ND = None Detected

NAM = Non Asbestos Material

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID:	041216273-0011	Volume (L):	377.1	Scope:	~~03-02~~ 03-01 AF 7/16
Customer Sample:	PA-ATV1-AA-04	Prepped By:	A. Fol GAR	GO area (mm²):	.013
Sample Description:	Ambient	Prepped Date:	7/2/12	Magnification:	10,000 X
Pore Size (micron):	0.45	Grid Box :	0312 · ERRG · 01	Analyzed By:	A. Fol GAR
EFA (mm²):	385	Grid Location:	J (1 - 3)	Analysis Date:	7/6/12

Analysis Information

Target Sensitivity:	0.002	s/cc	Minimum Aspect Ratio: (circle one)		**Comments:**
GO Required:	~~39~~ 40		none	**3:1**	5:1
GO Analyzed:	39 40				
Level of Analysis Chrysotile:	CD		Min Length:	>5	micron
Level of Analysis Amphibole:	ADX		Min Width:	0.25	micron

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
J1	I10	ND									
	I8										
	I6										
	I4										
	I2										
	G9										
	G7										
	G5										
	G3										
	G1										

ND= None Detected NAM= Non Asbestos Material

EMSL Analytical, Inc Particulate Loading: 3-5%
Traverse Direction: Vertical

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID: 041216273-0011

Customer Sample ID: PA-ATV1-AA-04

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
J1	f10	ND									
	f8										
	f6										
	f4										
	f2										
	B9										
	B7										
	B5										
	B3										
	B1										
J2	E1										
	E3										
	E5										
	E7										
	E9										

ND = None Detected

NAM = Non Asbestos Material

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID: 041216273-0011

Customer Sample ID: PA-ATV1-AA-04

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
J2	G1	ND									
	G3										
	G5										
	G7										
	G9										
	H2										
	H4										
	H6										
	H8										
	H10										
	I1										
	I3										
	I5										
	I7										
	J2	ND									

ND = None Detected

NAM = Non Asbestos Material

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID:	041216273-0012	Volume (L):	385.38	Scope:	03-01
Customer Sample:	PA-ATV1-AA-05	Prepped By:	A. Tolgoi	GO area (mm²):	0.013
Sample Description:	Ambient	Prepped Date:	7/2/12	Magnification:	10,000X
Pore Size (micron):	0.45	Grid Box :	0312-CRBG-01	Analyzed By:	D. Young
EFA (mm²):	385	Grid Location:	K(1-3)	Analysis Date:	7/6/12

Analysis Information

Target Sensitivity:	0.002	s/cc	Minimum Aspect Ratio: (circle one)		
GO Required:	~~39~~ 40		none	**3:1**	5:1
GO Analyzed:	~~39~~ 40				
Level of Analysis Chrysotile:	CD		Min Length:	>5	micron
Level of Analysis Amphibole:	ADX		Min Width:	0.25	micron

Comments:

$x^2 = 42.909$ = Random

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
K1	E1	ND									
	E3										
	E5										
	E7										
	E9										
	C10										
	C8										
	C6										
	C4										
	C2										

ND= None Detected

NAM= Non Asbestos Material

EMSL Analytical, Inc

Traverse Direction: Vertical
Particulate Loading: 3-5%

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID: 041216273-0012

Customer Sample ID: PA-ATV1-AA-05

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
K1	A1	ND									
	A3										
	A5										
	A7										
	A9										
K2	J10										
	J8										
	J6										
	J4										
	J2										
	H1										
	H3										
	H5										
	H7										
	H9										

ND = None Detected

NAM = Non Asbestos Material

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID: 041216273-0012

Customer Sample ID: PA-ATV1-AA-05

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
K3	G10	ND									
	G8	↓									
	G6										
	G4										
	G2										
	E1	B	1	1	10.5	0.55	CD	CH		#63118(D)	✓
	E3	ND									
	E5	↓									
	E7										
	E9										
	B10										
	B8										
	B6										
	B4										
	B2										

ND = None Detected

NAM = Non Asbestos Material

EMSL Analytical, Inc

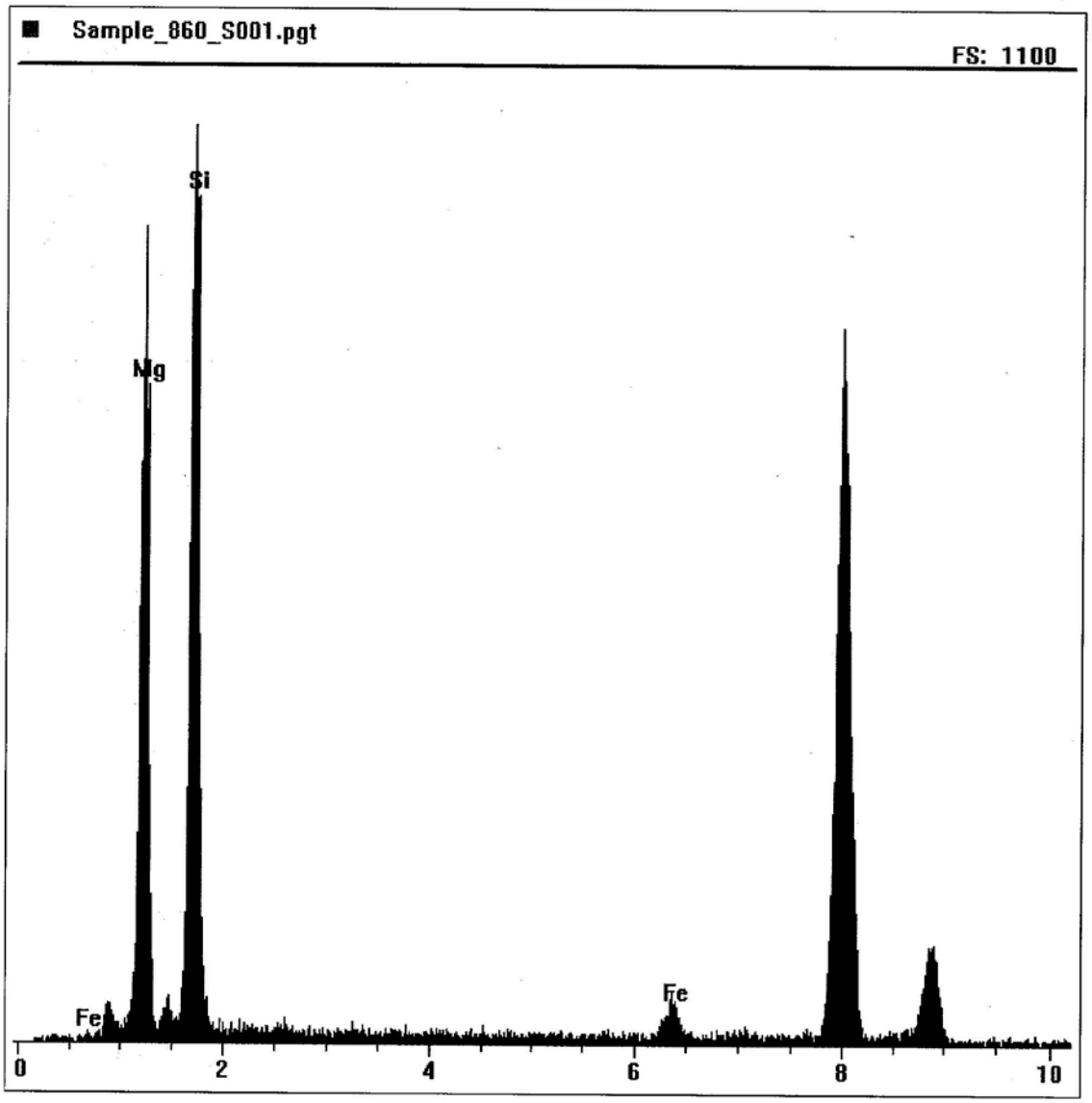
Energy Dispersive X-Ray Analysis
Qualitative Spectrum

EMSL ANALYTICAL, INC.

DY 7/16/12

File: 041216273~~-12~~ PA-ATV1-AA-05 K3 E1 1 CHRYSOTILE
Collected: July 06, 2012 15:03:31

Live Time:	137.87	Count Rate:	679	Dead Time:	14.61 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00



EMSL Analytical Inc. 307 West 38th Street, New York, NY, 10118
TEL: (212) 290-0051 • FAX: (212) 290-0058 • www.EMSL.com
Locally Focused ... Nationally Recognized

CHRYSOTILE SAED INDEXING FORM

EMSL Order ID : 041216273 DATE: 07/10/12

Indexing of negative number: 63118 SCOPE #: 03-01

Reference / Sample Number: PA-ATV1-AA-05

Preliminary ID: Chrysotile By: DY

Using Camera Constant of: 21.89 mm Angstroms

Determined from negative number: 63094

Quick Check

Measured Inter-row spacing: 4.075 mm

110 reflections present? Enter Yes or No Yes

200 doublets present? Enter Yes or No Yes

Full Index

Measured distance, center spot to closest hk0 spot (002):	3.00	mm
Measured distance, center spot to closest hk1 spot (110):	4.85	mm

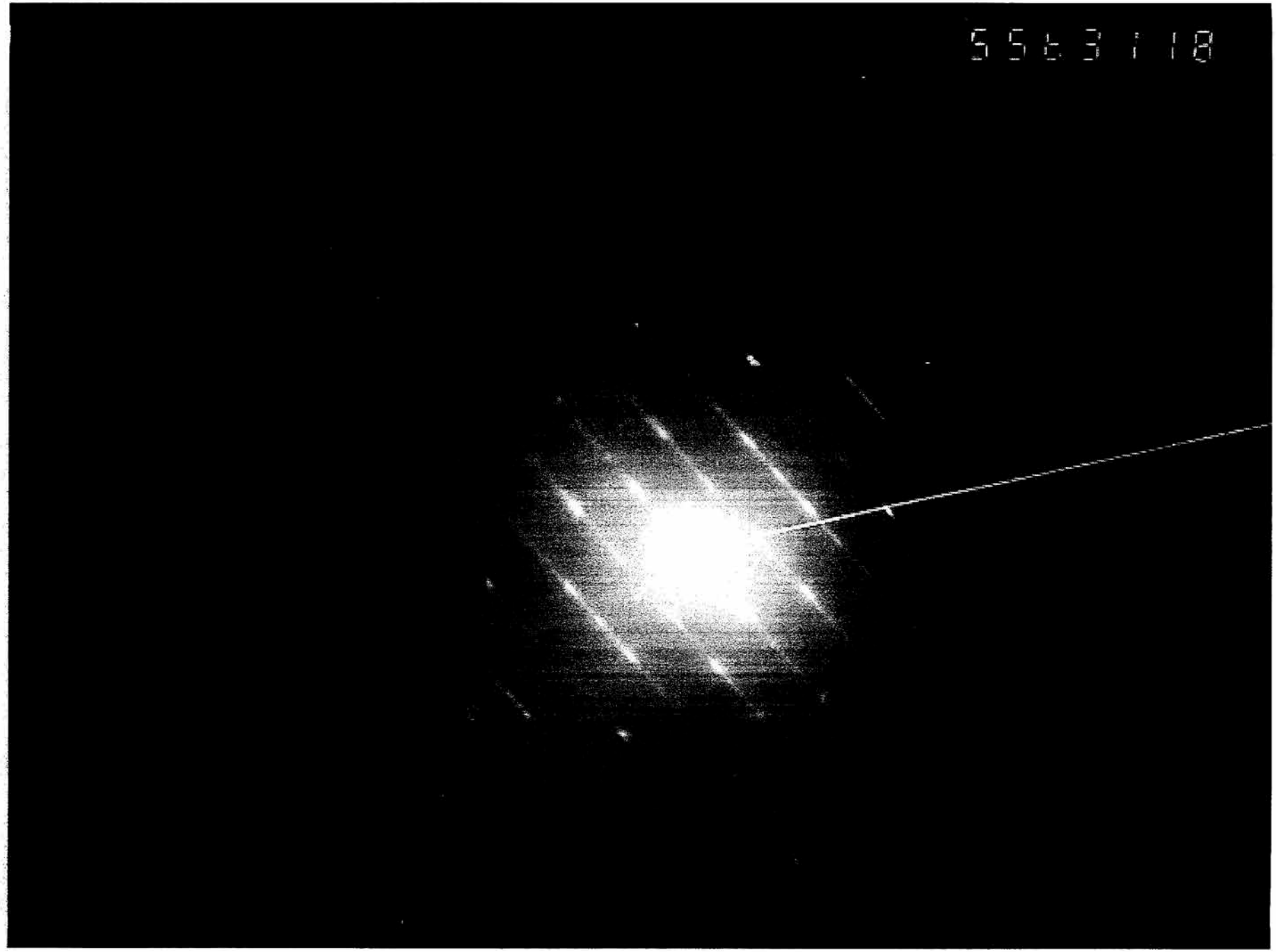
	Calculated	Ref	- 5%	+ 5%
Inter-row spacing (Ångstroms)	**5.37**	**5.30**	**5.035**	**5.565**
Angle to 110 reflection (Measured °)	62	**60.0**	**57.0**	**63.0**
d2 or d hk 0 (002) (Angstroms)	**7.30**	**7.32**	**6.954**	**7.686**
d1 or d hk 1 (110) (Angstroms)	**4.51**	**4.58**	**4.351**	**4.809**

From SAED Reference Book, "unknown" diffraction pattern was found to be that of: Chrysotile By: DY

Preliminary Identification was: [X] CORRECT

[ ] INCORRECT

percent accuracy to date: 100


5563118

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID:	041216273-0013	Volume (L):	512.28	Scope:	03-01
Customer Sample:	PA-ATV1-AA-06	Prepped By:	A. Folgar	GO area (mm²):	0.013
Sample Description:	Ambient	Prepped Date:	7/2/12	Magnification:	10,000X
Pore Size (micron):	0.45	Grid Box :	0312-ERRG-01	Analyzed By:	D. Young
EFA (mm²):	385	Grid Location:	L(1-3)	Analysis Date:	7/6/12

Analysis Information

Target Sensitivity:	0.002	s/cc	Minimum Aspect Ratio: (circle one)		
GO Required:	~~29~~ 30		none	**3:1**	5:1
GO Analyzed:	~~29~~ 30				
Level of Analysis Chrysotile:	CD		Min Length:	>5	micron
Level of Analysis Amphibole:	ADX		Min Width:	0.25	micron

Comments:

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
L1	D10	ND									
	D8	↓									
	D6	↓									
	D4	↓									
	D2	↓									
	F1	↓									
	F3	↓									
	F5	↓									
	F7	↓									
	F9	↓									

ND= None Detected

NAM= Non Asbestos Material

EMSL Analytical, Inc

Traverse Direction: Vertical
Particulate Loading: 15-20%

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID: 041216273-0013

Customer Sample ID: PA-ATV1-AA-06

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
L1	H10	ND									
	H8										
	H6										
	H4										
	H2										
L2	G9										
	G7										
	G5										
	G3										
	B10										
	B8										
	B6	B	Ø	Ø	8.5	1.15	nam	nam	Al Present Fe/Ca Too High		✓
	B4	ND									
	B2										
	E3										

ND = None Detected

NAM = Non Asbestos Material

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID: 041216273-0013

Customer Sample ID: PA-ATV1-AA-06

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
L3	H1	ND									
	H3										
	H5										
	H7										
	H9										

ND = None Detected

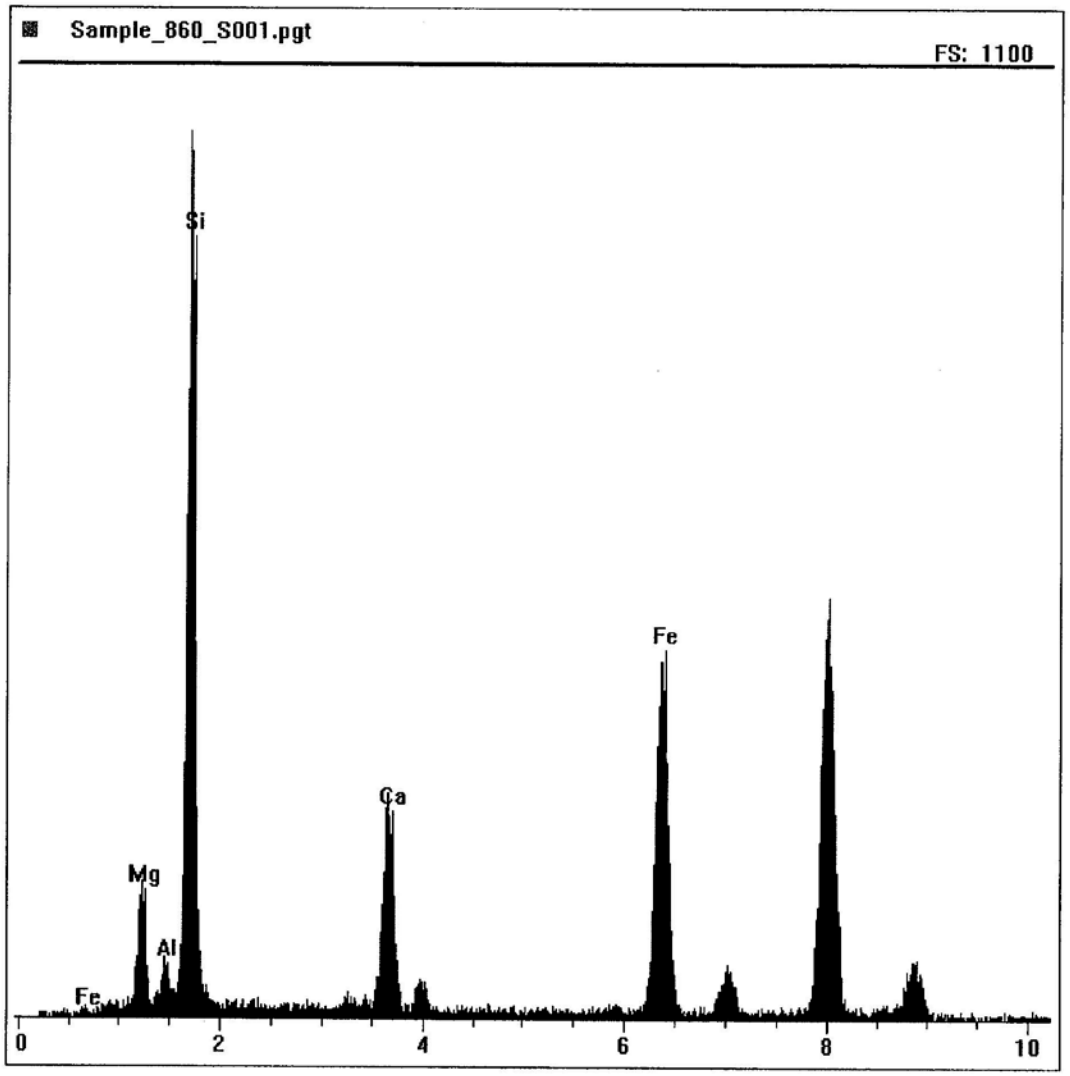
NAM = Non Asbestos Material

Energy Dispersive X-Ray Analysis
Qualitative Spectrum

EMSL ANALYTICAL, INC.

File: 041216273 PA-ATV1-AA-06 L2 B6 NAM
Collected: July 06, 2012 15:03:31

Live Time:	69.67	Count Rate:	1228	Dead Time:	24.22 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00



TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID:	041216273-0014	Volume (L):	430.2	Scope:	~~SEOL~~ 03-01
Customer Sample:	PA-ATV1-AM-01	Prepped By:	A. FOLGAR	GO area (mm²):	0.013
Sample Description:	ABS	Prepped Date:	7/2/12	Magnification:	10,000X
Pore Size (micron):	0.45	Grid Box :	0312-ERRG-01	Analyzed By:	E. Siauka
EFA (mm²):	385	Grid Location:	M (1-3)	Analysis Date:	7/6/12

Analysis Information

Target Sensitivity:	0.004	s/cc	Minimum Aspect Ratio: (circle one)		
GO Required:	19 ~~18~~ ES 7/10/12		none	**3:1**	5:1
GO Analyzed:	19 ~~18~~ ES 7/10/12				
Level of Analysis Chrysotile:	CD		Min Length:	>5	micron
Level of Analysis Amphibole:	ADX		Min Width:	0.25	micron

Comments:

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
M1	D6	F	0	0	8.46	1.21	NAM	NAM	Al PRESENT Fe Too High		✓
	D8	ND									
	D10										
	F1										
	F3										
	F5										
	F7										
	F9	↓									
	G2	MD11	1		13.09	8.23	NAM	~~NAM~~ ES 7/10/12	Al PRESENT		X SH 7/31/12
		MF		0	13.09	0.94		NAM			✓

ND= None Detected

NAM= Non Asbestos Material

EMSL Analytical, Inc

Particulate Loading: 5-10%
Traverse Direction: Vertical

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID: 041216273-0014

Customer Sample ID: PA-ATV1-AM-01

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
M1	G4	ND									
	G6										
M2	J7										
	J5										
	J3										
	I10										
	I4	F	0	0	5.09	1.07	NAM	NAM	AL PRESENT		✓
	I2	ND									
	G9	ND									
	G7	ND									

ND = None Detected

NAM = Non Asbestos Material

EMSL ANALYTICAL, INC.

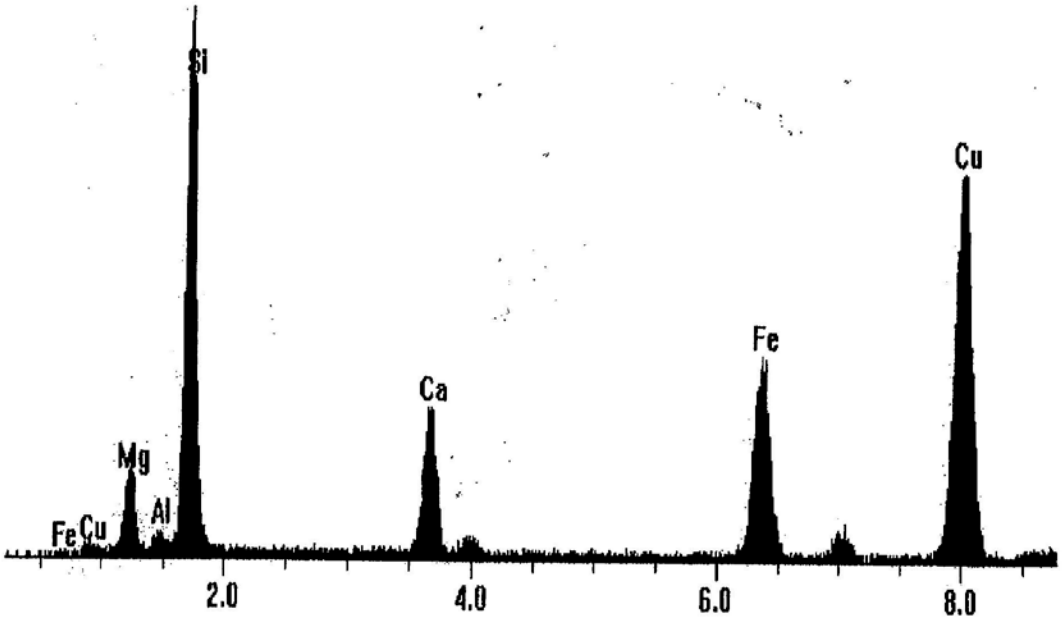
Energy Dispersive X-Ray Analysis
Quantitative Spectra & Data

File: 041216273 PA-ATV1-AM-01 M1 D6 NAM
Collected: July 06, 2012 17:19:28

Live Time:	121.15	Count Rate:	899	Dead Time:	18.69 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00

Sample_861_S001.pgt

FS: 1200



EMSL ANALYTICAL, INC.

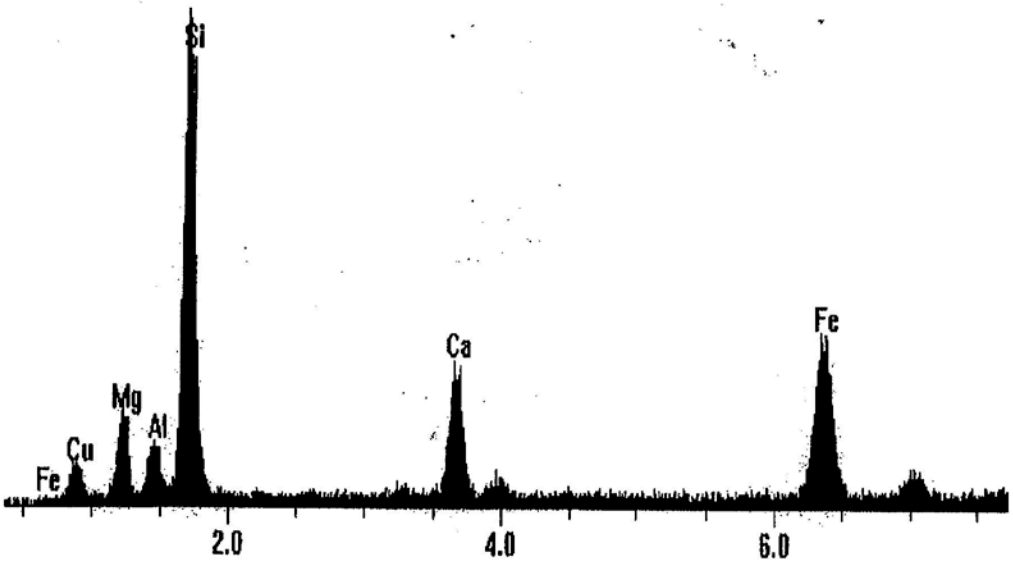
Energy Dispersive X-Ray Analysis
Quantitative Spectra & Data

File: 041216273 PA-ATV1-AM-01 M1 G2 NAM
Collected: July 06, 2012 17:19:28

Live Time:	109.13	Count Rate:	2215	Dead Time:	39.55 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00

Sample_861_S001.pgt

FS: 1200



EMSL ANALYTICAL, INC.

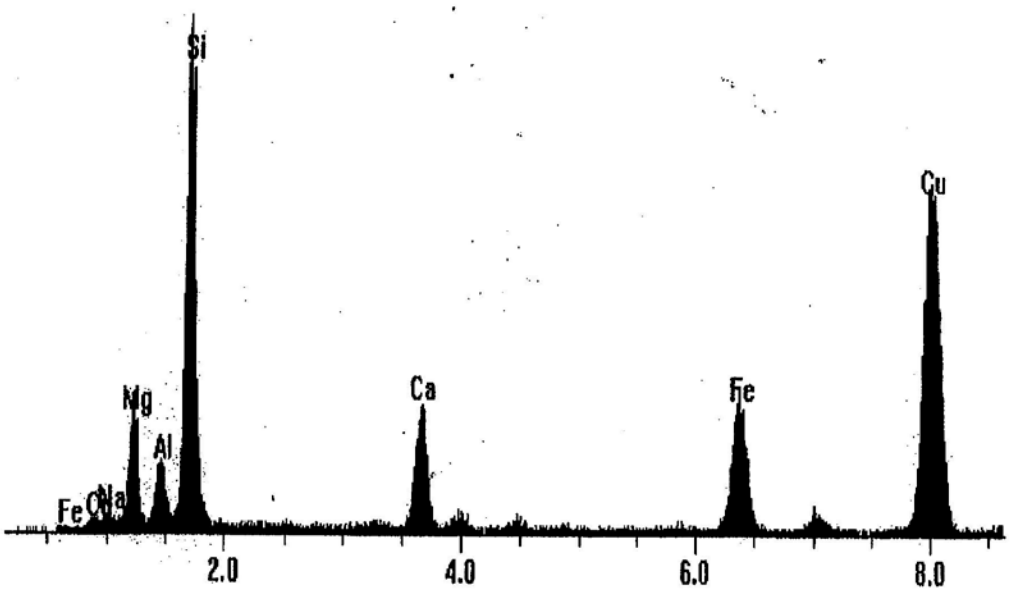
Energy Dispersive X-Ray Analysis
Quantitative Spectra & Data

File: 041216273-PA-ATV1-AM-01-M2-I4-NAM
Collected: July 06, 2012 18:26:29

Live Time:	255.75	Count Rate:	409	Dead Time:	9.80 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00

Sample_862_S001.pgt

FS: 1200



TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID:	041216273-0015	Volume (L):	403.2	Scope:	03-01
Customer Sample:	PA-ATV1-AM-02	Prepped By:	A. FOLGAR	GO area (mm²):	0.013
Sample Description:	ABS	Prepped Date:	7/2/12	Magnification:	10,000X
Pore Size (micron):	0.45	Grid Box :	0312-ERRG-01	Analyzed By:	Evie Sioukri
EFA (mm²):	385	Grid Location:	N (1-3)	Analysis Date:	7/6/12

Analysis Information

Target Sensitivity:	0.004	s/cc	Minimum Aspect Ratio: (circle one)		
GO Required:	20 ~~19~~ ES 7/10/12		none	**3:1**	5:1
GO Analyzed:	20 ~~19~~ ES 7/10/12				
Level of Analysis Chrysotile:	CD		Min Length:	>5	micron
Level of Analysis Amphibole:	ADX		Min Width:	0.25	micron

Comments:

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
N1	J4	ND									
	J2	F	0	0	5.8	1.4	NAM	NAM	Al PRESENT Fe Too High		✓
	B5	ND									
	B3										
	A2										
N2	C2										
	C4										
	C6										
	C8										
	C10	↓									

ND= None Detected

NAM= Non Asbestos Material

EMSL Analytical, Inc

Particulate Materials: 3-5%
Traverse direction: Vertical

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID: 041216273-0015

Customer Sample ID: PA-ATV1-AM-02

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
N2	H9	ND									
	J7										
	J10										
N3	A4										
	A6										
	A8										
	A10										
	G8										
	G10										
	I10										

ND = None Detected

NAM = Non Asbestos Material

EMSL ANALYTICAL, INC.

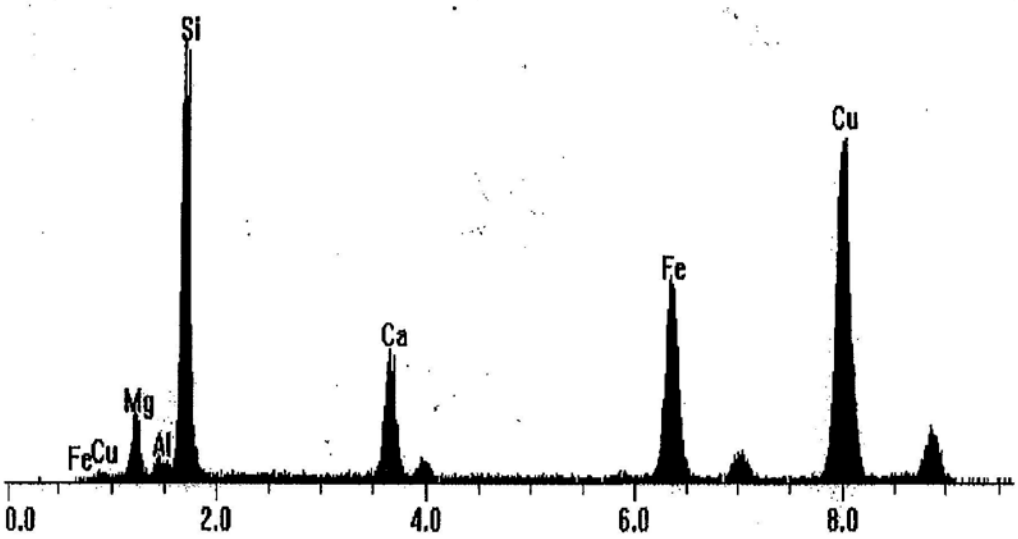
Energy Dispersive X-Ray Analysis
Quantitative Spectra & Data

File: 041216273 PA-ATV1-AM-02 N1 J2 NAM
Collected: July 06, 2012 19:12:05

Live Time:	89.03	Count Rate:	1314	Dead Time:	25.63 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00

Sample_863_S001.pgt

FS: 1400



TEM ISO 13794
Asbestos Count Sheet

EMSL Sample ID:	041216273-0016	Volume (L):	396.36	Scope:	JEOL 1200 EX (04-03)
Customer Sample:	PA-ATV1-AM-03	Prepped By:	D. Stanhope	GO area (mm²):	0.0132
Sample Description:	ABS	Prepped Date:	7/11/12	Magnification:	20kx
Pore Size (micron):	0.45	Grid Box :	Special Projects	Analyzed By:	R. Harrison
EFA (mm²):	~~385~~ 364.9 7/23/12 DYM	Grid Location:	C	Analysis Date:	7/20/12

Analysis Information

Target Sensitivity:	0.004	s/cc	Minimum Aspect Ratio: (circle one)			***Comments:***
GO Required:	10		none	**3:1**	5:1	Indirect prep, see indirect prep log for filter information
GO Analyzed:	10					
Level of Analysis Chrysotile:	CD		Min Length:	>5	micron	Filter aliquot used: 5 mL
Level of Analysis Amphibole:	ADX		Min Width:	0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
C5	A8	ND									
↓	B10	↓									
↓	C7	↓									
↓	D5	↓									
↓	I8	↓									
C6	E1	F	0	0	10.5	1.0	NAM	NAM	—	03298	1
↓	D6	ND									
↓	A3	↓									
C7	B8	↓									
↓	D7	↓									

ND= None Detected

NAM= Non Asbestos Material

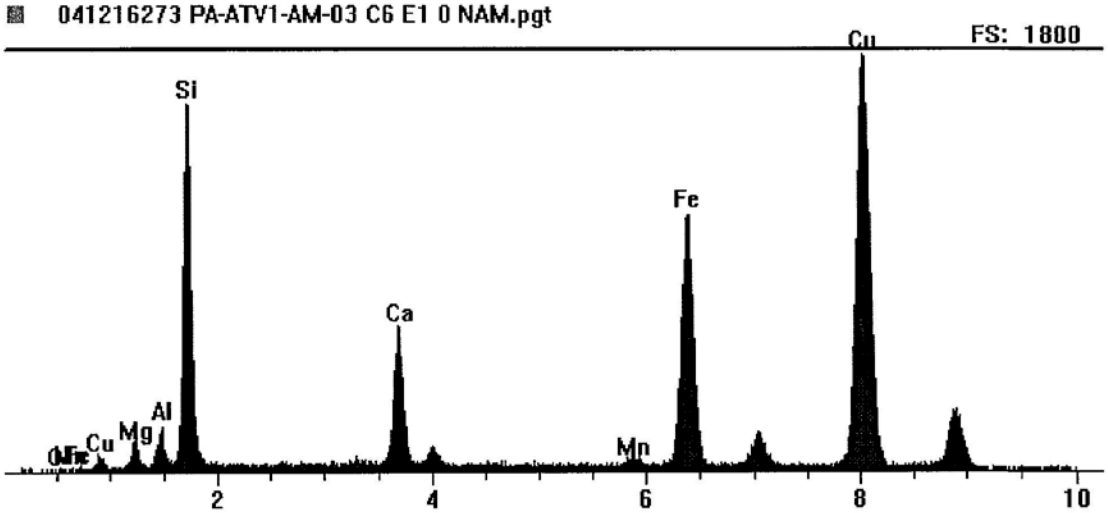
Energy Dispersive X-Ray Analysis
Quantitative Spectra & Data

EMSL ANALYTICAL, INC.

File: L:\EDS Spe...ope 04-03\2012\041216273 PA-ATV1-AM-03 C6 E1 0 NAM.pgt
Collected: July 20, 2012 08:38:41

Live Time:	121.02	Count Rate:	1589	Dead Time:	30.02 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00
Thickness limit:	35899.69				

041216273 PA-ATV1-AM-03 C6 E1 0 NAM.pgt



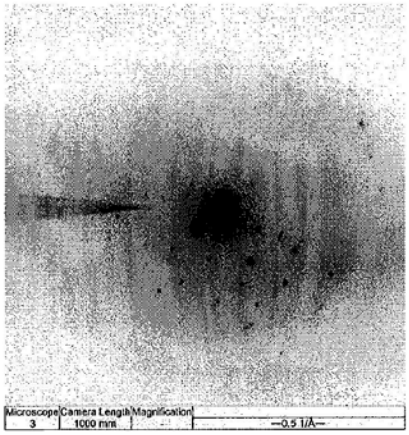
Element	Line	keV	CL Ratio	Wt%	At%	At Prop	Compound	Cmpd Wt%
Mg	KA1	1.254	1.7200	0.65	0.91	1.3	MgO	1.08
Al	KA1	1.487	1.1500	0.69	0.87	1.2	Al2O3	1.31
Si	KA1	1.740	1.0000	6.70	8.12	11.2	SiO	10.52
Ca	KA1	3.691	1.1400	3.58	3.04	4.2	CaO	5.01
Mn	KA1	5.898	0.0000	0.00	0.00	0.0	MnO	0.00
Fe	KA1	6.403	1.5300	11.60	7.07	9.8	Fe2O3	16.59
Cu	KA1	8.046	3.8285	52.32	28.01	38.8	CuO	65.50
O	KA1	0.523	0.0000	24.45	51.99	72.0		
Total			**0.0000**	**100.00**	**100.00**	**138.5**	**Total**	**100.00**

Element	Line	Gross (cps)	BKG (cps)	Net (cps)
Mg	KA1	14.1	3.7	10.4
Al	KA1	21.2	4.5	16.6
Si	KA1	190.0	5.2	184.8
Ca	KA1	93.3	6.7	86.6
Mn	KA1	12.5	6.9	5.6
Fe	KA1	216.9	7.4	209.1
Cu	KA1	383.6	6.7	376.9
O	KA1	1.2	0.9	0.3

AMPHIBOLE SAED INDEXING FORM

EMSL Order Number:	041216273	**Date:**	Jul 20, 2012
Image Number:	03298		
Reference / Sample Number:	0016		
Preliminary ID:	NRA		
Camera Constant:	1.875e-003	**1/A Pixels**	
Calibration Reference:	072012-04-03-03297_C		

	Measured	Reference	-5%	+5%
Inter-row Spacing:	**5.251**	5.300	**5.035**	**5.565**
d2 or hk0 (Camera K/zero row dist.):	**N/A**	N/A	-	-
d1 or hkl (Camera K/slant vector dist.):	**N/A**	N/A	-	-
Ratio of hk0/hkl:	**N/A**	N/A	-	-
Vector Angle:	**N/A**	N/A	-	-



From SAED Reference Book, "unknown" diffraction pattern was found to be that of: **NRA**

With a Zone Axis of: [**N/A**]

Preliminary Identification was:

X	CORRECT
	INCORRECT

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID:	041216273-0017	Volume (L):	381.6	Scope:	03-01
Customer Sample:	PA-ATV1-AM-04	Prepped By:	A. FOLGAR	GO area (mm²):	0.0130
Sample Description:	ABS	Prepped Date:	7-2-12	Magnification:	10,000 X
Pore Size (micron):	0.45	Grid Box :	0312-ERRG-01	Analyzed By:	José Arriaga
EFA (mm²):	385	Grid Location:	O (1-3)	Analysis Date:	7-7-12

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)			***Comments:***
GO Required:	~~20~~ 21 JL 7-9-12	none	**3:1**	5:1	
GO Analyzed:					
Level of Analysis Chrysotile:	CD	Min Length:	>5	micron	
Level of Analysis Amphibole:	ADX	Min Width:	0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
01	Sample Overloaded.										

ND= None Detected NAM= Non Asbestos Material

EMSL Analytical, Inc

Traverse Direction : Vertical
Particulate Loading : 50-60 %

TEM ISO 13794
Asbestos Count Sheet

EMSL Sample ID:	041216273-0017	Volume (L):	381.6	Scope:	JEOL 200 Ex (64-03)
Customer Sample:	PA-ATV1-AM-04	Prepped By:	D. Stanhope	GO area (mm²):	0.0132
Sample Description:	ABS	Prepped Date:	7/11/12	Magnification:	20kx
Pore Size (micron):	0.45	Grid Box :	Special Prep	Analyzed By:	P. Harrison
EFA (mm²):	~~385~~ 364.9 7/23/12 DM	Grid Location:	D	Analysis Date:	7/20/12

Analysis Information

Target Sensitivity:	0.004	s/cc	Minimum Aspect Ratio: (circle one)		
GO Required:	10		none	**3:1**	5:1
GO Analyzed:	10				
Level of Analysis Chrysotile:	CD		Min Length:	>5	micron
Level of Analysis Amphibole:	ADX		Min Width:	0.25	micron

Comments:
Indirect prep, please see prep log for filter information

Filter aliquot used: 5 mL

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
D5	A7	ND									
	B9	↓									
	D10	B	1	1	5.2	0.5	CD	CH		03299	1
	F8	ND									
↓	H6										
D6	A8										
	B5										
	C9										
	F8										
↓	J5	↓									

ND= None Detected

NAM= Non Asbestos Material

Energy Dispersive X-Ray Analysis
Quantitative Spectra & Data

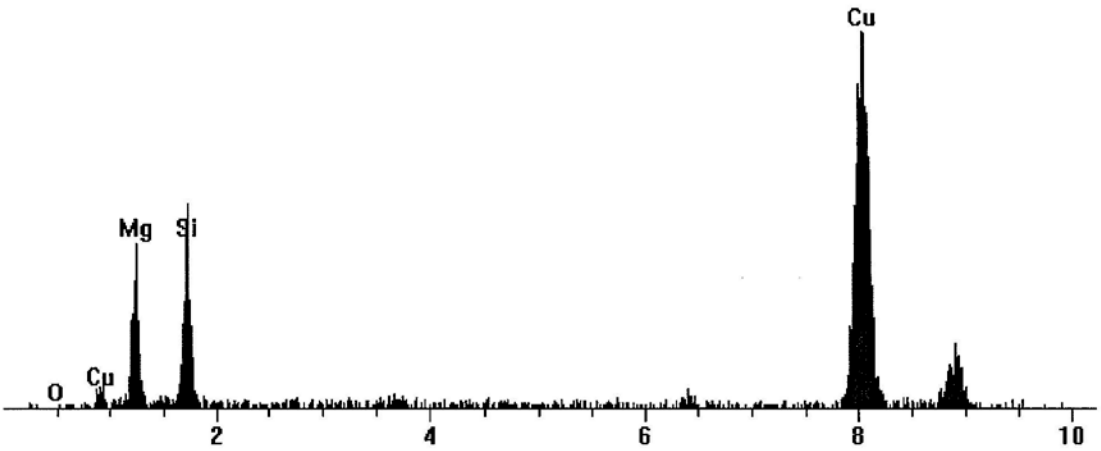
EMSL ANALYTICAL, INC.

File: L:\EDS Spe...ope 04-03\2012\041216273 PA-ATV1-AM-04 D5 D10 1 CH.pgt
Collected: July 20, 2012 08:38:41

Live Time:	108.96	Count Rate:	147	Dead Time:	3.20 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00
Thickness limit:	54071.46				

041216273 PA-ATV1-AM-04 D5 D10 1 CH.pgt

FS: 275



Element	Line	keV	CL Ratio	Wt%	At%	At Prop	Compound	Cmpd Wt%
Mg	KA1	1.254	1.7200	35.17	30.23	43.5	MgO	58.30
Si	KA1	1.740	1.0000	26.56	19.77	28.5	SiO	41.70
Cu	KA1	8.046	0.0000	0.00	0.00	0.0		
O	KA1	0.523	0.0000	38.27	50.00	72.0		
Total			**0.0000**	**100.00**	**100.00**	**144.0**	**Total**	**100.00**

Element	Line	Gross (cps)	BKG (cps)	Net (cps)
Mg	KA1	11.3	0.5	10.8
Si	KA1	14.6	0.5	14.1
Cu	KA1	56.1	1.0	55.2
O	KA1	0.3	0.3	0.1

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID:	041216273-0018	Volume (L):	374.94	Scope:	03-01
Customer Sample:	PA-MA-AA-01	Prepped By:	A. FOLGAR	GO area (mm²):	0.0130
Sample Description:	Ambient	Prepped Date:	7-2-12	Magnification:	10,000 x
Pore Size (micron):	0.45	Grid Box :	0312-ERRG-01	Analyzed By:	José Arriaga
EFA (mm²):	385	Grid Location:	P (1-3)	Analysis Date:	7-7-12

Analysis Information

Target Sensitivity:	0.002 s/cc	Minimum Aspect Ratio: (circle one)			***Comments:***
GO Required:	~~38~~ 40 Ja 7-9-12	none	**3:1**	5:1	
GO Analyzed:	~~39~~ 40				
Level of Analysis Chrysotile:	CD	Min Length:	>5	micron	
Level of Analysis Amphibole:	ADX	Min Width:	0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	Total	Length	Width					
P1	B2	ND									
	B4	↓									
	B6										
	B8										
	B10										
	D2										
	D4										
	D6										
	D8										
	D10										

ND= None Detected NAM= Non Asbestos Material

Traverse Direction: Vertical

Particulate Loading: 1-5%

Ja 7-9-12

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID: 041216273-0018

Customer Sample ID: PA-MA-AA-01

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
P1	F2	ND									
	F4										
	F6										
	F8										
	F10										
	H2										
	H4										
	H6										
	H8										
	H10										
P2	C2										
	C4										
	C6										
	C8										

ND = None Detected

NAM = Non Asbestos Material

Ja 7-9-12

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID: 041216273-0018

Customer Sample ID: PA-MA-AA-01

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
P2	C10	ND									
	E2										
	E4										
	E6										
	E8										
	E10										
	G2										
	G4										
	G6										
	G8										
	G10										
	I2										
	I4										
	I6										
	I8	F	Ø	Ø	58.8	3.75	NAM	NAM	Al Present		✓

ND = None Detected

NAM = Non Asbestos Material

ga 7-9-12

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID: 041216273-0018

Customer Sample ID: PA-MA-AA-01

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
P2	I10	ND									

ND = None Detected

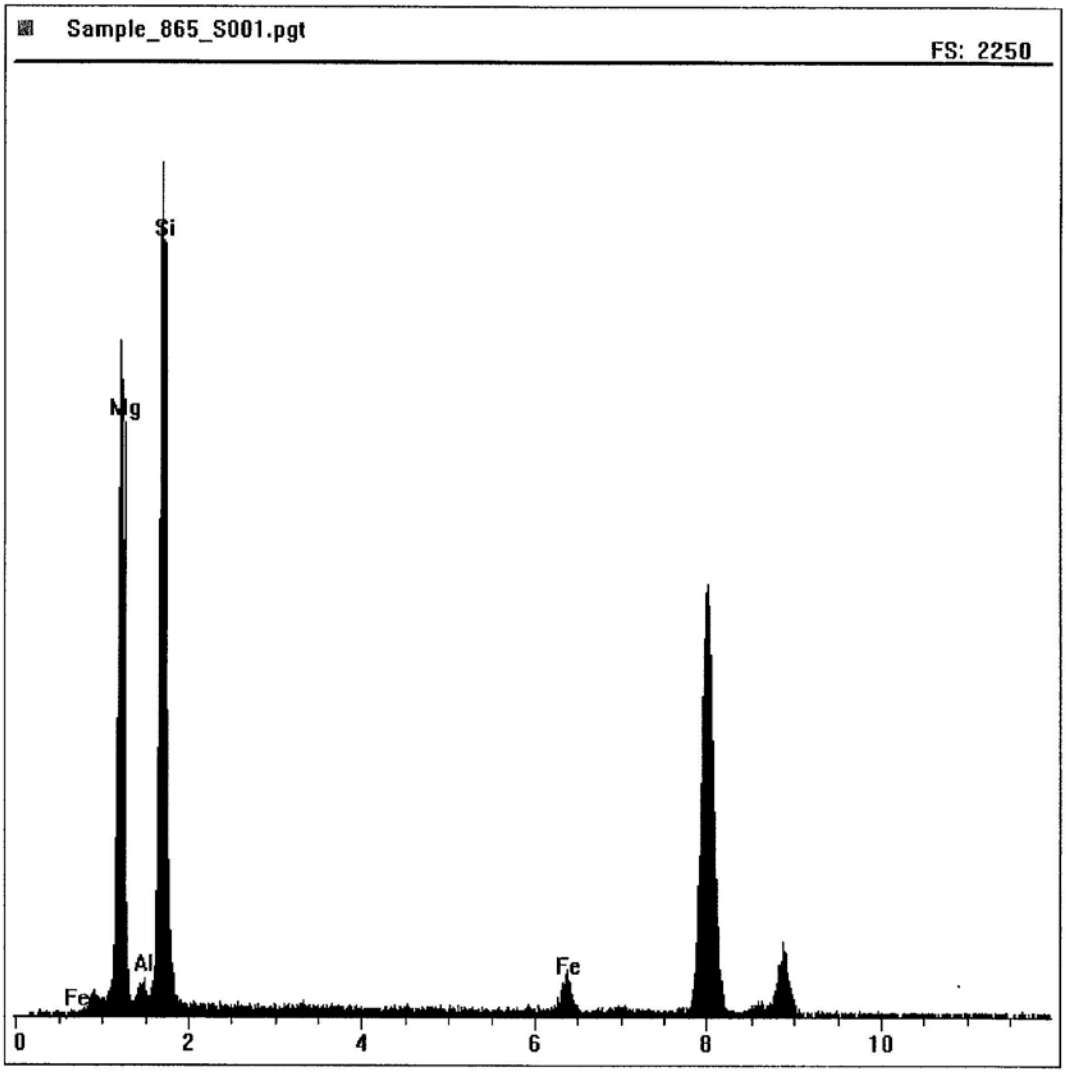
NAM = Non Asbestos Material

Energy Dispersive X-Ray Analysis
Qualitative Spectrum

EMSL ANALYTICAL, INC.

File: 041216273 PA-MA-AA-01 P2 I8 NAM
Collected: July 07, 2012 10:46:14

Live Time:	163.58	Count Rate:	947	Dead Time:	18.83 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00



TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID:	041216273-0019	Volume (L):	375.84	Scope:	03-01
Customer Sample:	PA-MA-AA-02	Prepped By:	AF	GO area (mm²):	0.013
Sample Description:	Ambient	Prepped Date:	7/2/12	Magnification:	10,000
Pore Size (micron):	0.45	Grid Box :	0312EPRG-01	Analyzed By:	G. Lannozzi
EFA (mm²):	385	Grid Location:	Q(1,2,3)	Analysis Date:	7/9/12

Analysis Information

Target Sensitivity:	0.002 s/cc	Minimum Aspect Ratio: (circle one)			**Comments:** ~~Significant Amount of non-countable Asbestos Obse~~ DL 7/9
GO Required:	~~39~~ 40	none	**3:1**	5:1	
GO Analyzed:	~~39~~ 40				
Level of Analysis Chrysotile:	CD	Min Length:	>5	micron	
Level of Analysis Amphibole:	ADX	Min Width:	0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
Q1	B2	ND									
	B4	↓									
	B6										
	B8										
	B10										
	D1										
	D3										
	D5										
	D7										
	D9										

ND= None Detected NAM= Non Asbestos Material

EMSL Analytical, Inc

Particle loading 1-2%
Transverse Direction Vertical

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID: 041216273-0019

Customer Sample ID: PA-MA-AA-02

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
	H2	ND									
	H4										
	H6										
Q2	H9										
	H7										
	H5										
	F10										
	F8										
	D10										
	D5										
	D3										
	C6										
	C4										
	A8										
	A6										

ND = None Detected

NAM = Non Asbestos Material

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID: 041216273-0019

Customer Sample ID: PA-MA-AA-02

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
	A4	ND									
Q3	A3										
	A5										
	A7										
	A9										
	B6										
	B8										
	C3										
	C5										
	C7										
	E9										
	G1										
	I1										
	I3										
	I5	ND									

ND = None Detected

NAM = Non Asbestos Material

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID:	041216273-0020	Volume (L):	430.2	Scope:	03-01
Customer Sample:	PA-MA-AM-01	Prepped By:	AF	GO area (mm²):	0.013
Sample Description:	ABS	Prepped Date:	7/2/12	Magnification:	10,000
Pore Size (micron):	0.45	Grid Box :	0312ERRG-1	Analyzed By:	G. Lannozzi
EFA (mm²):	385	Grid Location:	R1-3	Analysis Date:	7/9/12

Analysis Information

Target Sensitivity:	0.004	s/cc	Minimum Aspect Ratio: (circle one)		
GO Required:	~~18~~ 19		none	**3:1**	5:1
GO Analyzed:	19				
Level of Analysis Chrysotile:	CD		Min Length:	>5	micron
Level of Analysis Amphibole:	ADX		Min Width:	0.25	micron

Comments:
Significant amount of non-Countable Asbestos Observed. $x^2 = 34.750$ = Random

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
R1	J9	ND									
	J7	ND									
	J5	ND									
	C10	F	1	1	~~4.86~~ 9.72	~~2.19~~ 7.19	CD	CH		63123 63124,25	YES
		MD11	2		20.34	24.30	CD	CH			
		MF		2	20.34	0.25	CD	CH		63126 63127	YES
	C8	ND									
	C6	ND									
	C4	ND									
R2	D2	MD11	3		12.15	8.50	CD	CH		63128 63129	~~YES~~

ND= None Detected NAM= Non Asbestos Material

AR 7/10

EMSL Analytical, Inc

Particle loading 3-5%
Transverse Direction: Vertical

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID: 041216273-0020

Customer Sample ID: PA-MA-AM-01

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	Total	Length	Width					
		MF		3	12.15	0.25	CD	CH			YES
	D4	MD11	4		34.02	19.44	CD	CH			
		MB		4	34.02	0.47	CD	CH		63130 63131	YES
		MD11	5		60.75	10.93	CD	CH			
		MB		5	60.75	0.70	CD	CH			
		F	6	6	10.21	0.50	CD	CH			
	G3	ND									
	G5	ND									
	G7	F	7	7	68.04	0.52	CD	CH			
		MD11	8		10.94	5.83	CD	CH			
		MB		8	10.94	0.30	CD	CH			
	I3	ND									
B3	D3	ND									
	D5	ND									
	F3	ND									

ND = None Detected

NAM = Non Asbestos Material

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID: 041216273-0020

Customer Sample ID: PA-MA-AM-01

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
	F5	ND									
	F7	ND									
	I4	ND									

ND = None Detected

NAM = Non Asbestos Material

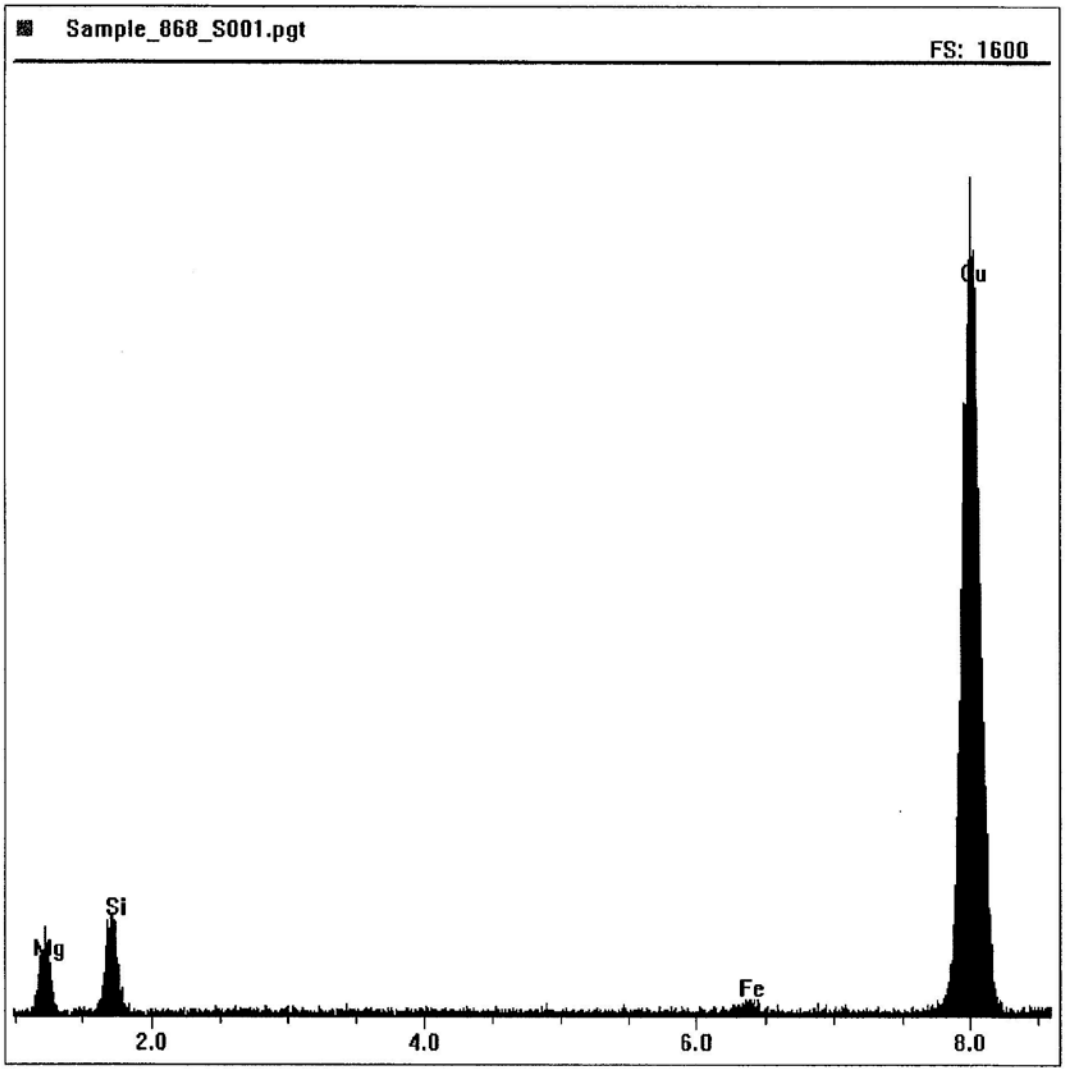
EMSL Analytical, Inc

Energy Dispersive X-Ray Analysis
Qualitative Spectrum

EMSL ANALYTICAL, INC.

File: 041216273 PA-MA-AM-01 R1 C10 1 Chrysotile
Collected: July 09, 2012 10:26:18

Live Time:	19.65	Count Rate:	3980	Dead Time:	61.14 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00



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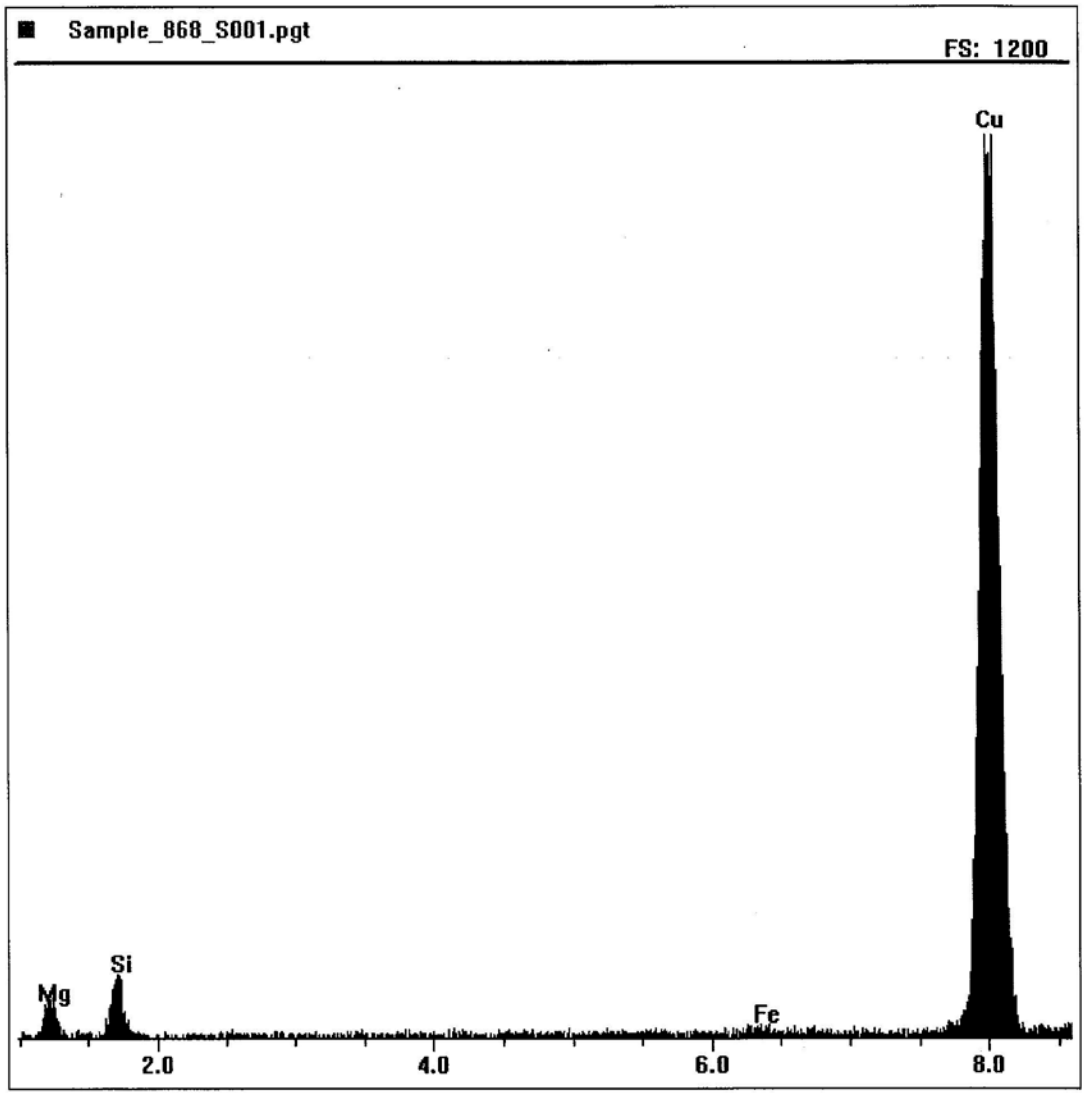
Energy Dispersive X-Ray Analysis
Qualitative Spectrum

EMSL ANALYTICAL, INC.

File: 041216273 PA-MA-AM-01 R1 C10 2 Chrysotile
Collected: July 09, 2012 10:26:18

Live Time:	89.03	Count Rate:	672	Dead Time:	15.38 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00

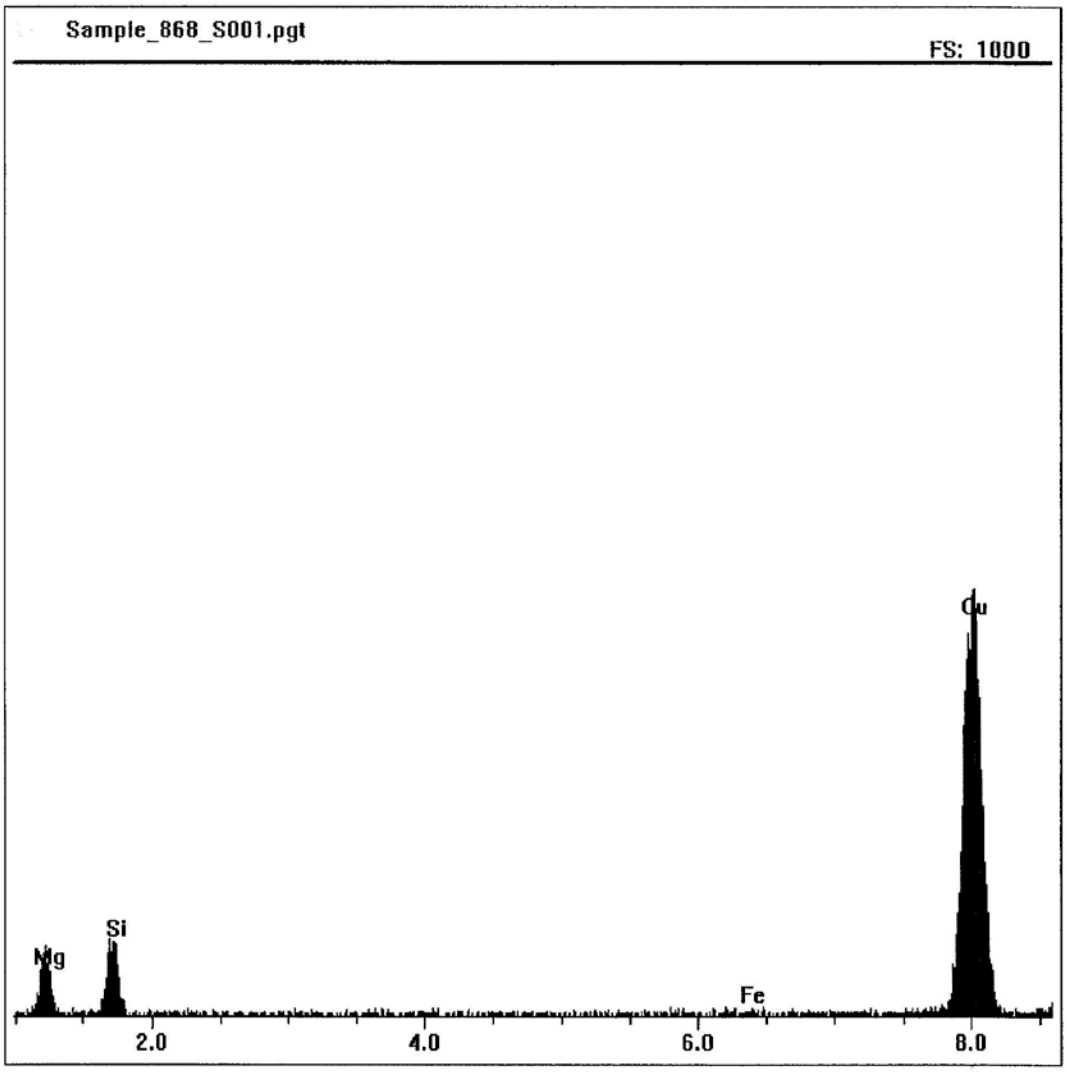


Energy Dispersive X-Ray Analysis
Qualitative Spectrum

EMSL ANALYTICAL, INC.

File: 041216273 PA-MA-AM-01 R2 D2 3 Chrysotile
Collected: July 09, 2012 10:26:18

Live Time:	118.57	Count Rate:	232	Dead Time:	6.87 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00



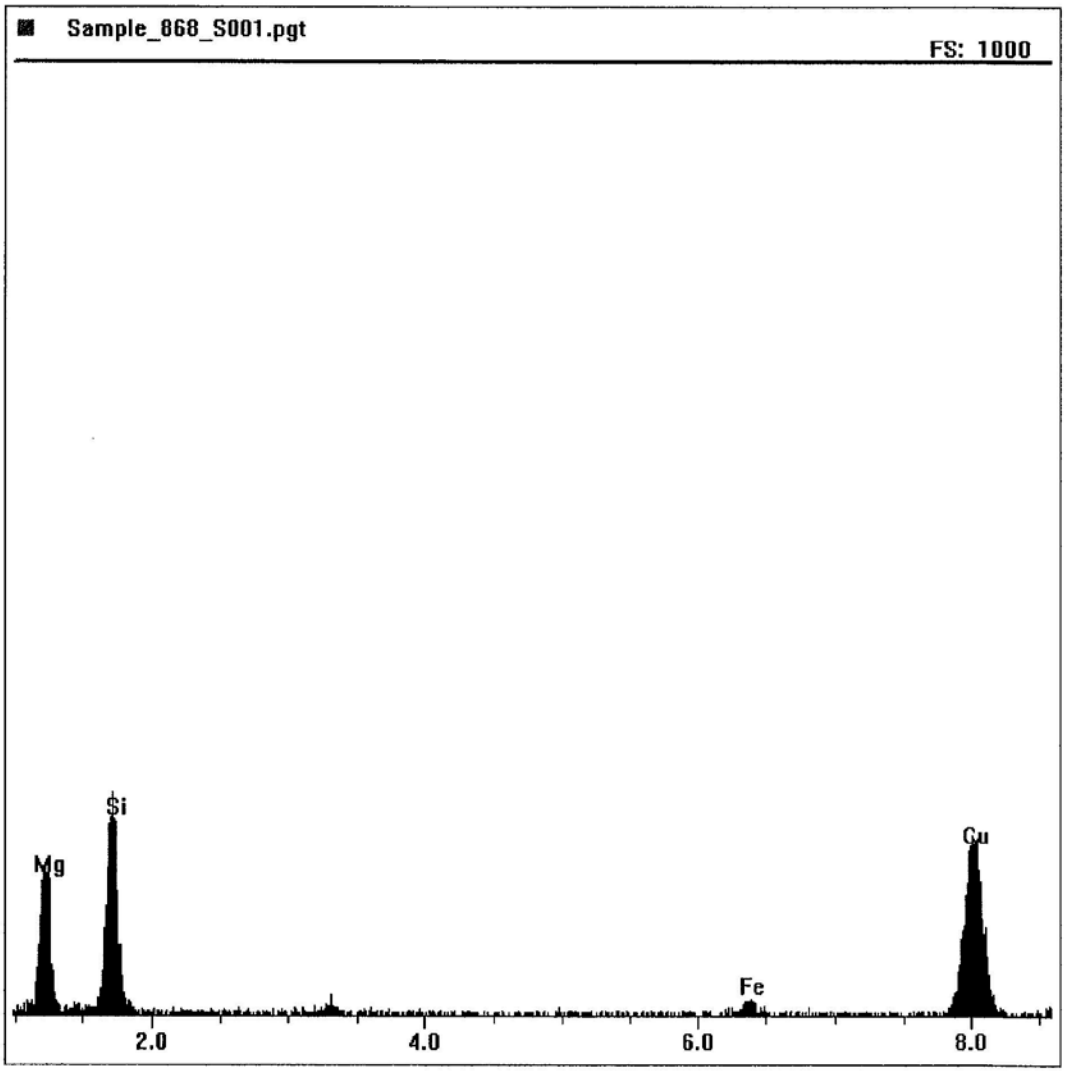
Energy Dispersive X-Ray Analysis
Qualitative Spectrum

EMSL ANALYTICAL, INC.

File: 041216273 PA-MA-AM-01 R2 D4 4 Chrysotile

Collected: July 09, 2012 10:26:18

Live Time:	75.61	Count Rate:	288	Dead Time:	7.62 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00



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CHRYSOTILE SAED INDEXING FORM

EMSL Order ID : 041216273 DATE: 07/10/12

Indexing of negative number: 63129 SCOPE #: 03-01

Reference / Sample Number: PA-MA-AM-01

Preliminary ID: Chrysotile By: GI

Using Camera Constant of: 21.89 mm Angstroms

Determined from negative number: 63094

Quick Check

Measured Inter-row spacing: 4.075 mm

110 reflections present? Enter Yes or No Yes

200 doublets present? Enter Yes or No Yes

Full Index

Measured distance, center spot to closest hk0 spot (002):	3.00	mm
Measured distance, center spot to closest hk1 spot (110):	4.85	mm

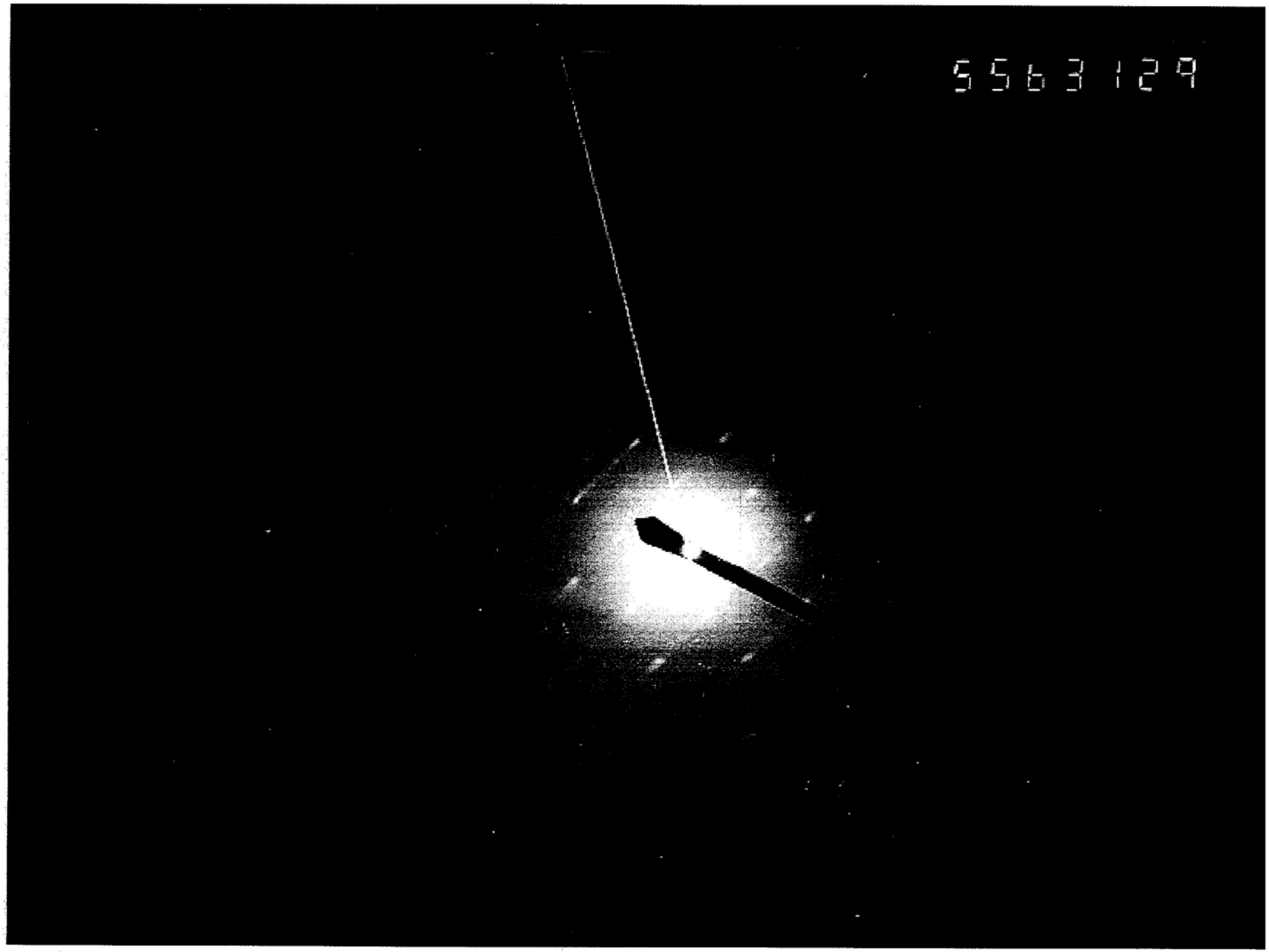
	Calculated	Ref	- 5%	+ 5%
Inter-row spacing (Ångstroms)	**5.37**	**5.30**	**5.035**	**5.565**
Angle to 110 reflection (Measured °)	59.5	**60.0**	**57.0**	**63.0**
d2 or d hk 0 (002) (Angstroms)	**7.30**	**7.32**	**6.954**	**7.686**
d1 or d hk 1 (110) (Angstroms)	**4.51**	**4.58**	**4.351**	**4.809**

From SAED Reference Book, "unknown" diffraction pattern was found to be that of: Chrysotile By: DY

Preliminary Identification was: [X] CORRECT

[ ] INCORRECT

percent accuracy to date: 100


5563129

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID:	041216273-0021	Volume (L):	458.82	Scope:	03-01
Customer Sample:	PA-MA-AM-02	Prepped By:	AF	GO area (mm²):	0.013
Sample Description:	ABS	Prepped Date:	7/2/12	Magnification:	10,000
Pore Size (micron):	0.45	Grid Box :	0312-ERR601	Analyzed By:	G. Lanuzza
EFA (mm²):	385	Grid Location:	S1-3	Analysis Date:	7/2/12

Analysis Information

Target Sensitivity:	0.004	s/cc	Minimum Aspect Ratio: (circle one)		
GO Required:	~~17~~ 18		none	**3:1**	5:1
GO Analyzed:	18				
Level of Analysis Chrysotile:	CD		Min Length:	>5	micron
Level of Analysis Amphibole:	ADX		Min Width:	0.25	micron

Comments:
Significant Amount of non-countable Asbestos Observed. $x^2 = 13.545$ = Random

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
S1	A9	F	1	1	8.50	0.52	CD	CH		63132 63133	YES
	A7	F	2	2	12.88	1.17	CD	CH			
		MD11	3		24.30	21.87	CD	CH			
		MF		3	19.48	0.45	CD	CH		63134	
	A5	ND									
	A3	ND									
S2	B3	ND									
	B5	F	4	4	12.40	2.11	CD	CH			
	B8	MD11	5	5	~~37.44~~ 14.04	~~16.38~~ 14.04	CD	CH			
		MF		5	37.44	2.50	CD	CH			

ND= None Detected

NAM= Non Asbestos Material

EMSL Analytical, Inc

Particulate loading 3-5%
Transverse Direction. Vertical

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID: 041216273-0021

Customer Sample ID: PA-MA-AM-02

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
	D2	F	6	6	12.63	0.95	CD	CH			
	D6	ND									
	D8	ND									
	F6	B	7	7	11.67	0.57	CD	CH			
		MD11	8		29.16	21.87	CD	CH			
		MB		8	29.16	0.50	CD	CH			
	F8	ND									
S3	C4	ND									
	C6	MD11	9		10.17	10.93	CD	CH			
		MB		9	8.01	0.68	CD	CH			
	C8	MD11	10		9.45	8.65	CD	CH			
		MB		10	8.74	0.95	CD	CH			
	H3	MD11	11		12.87	5.35	CD	CH			
		MB		11	12.87	0.52	CD	CH			
	H5	ND									

ND = None Detected

NAM = Non Asbestos Material

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID: 041216273-0021

Customer Sample ID: PA-MA-AM-02

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
	H7	ND									

ND = None Detected

NAM = Non Asbestos Material

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID: 041216273-0021

Customer Sample ID: PA-MA-AM-02

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
	H7	ND									

ND = None Detected

NAM = Non Asbestos Material

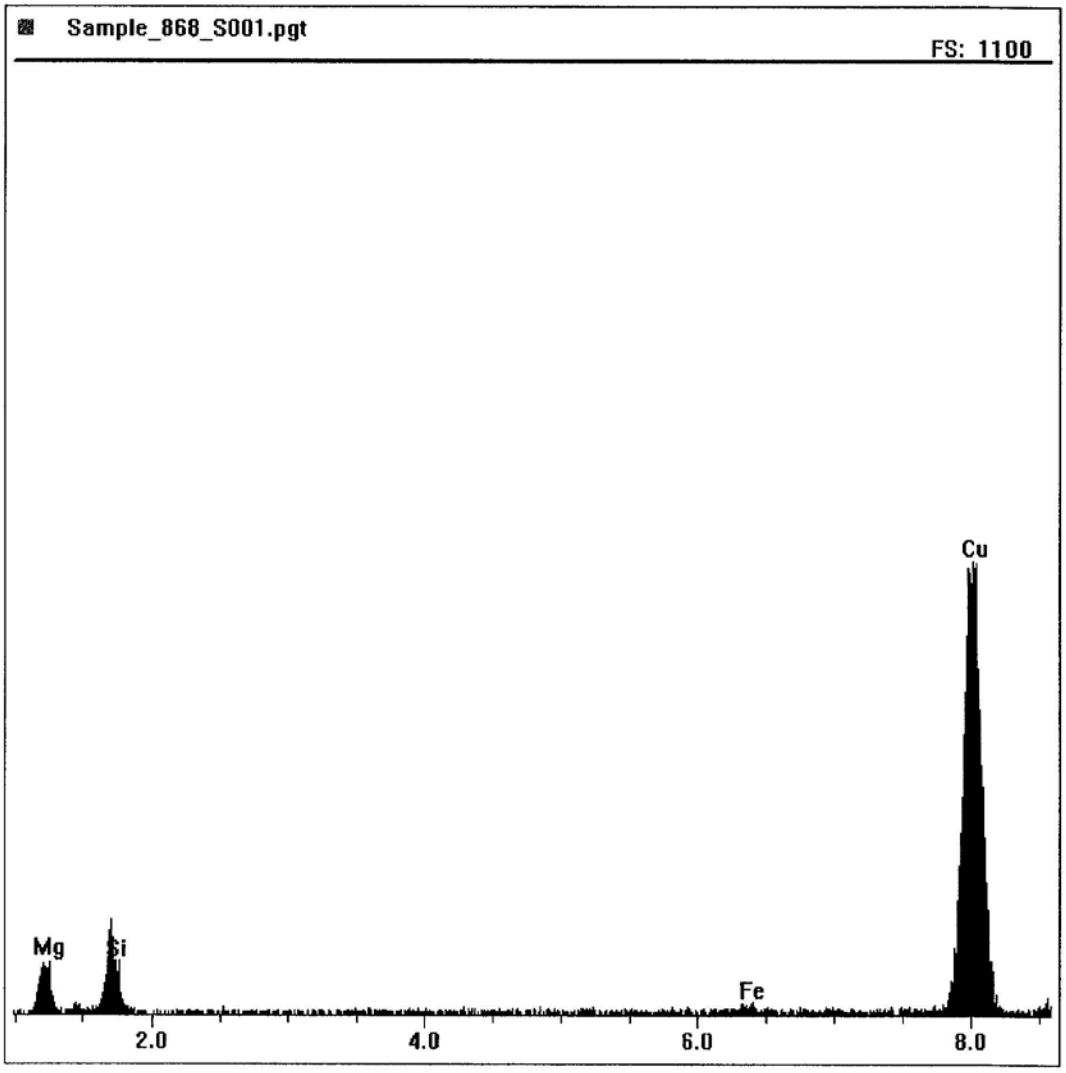
Energy Dispersive X-Ray Analysis
Qualitative Spectrum

EMSL ANALYTICAL, INC.

File: 041216273 PA-MA-AM-02 S1 A9 1 Chrysotile

Collected: July 09, 2012 10:26:18

Live Time:	15.00	Count Rate:	2135	Dead Time:	39.17 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00



EMSL

CHRYSOTILE SAED INDEXING FORM

EMSL Order ID : 041216273 DATE: 07/10/12

Indexing of negative number: 63134 SCOPE #: 03-01

Reference / Sample Number: PA-MA-AM-02

Preliminary ID: Chrysotile By: GI

Using Camera Constant of: 21.89 mm Angstroms

Determined from negative number: 63094

Quick Check

Measured Inter-row spacing: 4.075 mm

110 reflections present? Enter Yes or No Yes

200 doublets present? Enter Yes or No Yes

Full Index

Measured distance, center spot to closest hk0 spot (002):	2.93	mm
Measured distance, center spot to closest hk1 spot (110):	4.85	mm

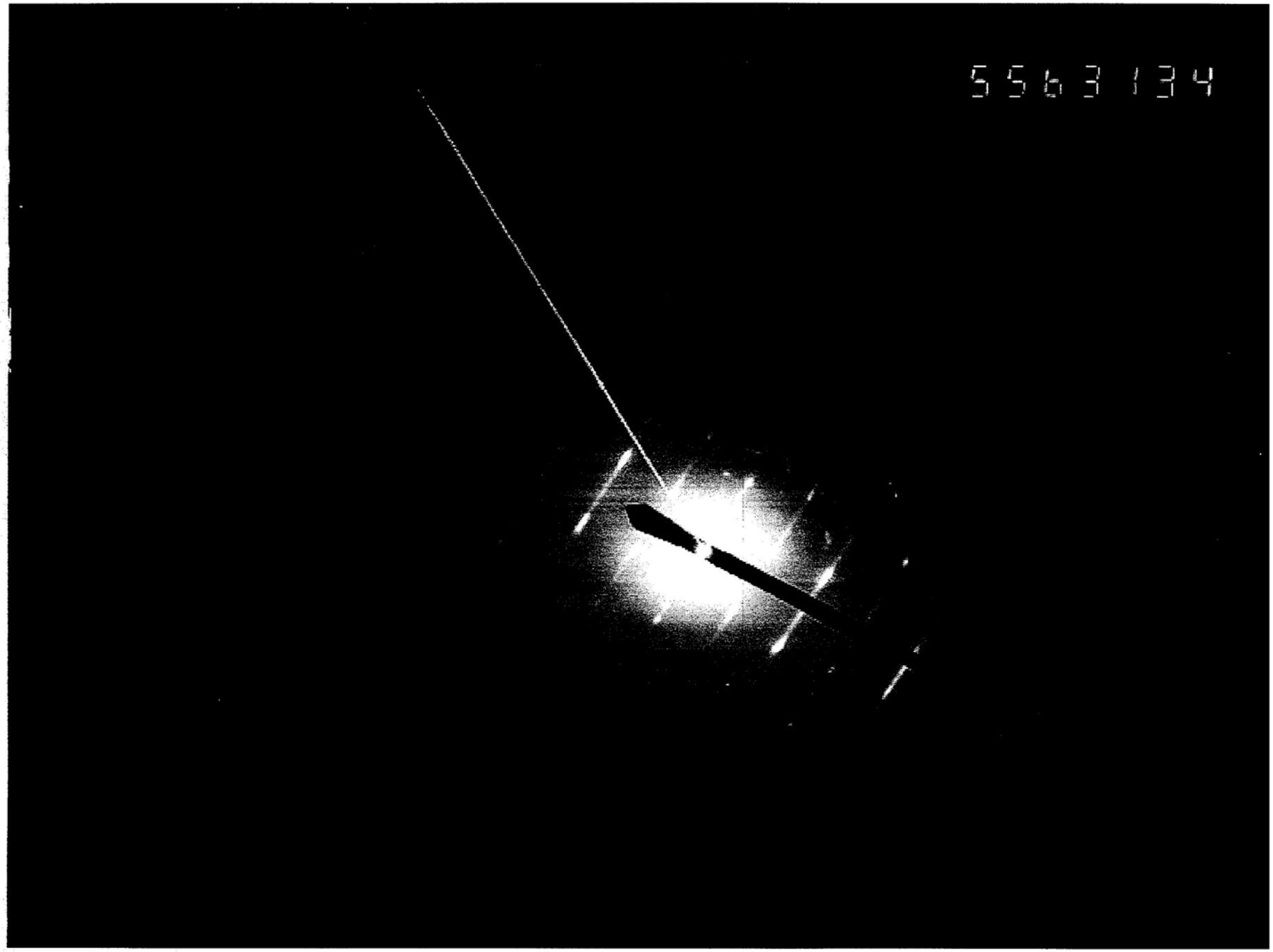
	Calculated	Ref	- 5%	+ 5%
Inter-row spacing (Ångstroms)	**5.37**	**5.30**	**5.035**	**5.565**
Angle to 110 reflection (Measured °)	63	**60.0**	**57.0**	**63.0**
d2 or d hk 0 (002) (Angstroms)	**7.48**	**7.32**	**6.954**	**7.686**
d1 or d hk 1 (110) (Angstroms)	**4.51**	**4.58**	**4.351**	**4.809**

From SAED Reference Book, "unknown" diffraction pattern was found to be that of: Chrysotile By: DY

Preliminary Identification was: [X] CORRECT

[ ] INCORRECT

percent accuracy to date: 100


5563134

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID:	041216273-0022	Volume (L):	396.36	Scope:	03-01
Customer Sample:	PA-MA-AM-03	Prepped By:	A. FOLGAR	GO area (mm²):	0.013
Sample Description:	ABS	Prepped Date:	7/2/12	Magnification:	10,000 X
Pore Size (micron):	0.45	Grid Box :	0312-ERRG-01	Analyzed By:	A. FOLGAR
EFA (mm²):	385	Grid Location:	T(1-3)	Analysis Date:	7/9/2012

Analysis Information

Target Sensitivity:	0.004	s/cc	Minimum Aspect Ratio: (circle one)		
GO Required:	~~19~~ 20		none	**3:1**	5:1
GO Analyzed:	20				
Level of Analysis Chrysotile:	CD		Min Length:	>5	micron
Level of Analysis Amphibole:	ADX		Min Width:	0.25	micron

Comments:
Significant amount of non-countable asbestos observed.

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
T1	C10	ND									
	C8										
	C6										
	C4										
	B9										
	B7										
	B5										
	B1										
	A6										
	A4										

ND= None Detected NAM= Non Asbestos Material

Particulate Loading: 5-10%
Traverse Direction: Vertical

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID: 041216273-0022

Customer Sample ID: PA-MA-AM-03

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
T2	J9	ND									
	J7	ND									
	J5	ND									
	J3	ND									
	J1	ND									
	f10	↓									
	f8										
	f6										
	B8										
	B6										

ND = None Detected

NAM = Non Asbestos Material

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID:	041216273-0023	Volume (L):	381.6	Scope:	03-01
Customer Sample:	PA-MA-AM-04	Prepped By:	A. FOLGAR	GO area (mm²):	0.0130
Sample Description:	ABS	Prepped Date:	7-2-12	Magnification:	10,000 X
Pore Size (micron):	0.45	Grid Box :	0312-ERRG-01	Analyzed By:	José Arriaga
EFA (mm²):	385	Grid Location:	U (1-3)	Analysis Date:	7-9-12

Analysis Information

Target Sensitivity:	0.004	s/cc	Minimum Aspect Ratio: (circle one)		
GO Required:	~~20~~ 21 Ja 7-9-12		none	**3:1**	5:1
GO Analyzed:	21				
Level of Analysis Chrysotile:	CD		Min Length:	>5	micron
Level of Analysis Amphibole:	ADX		Min Width:	0.25	micron

Comments:

$x^2 = 19 =$ Random

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
U1	B2	ND									
	B4	MD11	1		15.8	9.72	NAM	NAM			
		MB		0	15.8	0.28	NAM	NAM	Al Present		✓
	B6	ND									
	B8	ND									
	D2	ND									
	D4	ND									
	D6	MD11	2		34.0	21.9	NAM	NAM	Al Present		
		MF		0	34.0	4.86	NAM	NAM			✓
	D8	B	3	1	8.0	0.30	CD	CH			✓

ND= None Detected

NAM= Non Asbestos Material

EMSL Analytical, Inc

Traverse Direction : Vertical

Particulate Loading : 5-10 %

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID: 041216273-0023

Customer Sample ID: PA-MA-AM-04

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
N1	D10	ND									
	F2	ND									
	F4	ND									
N2	I9	ND									
	I7	ND									
	I5	ND									
	I3	ND									
	I1	ND									
	G9	MD11	4		33.0	7.29	CD	CH			
		MB		2	33.0	1.18	CD	CH		63136	✓
		MD11	5		24.3	6.80	NAM	NAM			
		MB		Ø	24.3	1.13	NAM	NAM	Al Present		✓
	G7	ND									
	G5	ND									

ND = None Detected

NAM = Non Asbestos Material

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID: 041216273-0023

Customer Sample ID: PA-MA-AM-04

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
U2	G3	ND									
	G1	ND									

ND = None Detected

NAM = Non Asbestos Material

Energy Dispersive X-Ray Analysis
Qualitative Spectrum

EMSL ANALYTICAL, INC.

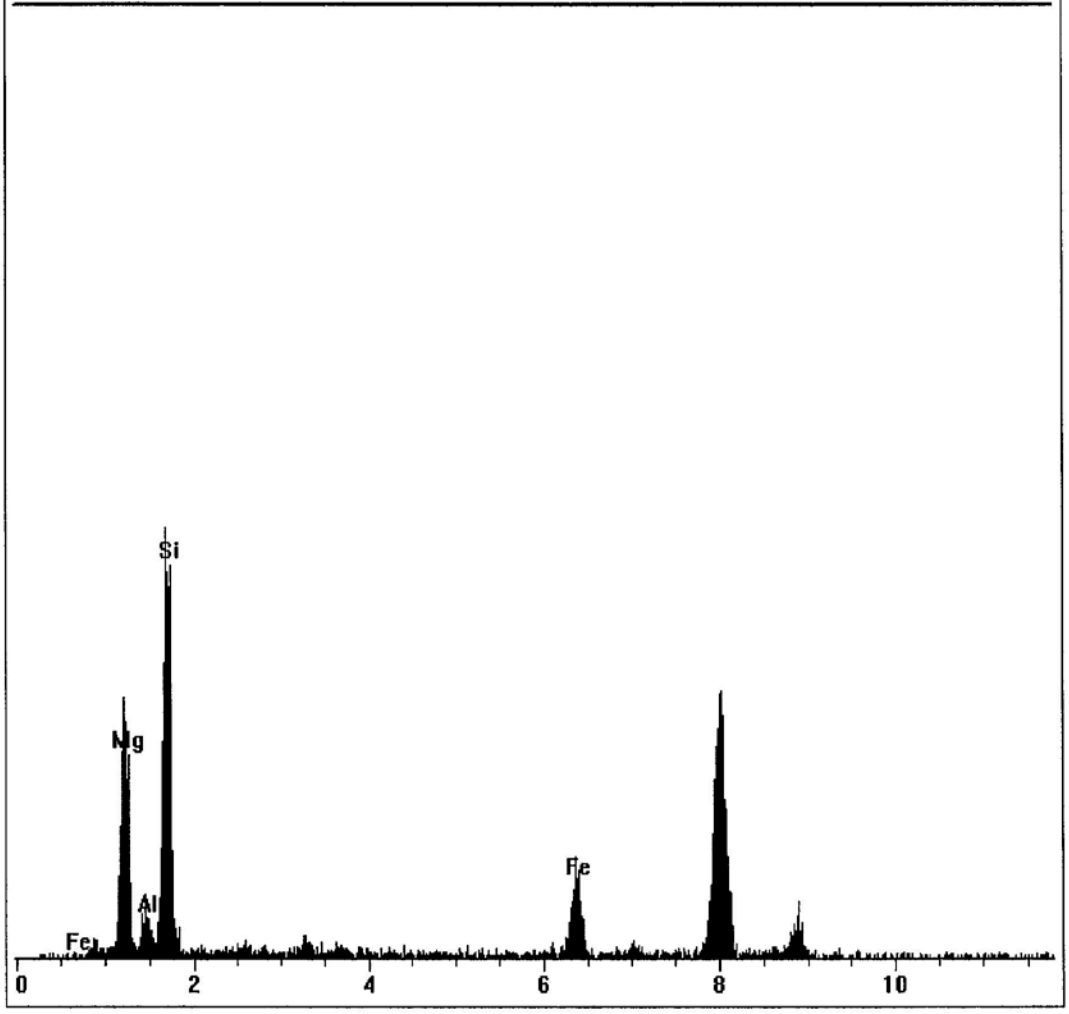
DMM 7/10/12

File: 041216273 PA-MA-AM-04 U1 B4 / NAM
Collected: July 09, 2012 17:02:02

Live Time:	138.46	Count Rate:	155	Dead Time:	5.24 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00

Sample_869_S001.pgt

FS: 540



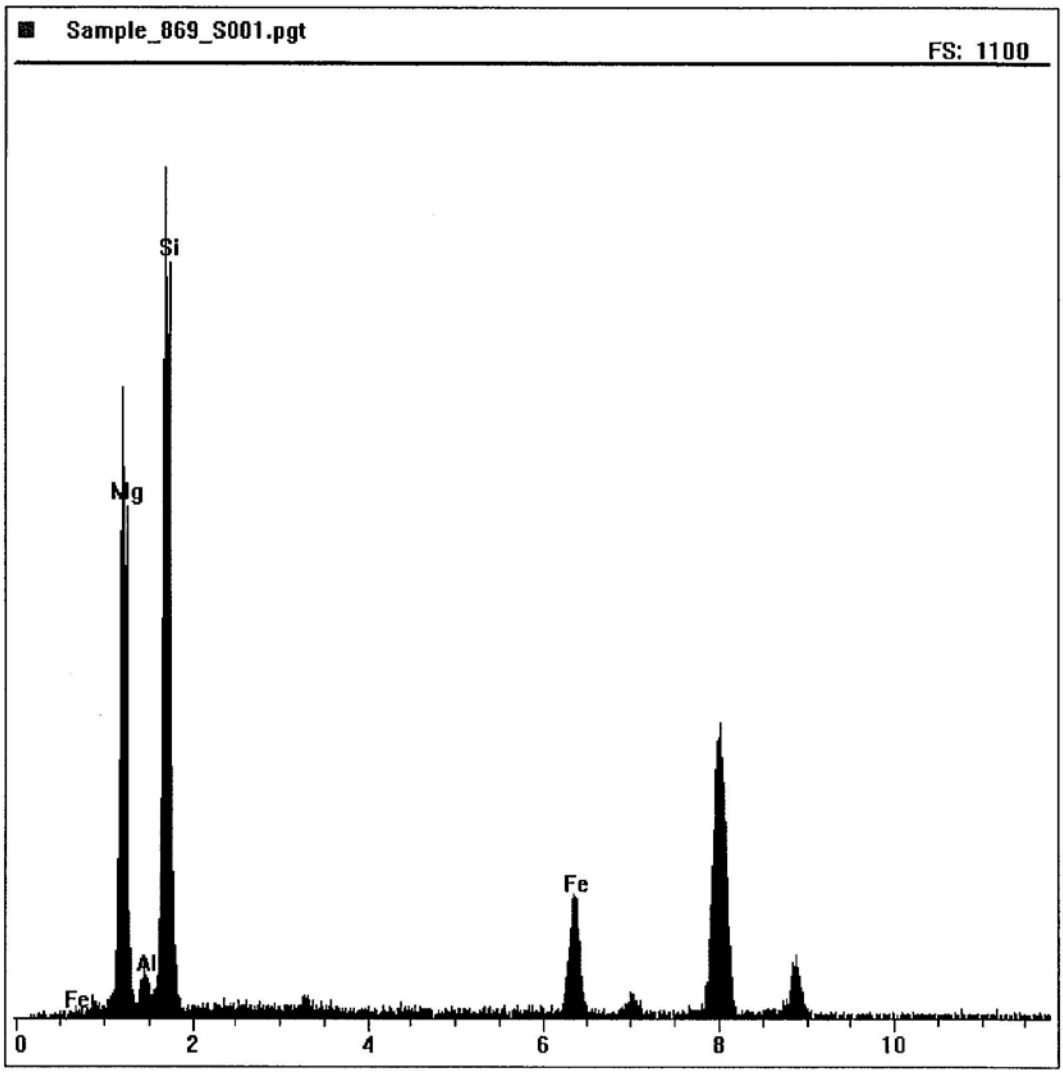
Energy Dispersive X-Ray Analysis
Qualitative Spectrum

EMSL ANALYTICAL, INC.

DM 7/16/12

File: 041216273 PA-MA-AM-04 U1 D6 ~~2~~ NAM
Collected: July 09, 2012 17:02:02

Live Time:	58.81	Count Rate:	1234	Dead Time:	23.62 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00



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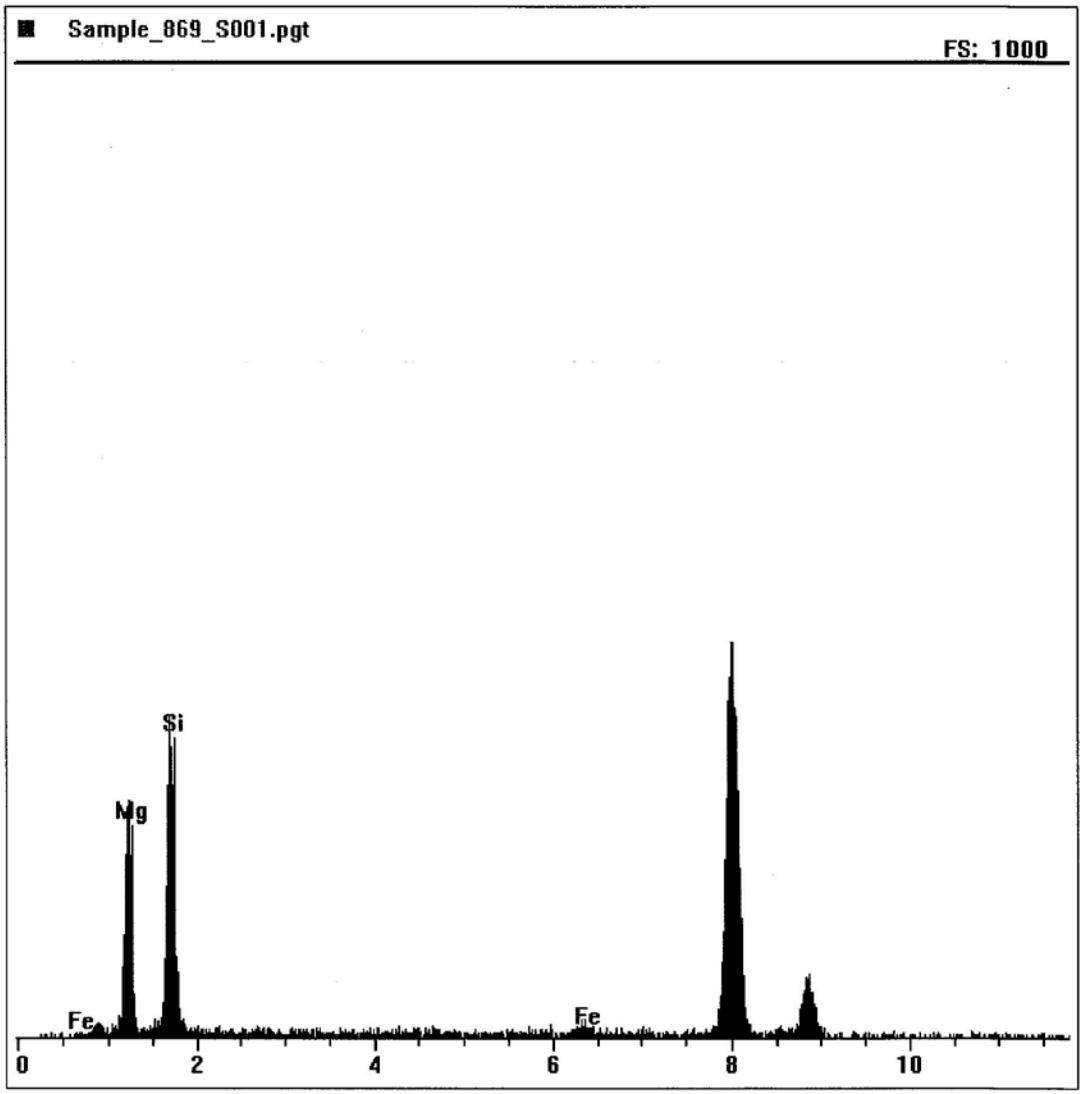
Energy Dispersive X-Ray Analysis
Qualitative Spectrum

EMSL ANALYTICAL, INC.

File: 041216273 PA-MA-AM-04 U1 D8 1 CHRYSOTILE
Collected: July 09, 2012 17:02:02

Live Time:	390.49	Count Rate:	100	Dead Time:	4.23 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00



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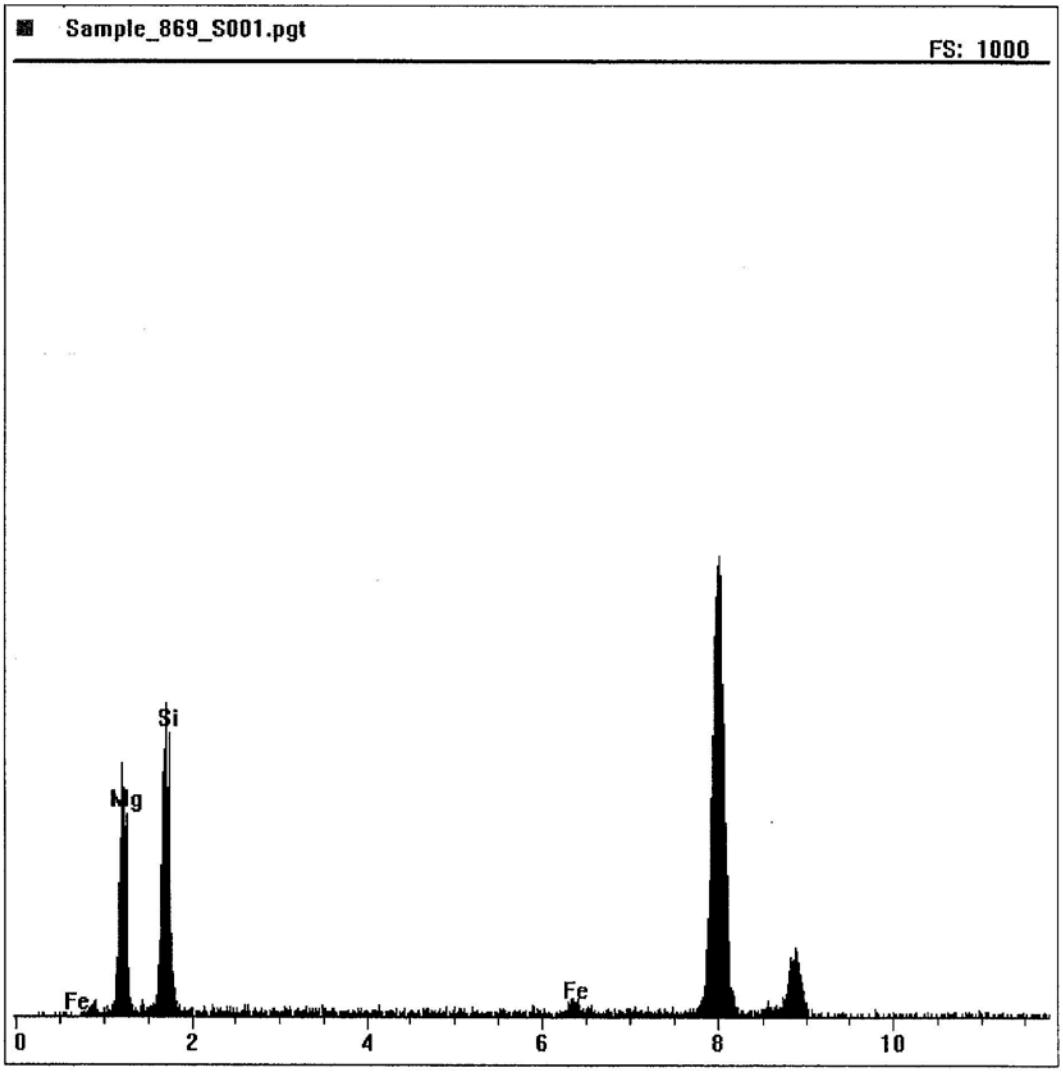
Qualitative Spectrum

EMSL ANALYTICAL, INC.

File: 041216273 PA-MA-AM-04 U2 G9 2 CHRYSOTILE
Collected: July 09, 2012 17:02:02

Live Time:	91.33	Count Rate:	453	Dead Time:	10.98 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00



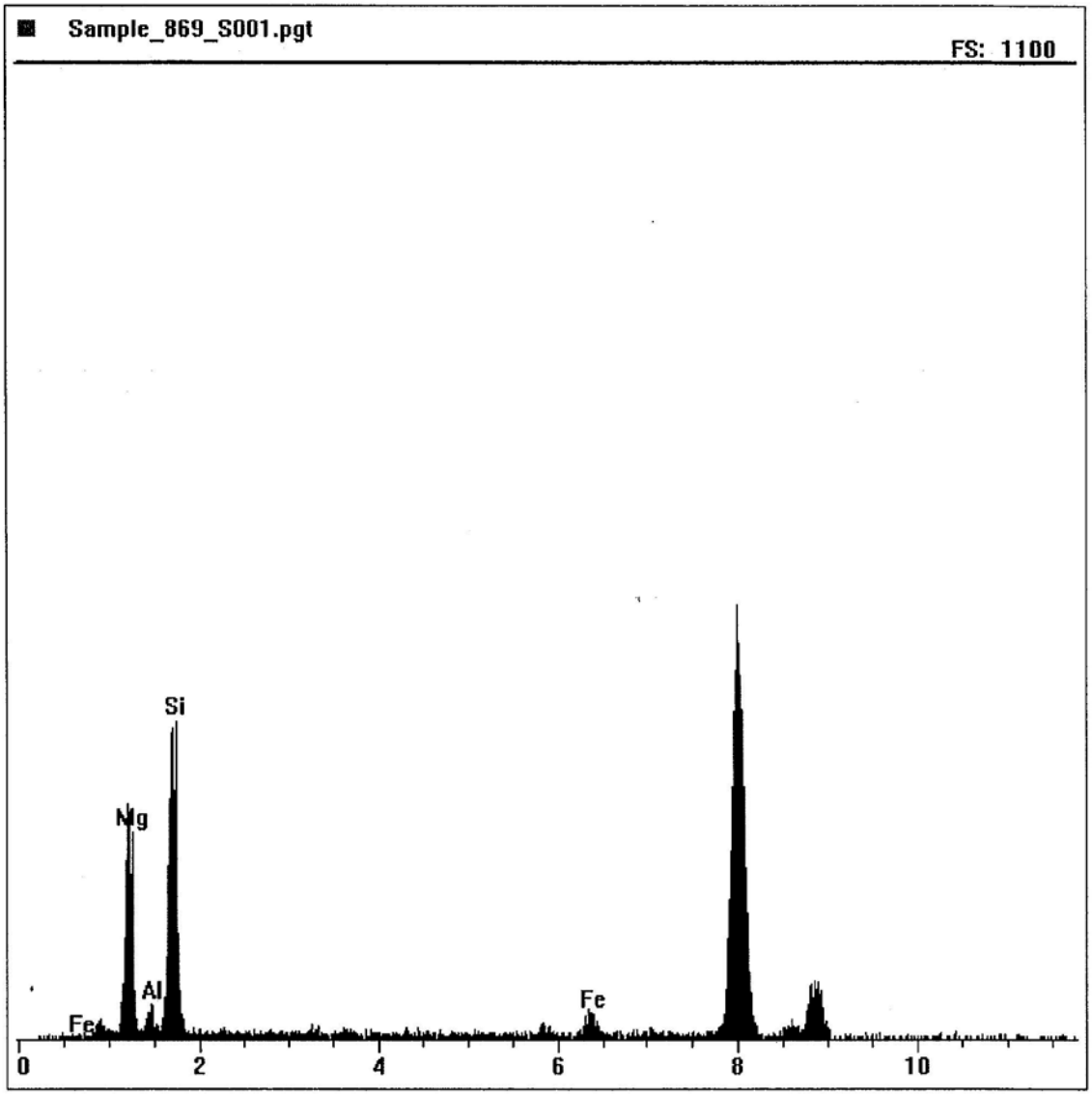
Energy Dispersive X-Ray Analysis
Qualitative Spectrum

EMSL ANALYTICAL, INC.

DM 7/11/12

File: 041216273 PA-MA-AM-04 U2 G9 ~~8~~ NAM
Collected: July 09, 2012 17:02:02

Live Time:	178.29	Count Rate:	254	Dead Time:	7.18 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00



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CHRYSOTILE SAED INDEXING FORM

EMSL Order ID : 041216273 DATE: 07/10/12

Indexing of negative number: 63136 SCOPE #: 03-01

Reference / Sample Number: PA-MA-AM-04

Preliminary ID: Chrysotile By: JA

Using Camera Constant of: 21.89 mm Angstroms

Determined from negative number: 63094

Quick Check

Measured Inter-row spacing: 4.075 mm

110 reflections present? Enter Yes or No Yes

200 doublets present? Enter Yes or No Yes

Full Index

Measured distance, center spot to closest hk0 spot (002):	3.00	mm
Measured distance, center spot to closest hk1 spot (110):	4.85	mm

	Calculated	Ref	- 5%	+ 5%
Inter-row spacing (Ångstroms)	**5.37**	**5.30**	**5.035**	**5.565**
Angle to 110 reflection (Measured °)	63	**60.0**	**57.0**	**63.0**
d2 or d hk 0 (002) (Angstroms)	**7.30**	**7.32**	**6.954**	**7.686**
d1 or d hk 1 (110) (Angstroms)	**4.51**	**4.58**	**4.351**	**4.809**

From SAED Reference Book, "unknown" diffraction pattern was found to be that of: Chrysotile By: DY

Preliminary Identification was: [X] CORRECT

[ ] INCORRECT

percent accuracy to date: 100

5463136

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID:	041216273-0024	Volume (L):	403.2	Scope:	03-01
Customer Sample:	PA-MA-AM-05	Prepped By:	AF	GO area (mm²):	0.013
Sample Description:	ABS	Prepped Date:	7/2/12	Magnification:	10,000
Pore Size (micron):	0.45	Grid Box:	0312ERRG-02	Analyzed By:	Glunnuzzi
EFA (mm²):	385	Grid Location:	A1-3	Analysis Date:	7/10/12

Analysis Information

Target Sensitivity:	0.004	s/cc	Minimum Aspect Ratio: (circle one)		
GO Required:	~~20~~ ~~19~~ ~~18~~ 7/10		none	**3:1**	5:1
GO Analyzed:	20				
Level of Analysis Chrysotile:	CD		Min Length:	>5	micron
Level of Analysis Amphibole:	ADX		Min Width:	0.25	micron

Comments:
Significant amount of non-Countable Asbestos observed. $X^2 = 15$ = Random

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
A1	H9	F	1	1	54.67	0.35	CD	CH		63137 63138	YES
	H7	F	Ø	Ø	5.75	0.90	NAM	NAM			YES
	H5	ND									
	E9	MD11	2		17.01	14.58	CD	CH			~~YES~~ 7/10
		MB		2	17.01	0.90	CD	CH			YES
	F5	MD11	3		9.72	3.65	CD	CH			
		MB		3	9.72	0.30	CD	CH			
	C7	ND									
	C5	ND									
	B4	ND									

ND= None Detected NAM= Non Asbestos Material

EMSL Analytical, Inc

Particulate loading 3-5%
Transverse Direction: Vertical

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID: 041216273-0024

Customer Sample ID: PA-MA-AM-05

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
A2	G9	MD11	4		24.30	14.58	CD	CH			
		MB		4	24.30	0.25	CD	CH			
	G3	ND									
	G1	ND									
	I8	ND									
	F6	ND									
	B8	ND									
	A6	ND									
A3	D4	ND									
	D6	ND									
	D8	ND									
	I5	F	5	5	19.44	0.52	CD	CH		63139	
	I7	ND									

ND = None Detected

NAM = Non Asbestos Material

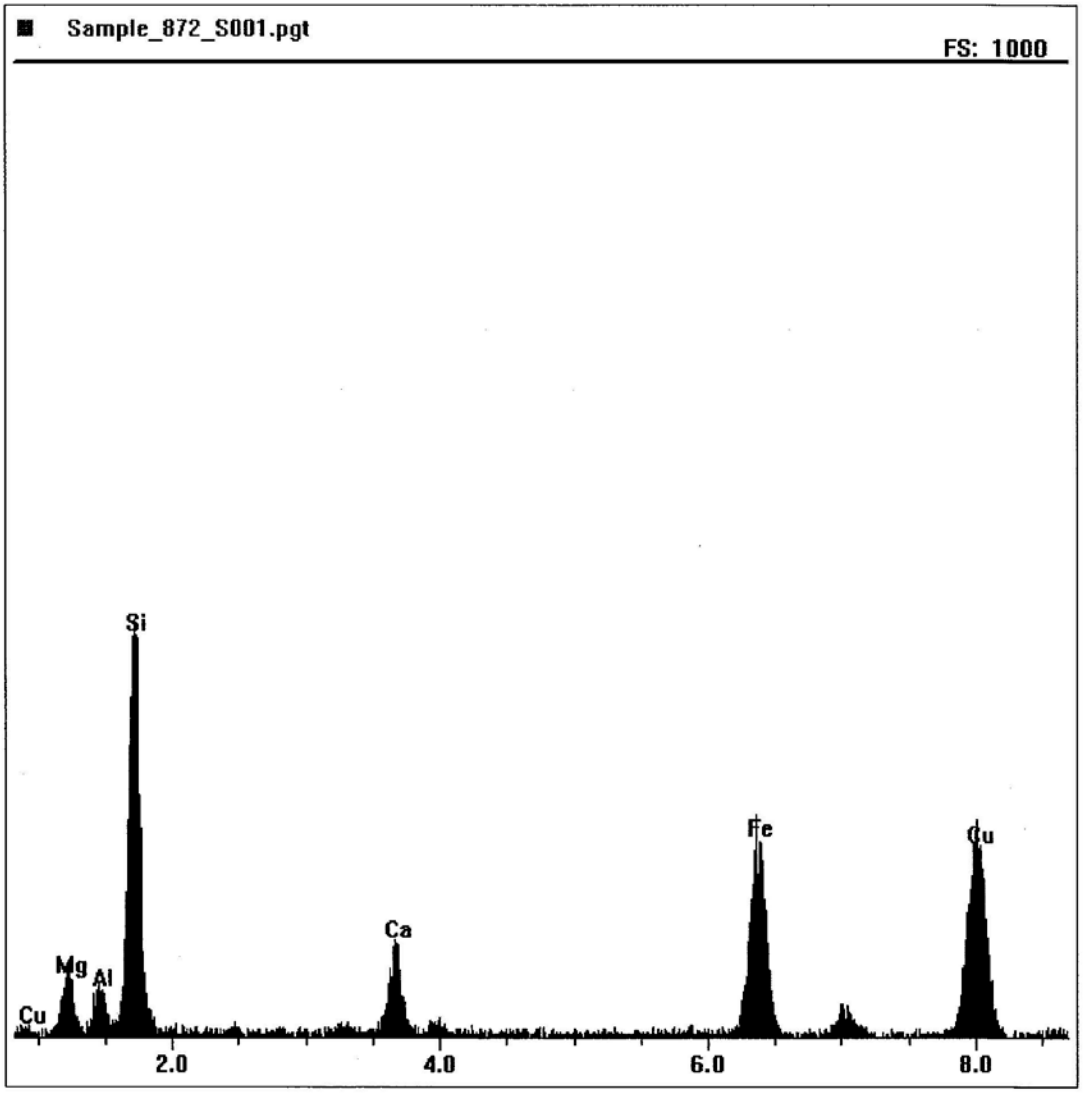
Energy Dispersive X-Ray Analysis
Qualitative Spectrum

EMSL ANALYTICAL, INC.

File: 041216273 PA-MA-AM-05 A1 H7 NAM

Collected: July 10, 2012 09:33:32

Live Time:	32.77	Count Rate:	1185	Dead Time:	23.09 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00



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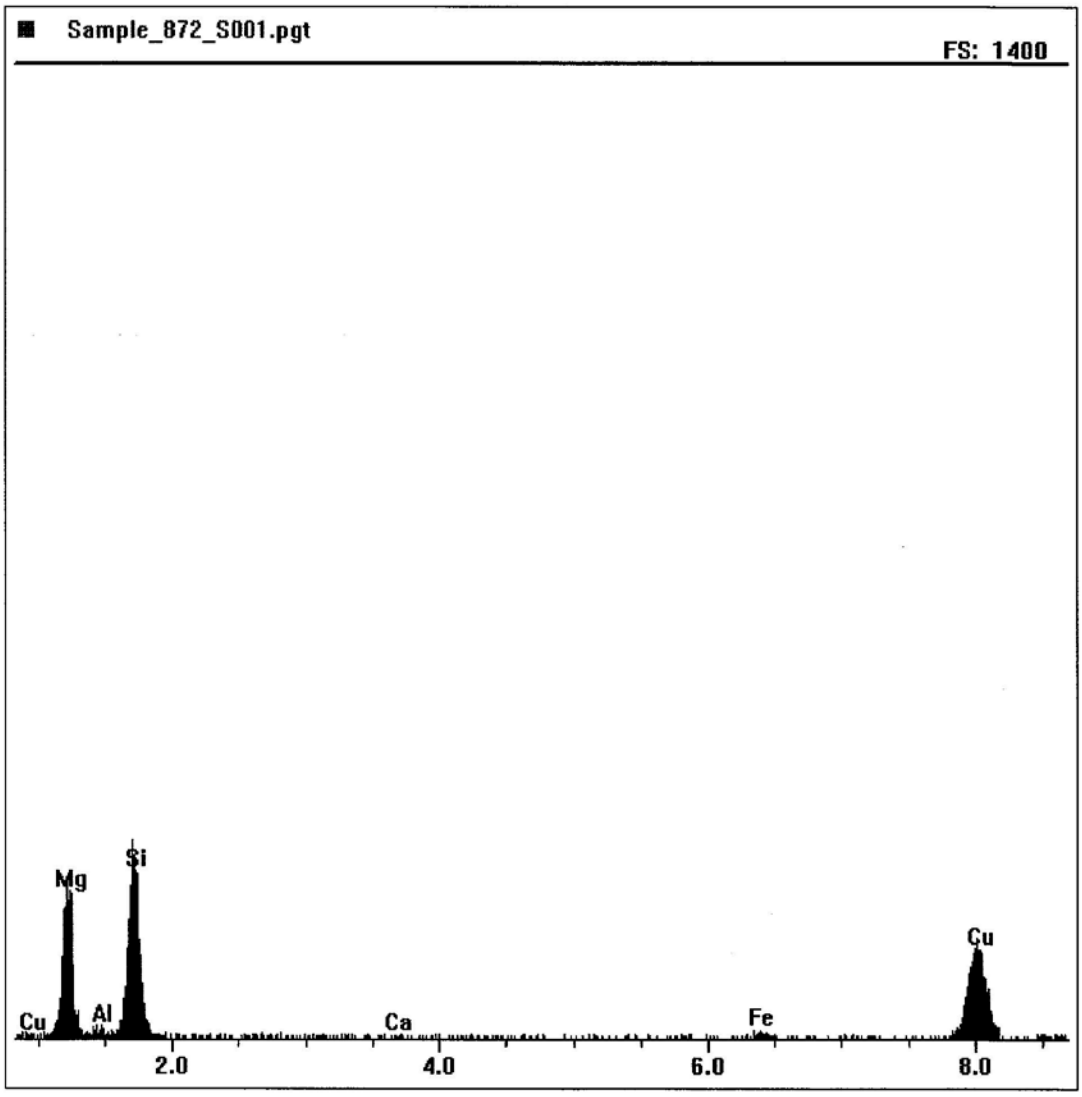
Qualitative Spectrum

EMSL ANALYTICAL, INC.

File: 041216273 PA-MA-AM-05 A1 E9 2 Chrysotile

Collected: July 10, 2012 09:33:32

Live Time:	39.46	Count Rate:	519	Dead Time:	11.76 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00



CHRYSOTILE SAED INDEXING FORM

EMSL Order ID : 041216273 DATE: 07/10/12

Indexing of negative number: 63137 SCOPE #: 03-01

Reference / Sample Number: PA-MA-AM-05

Preliminary ID: Chrysotile By: GI

Using Camera Constant of: 21.89 mm Angstroms

Determined from negative number: 63094

Quick Check

Measured Inter-row spacing: 4.075 mm

110 reflections present? Enter Yes or No Yes

200 doublets present? Enter Yes or No Yes

Full Index

Measured distance, center spot to closest hk0 spot (002):	3.00	mm
Measured distance, center spot to closest hk1 spot (110):	4.85	mm

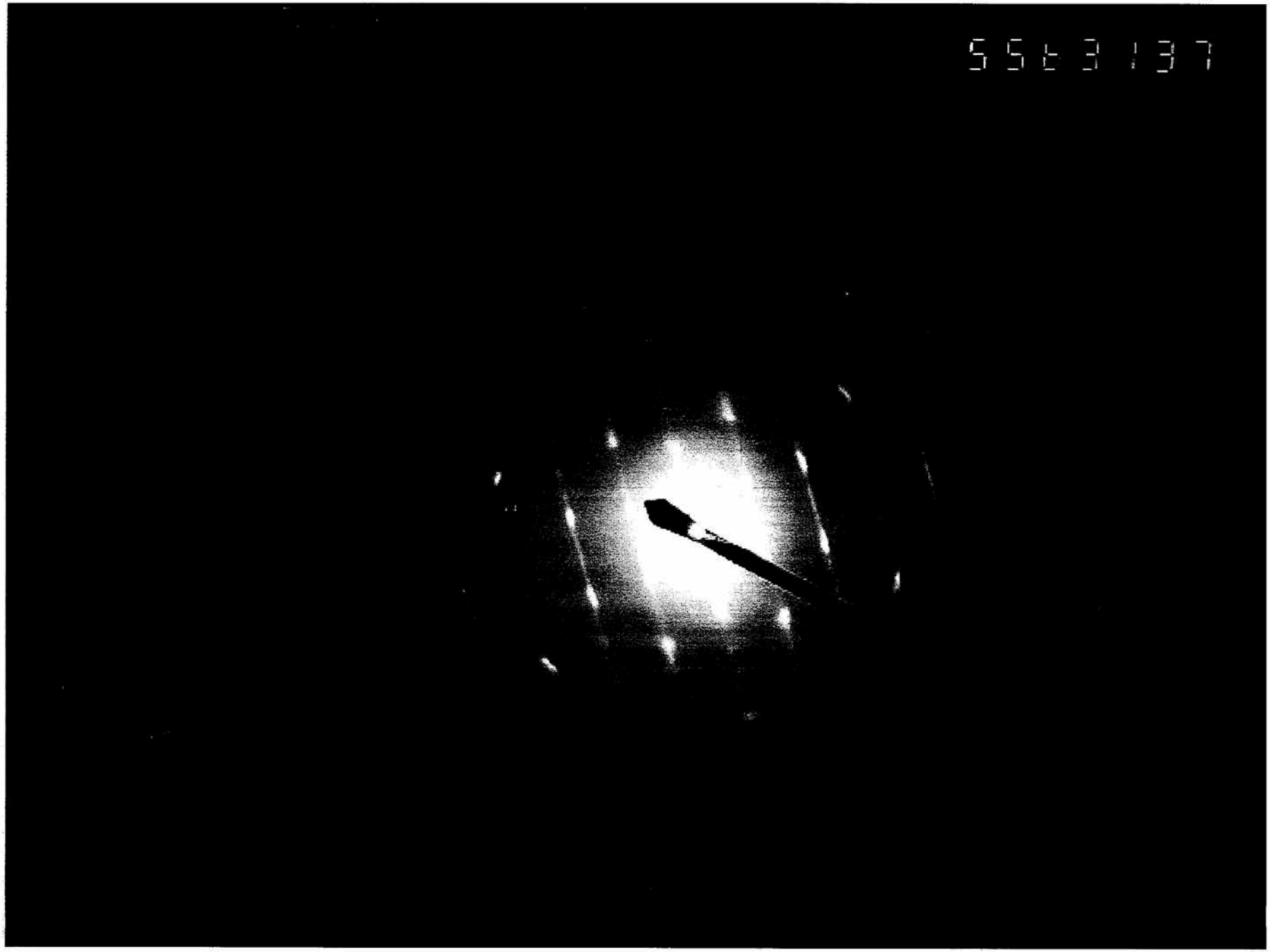
	Calculated	Ref	- 5%	+ 5%
Inter-row spacing (Ångstroms)	**5.37**	**5.30**	**5.035**	**5.565**
Angle to 110 reflection (Measured °)	61	**60.0**	**57.0**	**63.0**
d2 or d hk 0 (002) (Angstroms)	**7.30**	**7.32**	**6.954**	**7.686**
d1 or d hk 1 (110) (Angstroms)	**4.51**	**4.58**	**4.351**	**4.809**

From SAED Reference Book, "unknown" diffraction pattern was found to be that of: Chrysotile By: DY

Preliminary Identification was: [X] CORRECT

[ ] INCORRECT

percent accuracy to date: 100


5563137

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID:	041216273-0025	Volume (L):	393.9	Scope:	0301
Customer Sample:	PA-UW-AA-01	Prepped By:	AF	GO area (mm²):	013
Sample Description:	Ambient	Prepped Date:	7/2/12	Magnification:	10,000
Pore Size (micron):	0.45	Grid Box :	0312ERRG02	Analyzed By:	Glannzzi
EFA (mm²):	385	Grid Location:	B1-3	Analysis Date:	7/10/12

Analysis Information

Target Sensitivity:	0.002 s/cc	Minimum Aspect Ratio: (circle one)			**Comments:**
GO Required:	~~38~~ 39 JR 7/10	none	**3:1**	5:1	
GO Analyzed:	39				
Level of Analysis Chrysotile:	CD	Min Length:	>5	micron	
Level of Analysis Amphibole:	ADX	Min Width:	0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
B1	B2	ND									
	B4	↓									
	B6										
	B8										
	D2										
	D4										
	D6										
	D8										
	F2										
	F4										

ND= None Detected NAM= Non Asbestos Material

EMSL Analytical, Inc

Particulate Loading 1-2%
Transverse Direction: Vertical

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID: 041216273-0025

Customer Sample ID: PA-UW-AA-01

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
	F6	ND									
	F8										
B2	I10										
	I8										
	I6										
	I4										
	G9										
	G7										
	G5										
	D10										
	D8										
	D4										
	D2										
	B9										
	B7										

ND = None Detected

NAM = Non Asbestos Material

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID: 041216273-0025

Customer Sample ID: PA-UW-AA-01

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
B3	J9	ND									
	J7										
	J5										
	J3										
	H9										
	H7										
	H5										
	H3										
	G8										
	G6										
	G4										
	C8										
	C6										
	C4	ND									

ND = None Detected

NAM = Non Asbestos Material

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID:	041216273-0026	Volume (L):	406.9	Scope:	03-01
Customer Sample:	PA-UW-AA-02	Prepped By:	AF	GO area (mm²):	0.013
Sample Description:	Ambient	Prepped Date:	7/2	Magnification:	10,000
Pore Size (micron):	0.45	Grid Box :	0312ERRG02	Analyzed By:	Glannozzi
EFA (mm²):	385	Grid Location:	C(1-3)	Analysis Date:	7/10/12

Analysis Information

Target Sensitivity:	0.002	s/cc	Minimum Aspect Ratio: (circle one)		
GO Required:	~~36~~ 37 7/10		none	**3:1**	5:1
GO Analyzed:	37				
Level of Analysis Chrysotile:	CD		Min Length:	>5	micron
Level of Analysis Amphibole:	ADX		Min Width:	0.25	micron

Comments:

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
C1	J10	ND									
	J8										
	J6										
	J4										
	H9										
	H7										
	H5										
	H3										
	F9										
	F7										

ND= None Detected NAM= Non Asbestos Material

EMSL Analytical, Inc

Particulate loading 1-2%
Transverse Direction: Vertical

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID: 041216273-0026

Customer Sample ID: PA-UW-AA-02

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
	F5	ND									
	F3										
C2	I8										
	I6										
	I4										
	G9										
	G7										
	G5										
	G3										
	E9										
	E7										
	E5										
	E3										
	C7										
	C5										

ND = None Detected

NAM = Non Asbestos Material

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID: 041216273-0026

Customer Sample ID: PA-UW-AA-02

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
C3	B1	ND									
	B3										
	B5										
	B7										
	B9										
	D3										
	D5										
	D7										
	D9										
	G5										
	G7										
	G9										

ND = None Detected

NAM = Non Asbestos Material

TEM ISO 10312
Asbestos Count Sheet

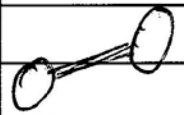
EMSL Sample ID:	041216273-0027	Volume (L):	468.195	Scope:	03-01
Customer Sample:	PA-UW-AM-01	Prepped By:	AF	GO area (mm²):	0.013
Sample Description:	ABS	Prepped Date:	7/2/12	Magnification:	10,000
Pore Size (micron):	0.45	Grid Box:	0312 ERRG-02	Analyzed By:	Glannari
EFA (mm²):	385	Grid Location:	D 1-3	Analysis Date:	7/10/12

Analysis Information

Target Sensitivity:	0.004	s/cc	Minimum Aspect Ratio: (circle one)		
GO Required:	~~16~~ 17 ~~12~~ 7/10		none	**3:1**	5:1
GO Analyzed:	17				
Level of Analysis Chrysotile:	CD		Min Length:	>5	micron
Level of Analysis Amphibole:	ADX		Min Width:	0.25	micron

Comments:

$\chi^2 = 18.619$ = Random

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
D1	I8	ND									
	I6	ND									
	I4	ND									
	C8	ND									
	C6	ND									
	C4	MD11	1		10.21	3.15	CD	CH		63140	~~YES~~ 12/7/10
		MB		1	10.21	0.35	CD	CH			YES
D2	C3	ND									
	C5	ND									
	C7	ND									

ND= None Detected

NAM= Non Asbestos Material

EMSL Analytical, Inc

Particulate Loading 3-5%
Transverse Direction: Vertical

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID: 041216273-0027

Customer Sample ID: PA-UW-AM-01

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
	F3	F	2	2	24.30	0.90	CD	CH	—	63156	YES
	F5	ND									
	F7	ND									
D3	D3	ND									
	D5	ND									
	D7	ND									
	H4	ND									
	H6	ND									

ND = None Detected

NAM = Non Asbestos Material

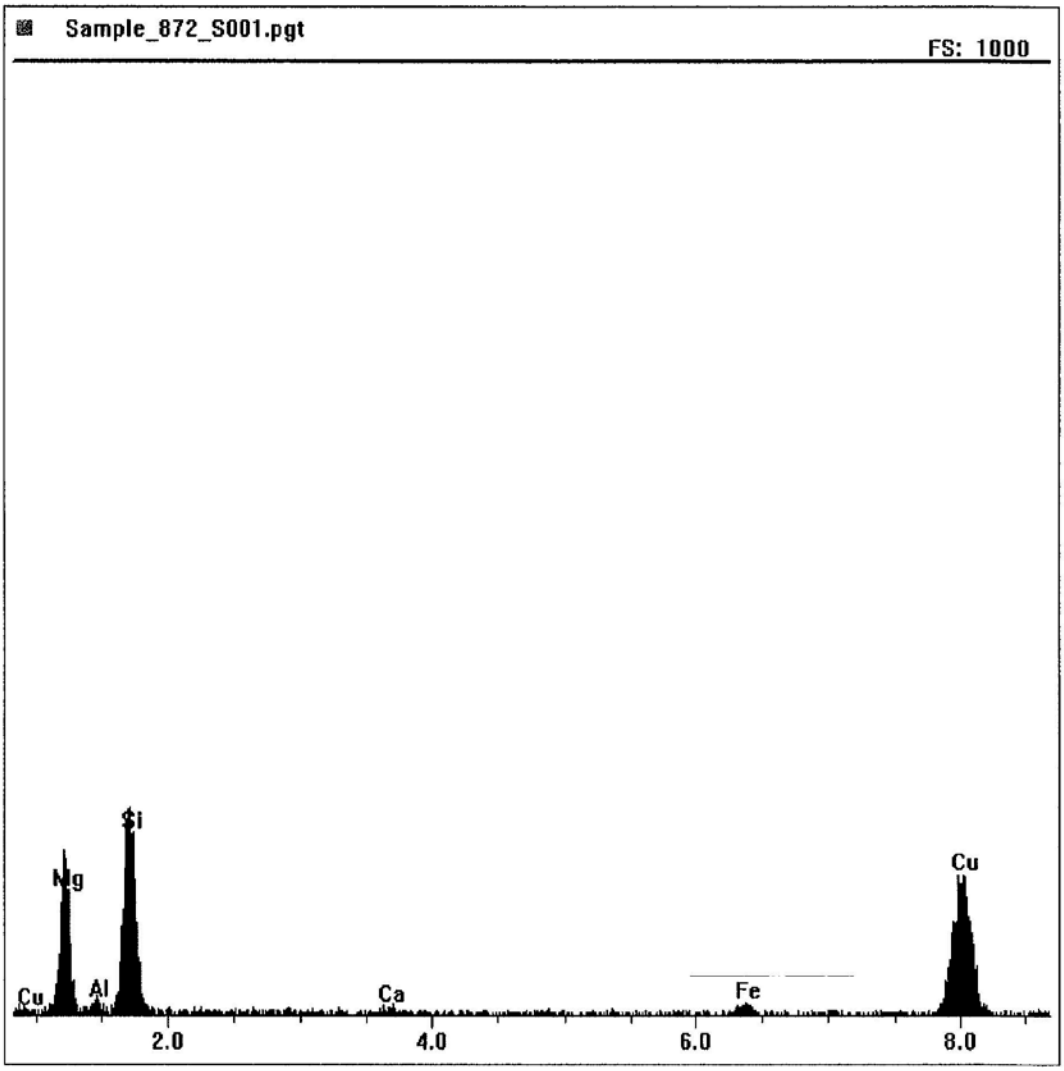
Energy Dispersive X-Ray Analysis
Qualitative Spectrum

EMSL ANALYTICAL, INC.

File: 041216273 PA-UW-AM-01 D1 C4 1 Chrysotile

Collected: July 10, 2012 09:33:32

Live Time:	262.78	Count Rate:	73	Dead Time:	3.81 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00

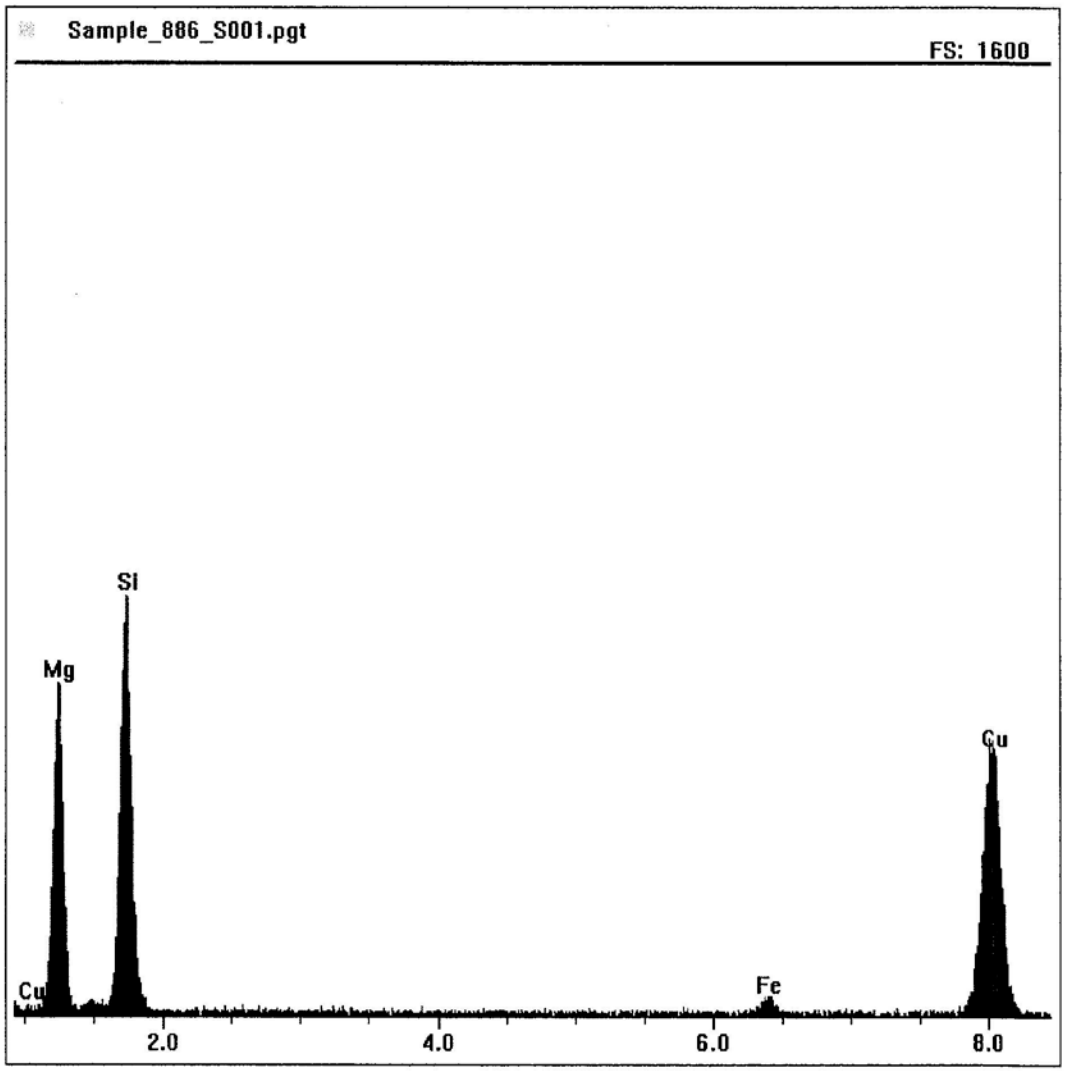


Energy Dispersive X-Ray Analysis
Qualitative Spectrum

EMSL ANALYTICAL, INC.

File: 041216273 PA-UW-AM-01 D2 F3 2 Chrysotile
Collected: July 12, 2012 13:56:38

Live Time:	101.18	Count Rate:	581	Dead Time:	13.02 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00



EMSL

CHRYSOTILE SAED INDEXING FORM

EMSL Order ID : 041216273 DATE: 07/11/12

Indexing of negative number: 63140 SCOPE #: 03-01

Reference / Sample Number: PA-UW-AM-01

Preliminary ID: Chrysotile By: GI

Using Camera Constant of: 21.89 mm Angstroms

Determined from negative number: 63094

Quick Check

Measured Inter-row spacing: 4 mm

110 reflections present? Enter Yes or No Yes

200 doublets present? Enter Yes or No Yes

Full Index

Measured distance, center spot to closest hk0 spot (002):	2.88	mm
Measured distance, center spot to closest hk1 spot (110):	4.65	mm

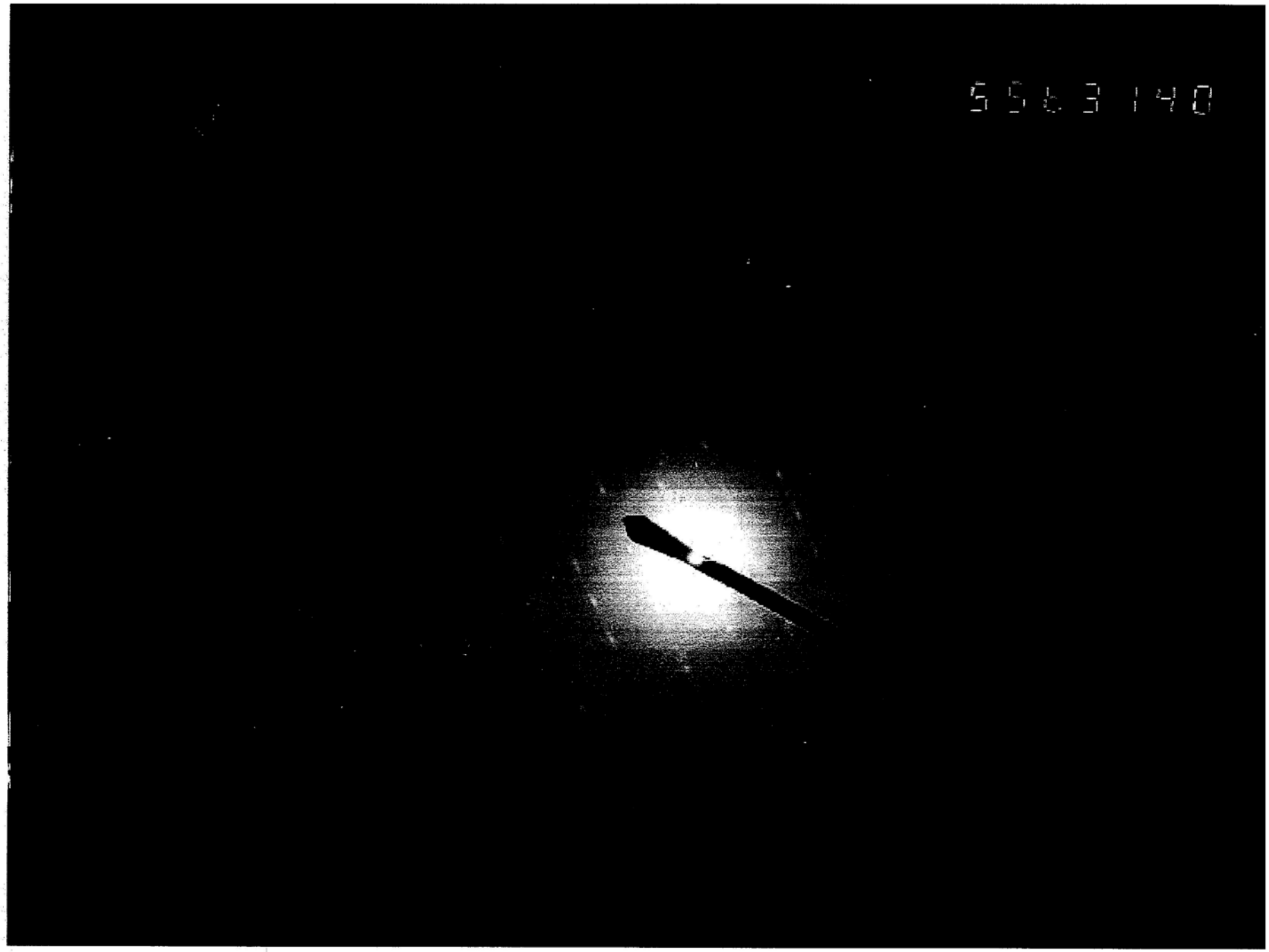
	Calculated	Ref	- 5%	+ 5%
Inter-row spacing (Ångstroms)	**5.47**	**5.30**	**5.035**	**5.565**
Angle to 110 reflection (Measured °)	61	**60.0**	**57.0**	**63.0**
d2 or d hk 0 (002) (Angstroms)	**7.61**	**7.32**	**6.954**	**7.686**
d1 or d hk 1 (110) (Angstroms)	**4.71**	**4.58**	**4.351**	**4.809**

From SAED Reference Book, "unknown" diffraction pattern was found to be that of: Chrysotile By: DY

Preliminary Identification was: [X] CORRECT

[ ] INCORRECT

percent accuracy to date: 100


5563140

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID:	041216273-0028	Volume (L):	423.54	Scope:	03-01
Customer Sample:	PA-UW-AM-02	Prepped By:	A. FOLGAR	GO area (mm²):	0.013
Sample Description:	ABS	Prepped Date:	7/2/12	Magnification:	10,000X
Pore Size (micron):	0.45	Grid Box :	0312.E6RG-02	Analyzed By:	A. FOLGAR
EFA (mm²):	385	Grid Location:	E6 C1-3	Analysis Date:	7/10/12

Analysis Information

Target Sensitivity:	0.004	s/cc	Minimum Aspect Ratio: (circle one)		
GO Required:	~~18~~ 19 AF 7/10		none	**3:1**	5:1
GO Analyzed:	19				
Level of Analysis Chrysotile:	CD		Min Length:	>5	micron
Level of Analysis Amphibole:	ADX		Min Width:	0.25	micron

Comments:

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
E1	A1	ND									
	A3	ND									
	A5	ND									
	f2	ND									
	f4	ND									
	f6	ND									
	f8	ND									
	H8	ND									
	H10	ND									
	J2	ND									

ND= None Detected

NAM= Non Asbestos Material

EMSL Analytical, Inc

Particulate Loading: 5-10%
Traverse Direction: Vertical

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID: 041216273-0028

Customer Sample ID: PA-UW-AM-02

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
E3	G4	ND									
	G2	ND									
	C9										
	C7										
	C5										
	C3										
	A7										
	A5										
	A3										

ND = None Detected

NAM = Non Asbestos Material

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID:	041216273-0029	Volume (L):	398.19	Scope:	03-01
Customer Sample:	PA-UW-AM-03	Prepped By:	A. FOIGAR	GO area (mm²):	0.013
Sample Description:	ABS	Prepped Date:	7/2/12	Magnification:	10,000X
Pore Size (micron):	0.45	Grid Box :	0312 · EBRG-02	Analyzed By:	A. FOIGAR
EFA (mm²):	385	Grid Location:	f (1-3)	Analysis Date:	7/10/12

Analysis Information

Target Sensitivity:	0.004	s/cc	Minimum Aspect Ratio: (circle one)		
GO Required:	~~19~~ 20 AF 7/10		none	**3:1**	5:1
GO Analyzed:	20				
Level of Analysis Chrysotile:	CD		Min Length:	>5	micron
Level of Analysis Amphibole:	ADX		Min Width:	0.25	micron

Comments:

$\chi^2 = 22.833$ = Random

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
f1	C2	ND									
	C4	ND									
	E1	ND									
	E3	ND									
	E5	ND									
	f8	B	1	1	20.1	2.5	CD	CH		63141 63142	Yes
	f10	ND									
	H3	↓									
	H5										
	J4										

ND= None Detected

NAM= Non Asbestos Material

Particulate Loading: 3-5%
Traverse Direction: Vertical

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID: 041216273-0029

Customer Sample ID: PA-UW-AM-03

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
f2	B3	ND									
	B5										
	E3										
	E5										
	E7										
	E9										
	f6										
	f8										
	f10										
	I7										

ND = None Detected

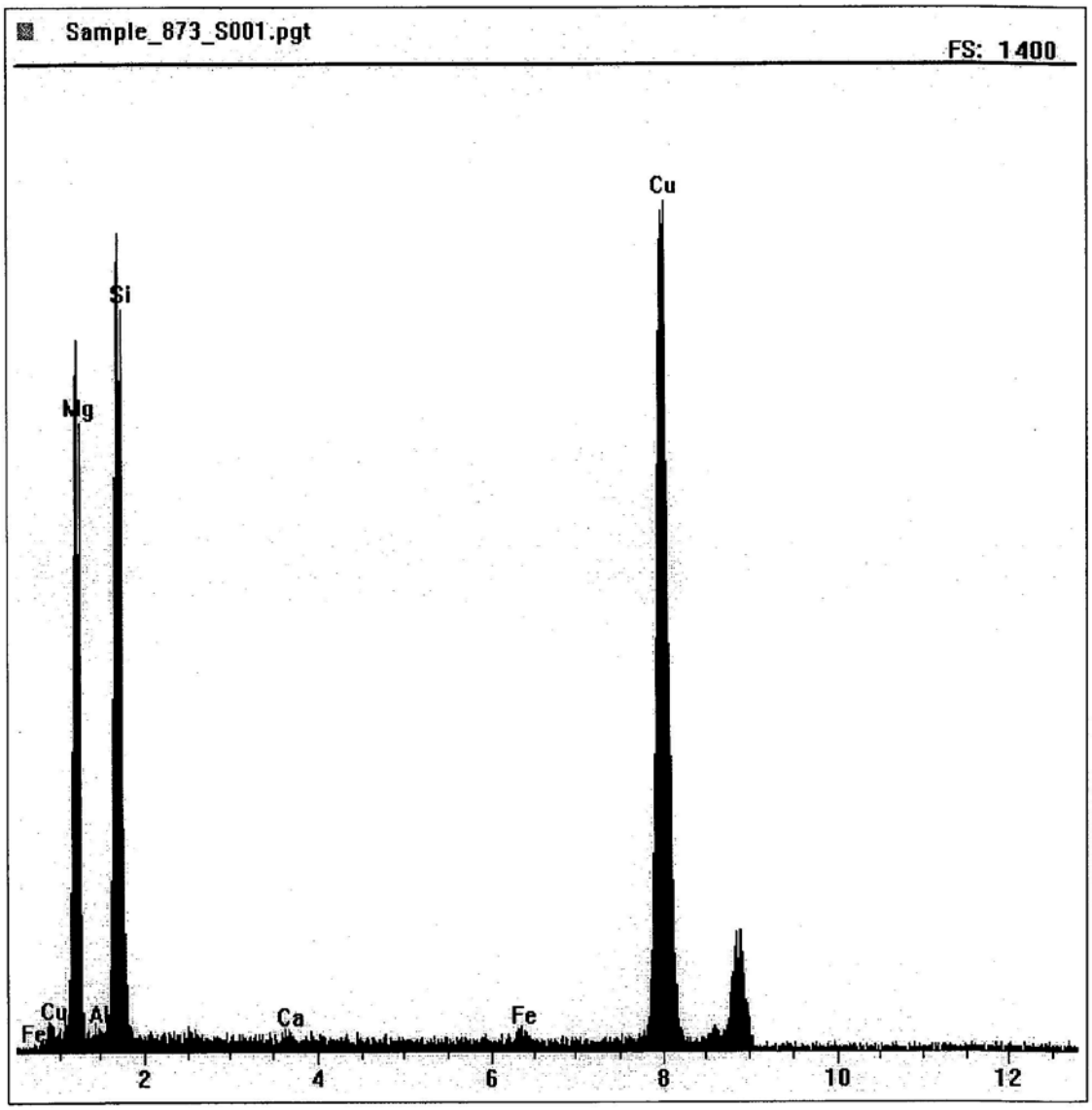
NAM = Non Asbestos Material

Energy Dispersive X-Ray Analysis
Qualitative Spectrum

EMSL ANALYTICAL, INC.

File: 041216273 PA-UW-AM-03 F1 F8 1 CHRYSOTILE
Collected: July 10, 2012 13:51:54

Live Time:	267.70	Count Rate:	471	Dead Time:	11.19 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00



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CHRYSOTILE SAED INDEXING FORM

EMSL Order ID : 041216273 DATE: 07/11/12

Indexing of negative number: 63141 SCOPE #: 03-01

Reference / Sample Number: PA-UW-AM-03

Preliminary ID: Chrysotile By: AF

Using Camera Constant of: 21.89 mm Angstroms

Determined from negative number: 63094

Quick Check

Measured Inter-row spacing: 4 mm

110 reflections present? Enter Yes or No Yes

200 doublets present? Enter Yes or No Yes

Full Index

Measured distance, center spot to closest hk0 spot (002):	3.08	mm
Measured distance, center spot to closest hk1 spot (110):	4.65	mm

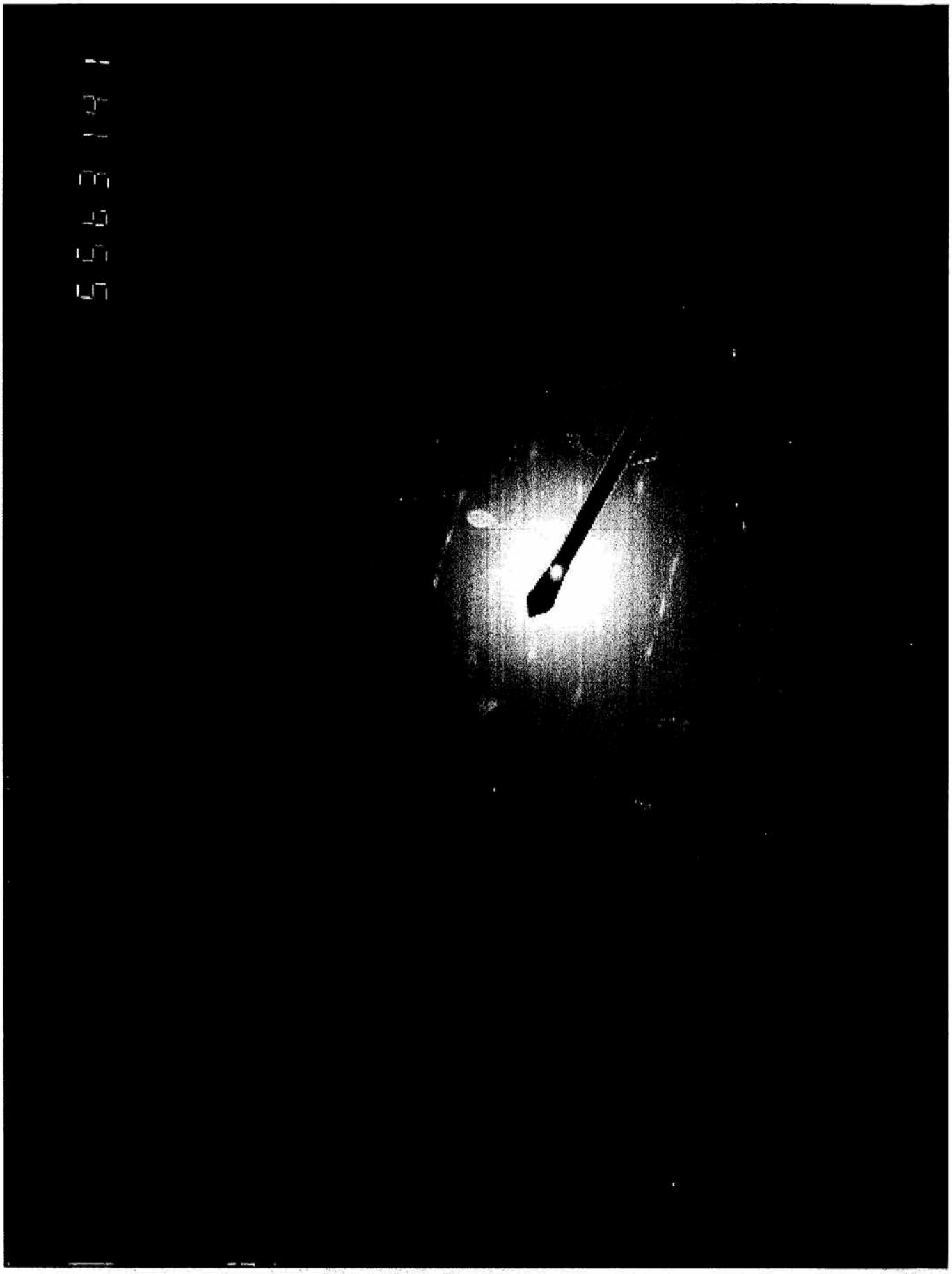
	Calculated	Ref	-5%	+5%
Inter-row spacing (Ångstroms)	**5.47**	**5.30**	**5.035**	**5.565**
Angle to 110 reflection (Measured °)	60	**60.0**	**57.0**	**63.0**
d2 or d hk 0 (002) (Angstroms)	**7.12**	**7.32**	**6.954**	**7.686**
d1 or d hk 1 (110) (Angstroms)	**4.71**	**4.58**	**4.351**	**4.809**

From SAED Reference Book, "unknown" diffraction pattern was found to be that of: Chrysotile By: DY

Preliminary Identification was: [X] CORRECT

[ ] INCORRECT

percent accuracy to date: 100



TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID:	041216273-0030	Volume (L):	456.69	Scope:	03-01
Customer Sample:	PA-UW-AM-04	Prepped By:	AF	GO area (mm²):	0.013
Sample Description:	ABS	Prepped Date:	7/2/12	Magnification:	10,000
Pore Size (micron):	0.45	Grid Box :	0312ERRG-02	Analyzed By:	G. Lunnszl
EFA (mm²):	385	Grid Location:	G1-3	Analysis Date:	7/10/12

Analysis Information

Target Sensitivity:	0.004	s/cc	Minimum Aspect Ratio: (circle one)		
GO Required:	~~17~~ 18 ~~22~~ 7/10/12		none	**3:1**	5:1
GO Analyzed:	18				
Level of Analysis Chrysotile:	CD		Min Length:	>5	micron
Level of Analysis Amphibole:	ADX		Min Width:	0.25	micron

Comments:

$X^2 = 16.091$ = Random

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
G1	H9	ND									
	H7	ND									
	H5	ND									
	D9	MD11	1		10.66	5.31	CD	CH			
		MB		1	10.66	0.25	CD	CH		63143 63144	YES
	D7	ND									
	D5	ND									
G2	C3	ND									
	C5	ND									
	C7	MD11	2		18.72	4.68	CD	CH			

ND= None Detected

NAM= Non Asbestos Material

Particulate Loading: 7-10%
Transverse Direction: Vertical

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID: 041216273-0030

Customer Sample ID: PA-UW-AM-04

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	Total	Length	Width					
		MF	~~[illegible]~~	2	18.72	0.36	CD	CH		63145	
	F2	ND									
	F4	ND									
	F6	MD11	3		21.53	14.51	CD	CH			
		MB		3	21.53	0.90	CD	CH		63146	
G3	D5	ND									
	D7	ND									
	D9	B	4	4	19.44	0.92	CD	CH			
	G3	F	Ø	Ø	5.45	1.10	NAM	NAM			YES
	G5	MD11	5		25.52	4.86	CD	CH			
		MB		5	25.52	1.17	CD	CH			
	G7	ND									

ND = None Detected

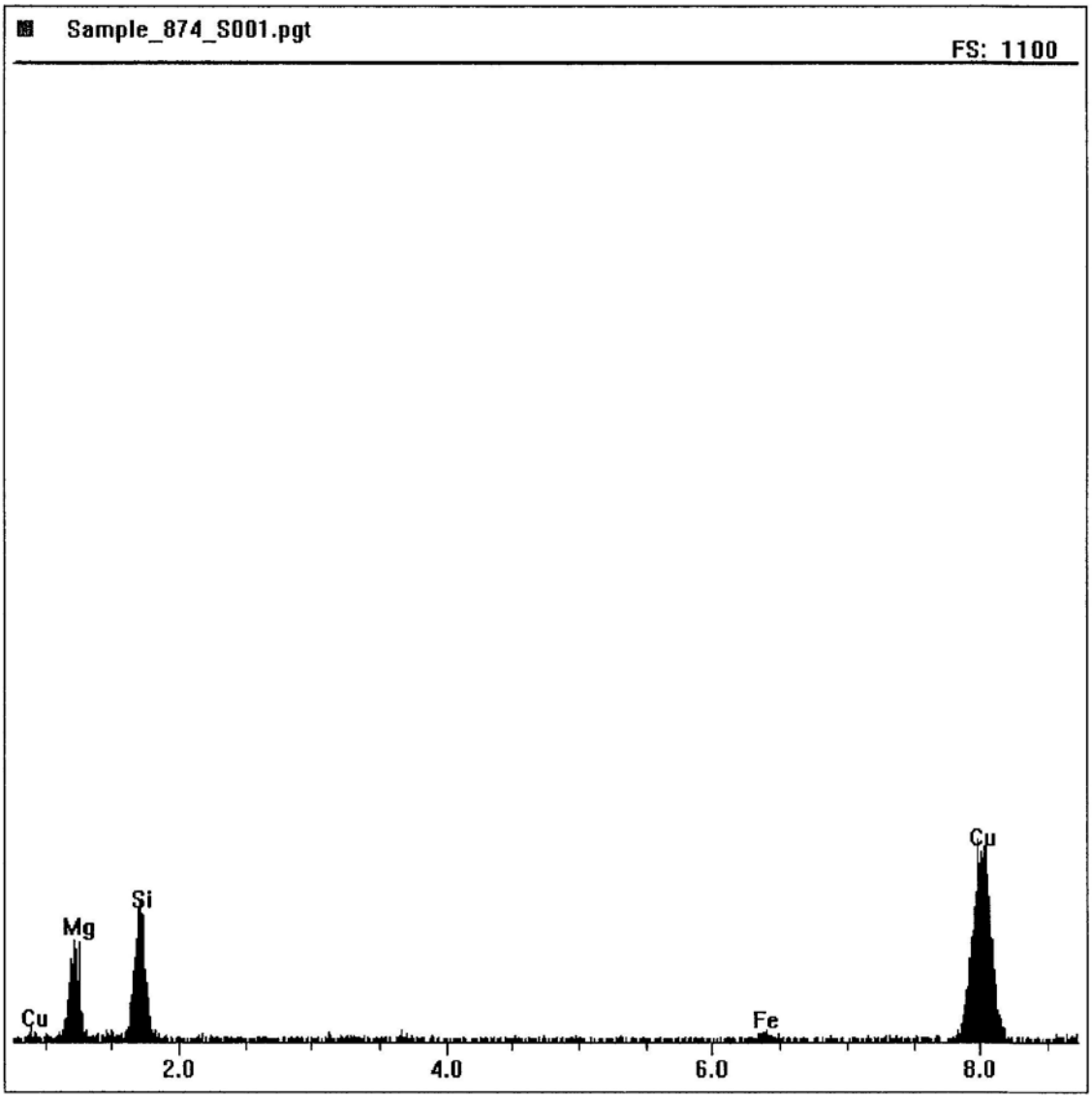
NAM = Non Asbestos Material

Energy Dispersive X-Ray Analysis
Qualitative Spectrum

EMSL ANALYTICAL, INC.

File: 041216273 PA-UW-AM-04 G1 D9 1 Chrysotile
Collected: July 10, 2012 14:53:37

Live Time:	84.48	Count Rate:	243	Dead Time:	7.19 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00



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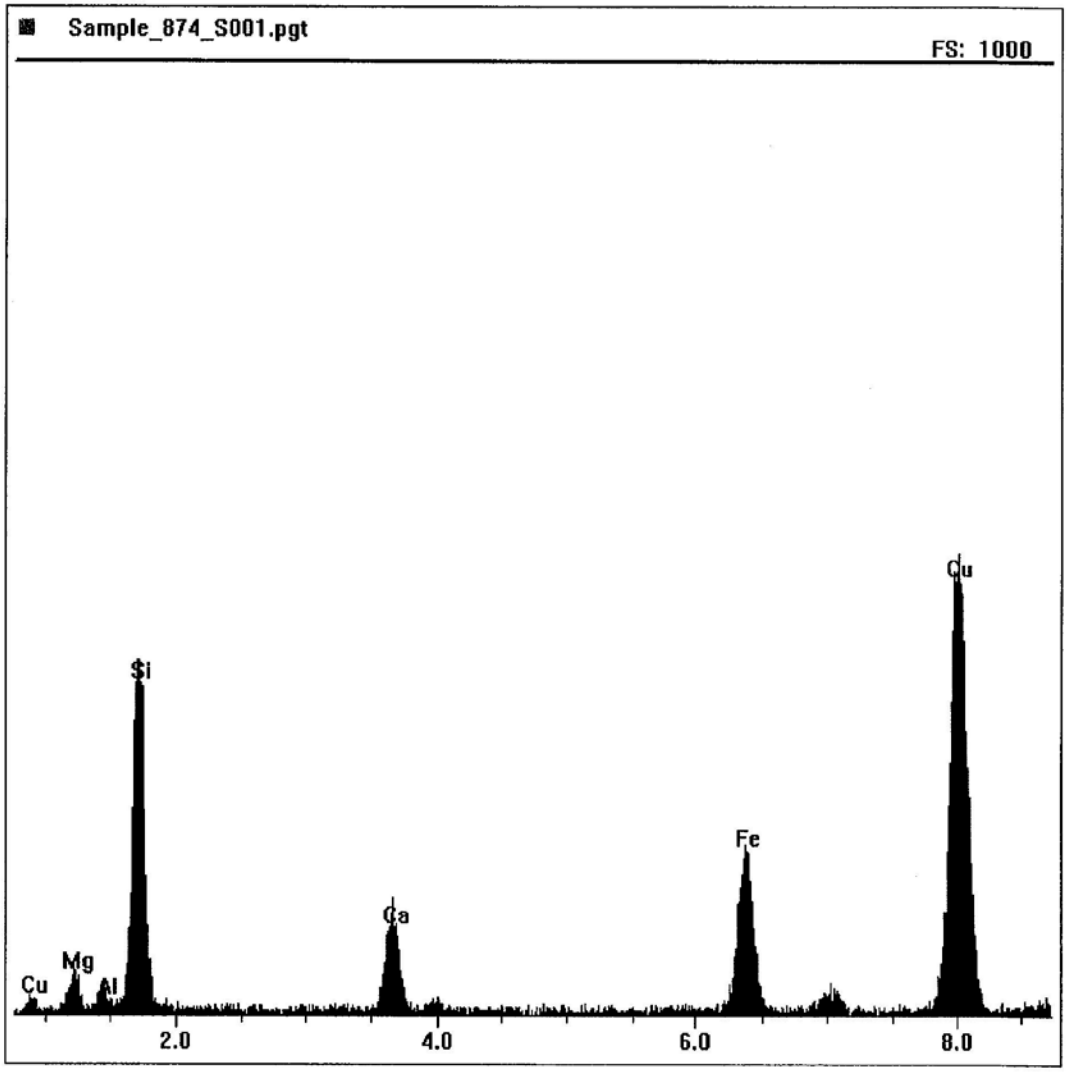
Energy Dispersive X-Ray Analysis
Qualitative Spectrum

EMSL ANALYTICAL, INC.

File: 041216273 PA-UW-AM-04 G3 G3 NAM

Collected: July 10, 2012 14:53:37

Live Time:	18.72	Count Rate:	2653	Dead Time:	44.99 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00



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EMSL

CHRYSOTILE SAED INDEXING FORM

EMSL Order ID : 041216273 DATE: 07/11/12

Indexing of negative number: 63143 SCOPE #: 03-01

Reference / Sample Number: PA-UW-AM-04

Preliminary ID: Chrysotile By: GI

Using Camera Constant of: 21.89 mm Angstroms

Determined from negative number: 63094

Quick Check

Measured Inter-row spacing: 4.25 mm

110 reflections present? Enter Yes or No Yes

200 doublets present? Enter Yes or No Yes

Full Index

Measured distance, center spot to closest hk0 spot (002):	3.00	mm
Measured distance, center spot to closest hk1 spot (110):	4.75	mm

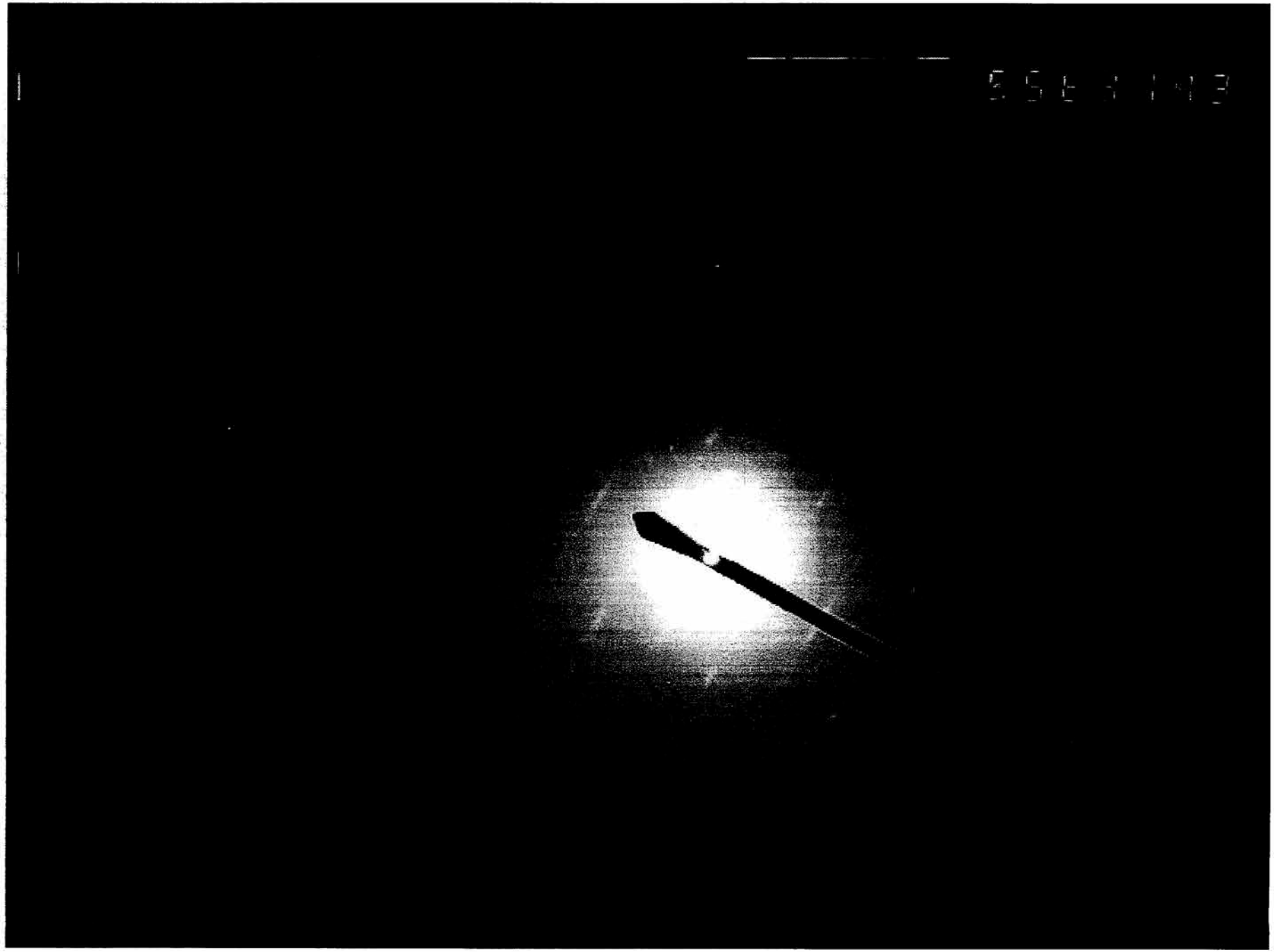
	Calculated	Ref	- 5%	+ 5%
Inter-row spacing (Ångstroms)	**5.15**	**5.30**	**5.035**	**5.565**
Angle to 110 reflection (Measured °)	63	**60.0**	**57.0**	**63.0**
d2 or d hk 0 (002) (Angstroms)	**7.30**	**7.32**	**6.954**	**7.686**
d1 or d hk 1 (110) (Angstroms)	**4.61**	**4.58**	**4.351**	**4.809**

From SAED Reference Book, "unknown" diffraction pattern was found to be that of: Chrysotile By: DY

Preliminary Identification was: [X] CORRECT

[ ] INCORRECT

percent accuracy to date: 100



TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID:	041216273-0031	Volume (L):	503.295	Scope:	03-01
Customer Sample:	PA-UW-AM-05	Prepped By:	A. FOLGAR	GO area (mm²):	0.013
Sample Description:	ABS	Prepped Date:	7/2/12	Magnification:	10,000x
Pore Size (micron):	0.45	Grid Box :	0312·ERRG·02	Analyzed By:	A. FOLGAR
EFA (mm²):	385	Grid Location:	H (1-3)	Analysis Date:	7/10/12

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)			***Comments:***
GO Required:	~~15~~ 16 AF 7/10	none	**3:1**	5:1	
GO Analyzed:	16				
Level of Analysis Chrysotile:	CD	Min Length:	>5	micron	
Level of Analysis Amphibole:	ADX	Min Width:	0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
H1	B2	ND									
	B4	↓									
	B6	↓									
	B8	↓									
	H1	↓									
	H3	↓									
	J3	↓									
	J5	↓									
H2	C2	ND									
	C4	↓									

ND= None Detected

NAM= Non Asbestos Material

Particulate Loading: 5-10%
Traverse Direction: Vertical

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID: 041216273-0031

Customer Sample ID: PA-UW-AM-05

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
H2	H2	ND									
	H4										
	H6										
	A5										
	A7										
	J6										

ND = None Detected

NAM = Non Asbestos Material

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID:	041216273-0032	Volume (L):	424.2	Scope:	~~03-02~~ 0301 AF 7/16
Customer Sample:	PA-ATV2-AA-01	Prepped By:	A. Folgar	GO area (mm²):	0.013
Sample Description:	Ambient	Prepped Date:	7/2/12	Magnification:	10,000X
Pore Size (micron):	0.45	Grid Box :	0312-ERRG-02	Analyzed By:	A. Folgar
EFA (mm²):	385	Grid Location:	I (1-3)	Analysis Date:	7/10/12

Analysis Information

Target Sensitivity:	0.002	s/cc	Minimum Aspect Ratio: (circle one)		
GO Required:	~~35~~ 36 AF 7/10		none	**3:1**	5:1
GO Analyzed:	36				
Level of Analysis Chrysotile:	CD		Min Length:	>5	micron
Level of Analysis Amphibole:	ADX		Min Width:	0.25	micron

Comments:

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
I1	B1	ND									
	B3										
	B5										
	B8										
	B10										
	D1										
	D3										
	D5										
	E2										
	E4										

ND= None Detected

NAM= Non Asbestos Material

Particulate Loading: 5-7%
Traverse Direction: Vertical

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID: 041216273-0032

Customer Sample ID: PA-ATV2-AA-01

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
I1	E6	ND									
	E8										
	E10										
	H2										
	H4										
	H6										
	I3										
	I5										
I2	A1										
	A3										
	A5										
	A7										
	A9										
	B2										
	B4	✓									

ND = None Detected

NAM = Non Asbestos Material

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID: 041216273-0032

Customer Sample ID: PA-ATV2-AA-01

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
I2	B6	ND									
	B8										
	B10										
	H1										
	H3										
	H5										
	H7										
	H9										
	J4										
	J6										
	J8	✓									

ND = None Detected

NAM = Non Asbestos Material

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID:	041216273-0033	Volume (L):	438.27	Scope:	03-01
Customer Sample:	PA-ATV2-AA-02	Prepped By:	A. FOLGAR	GO area (mm²):	0.0130
Sample Description:	Ambient	Prepped Date:	7/2/12	Magnification:	10,000X
Pore Size (micron):	0.45	Grid Box :	0312-ERRG-02	Analyzed By:	Evie Sioukri
EFA (mm²):	385	Grid Location:	J (1-3)	Analysis Date:	7/10/12

Analysis Information

Target Sensitivity:	0.002	s/cc	Minimum Aspect Ratio: (circle one)		
GO Required:	35 ~~34~~ ES 7/10/12		none	**3:1**	5:1
GO Analyzed:	35				
Level of Analysis Chrysotile:	CD		Min Length:	>5	micron
Level of Analysis Amphibole:	ADX		Min Width:	0.25	micron

Comments:

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
J1	J6	ND									
	J4	↓									
	J2	↓									
	H6	↓									
	H4	↓									
	H2	F	~~0~~	~~0~~	8.0	1.7	NAM	NAM	Al present Ca too high		✓
	G5	ND									
	G3	↓									
	G1	↓									
	F6	↓									

ND= None Detected NAM= Non Asbestos Material

Traverse Direction: Vertical
Particulate Loading: 1-3%

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID: 041216273-0033

Customer Sample ID: PA-ATV2-AA-02

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
J1	F4	ND									
	E5										
	E3										
	E1										
	D6										
	D4										
	D2										
	C5										
	C3										
	C1										
	B6										
	B4										
	B2										
	A5										
J2	G3										

ND = None Detected

NAM = Non Asbestos Material

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID: 041216273-0033

Customer Sample ID: PA-ATV2-AA-02

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
J2	G5	ND									
	G7										
	G9										
	H4										
	H6										
	H8										
	H10										
	I3										
	I5										
	J7	F	0	0	5.5	0.8	NAM	NAM	Al present Fe too high		✓

ND = None Detected

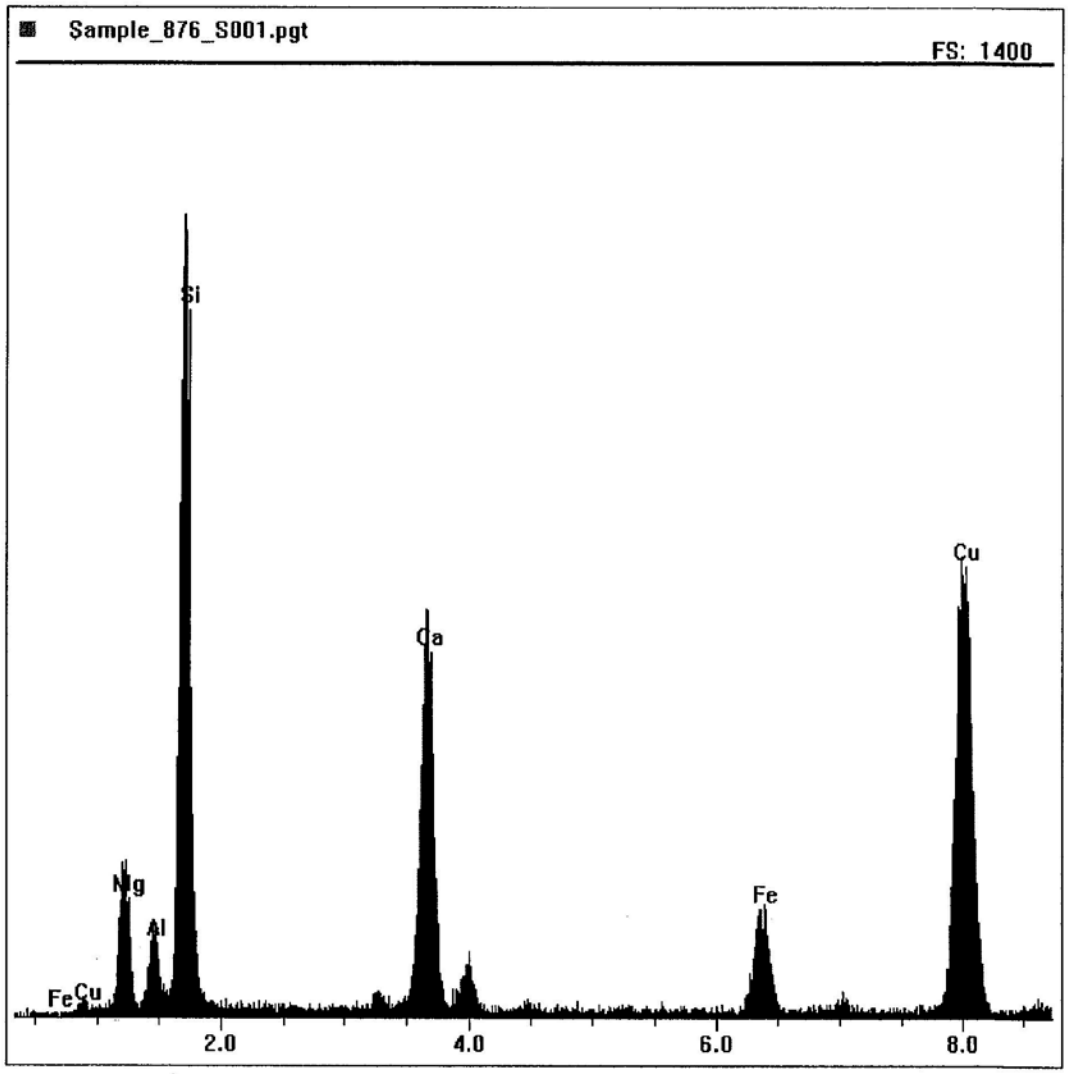
NAM = Non Asbestos Material

Energy Dispersive X-Ray Analysis
Qualitative Spectrum

EMSL ANALYTICAL, INC.

File: 041216273 PA-ATV2-AA-02 J1 H2 NAM
Collected: July 10, 2012 17:47:42

Live Time:	60.93	Count Rate:	1725	Dead Time:	31.55 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00



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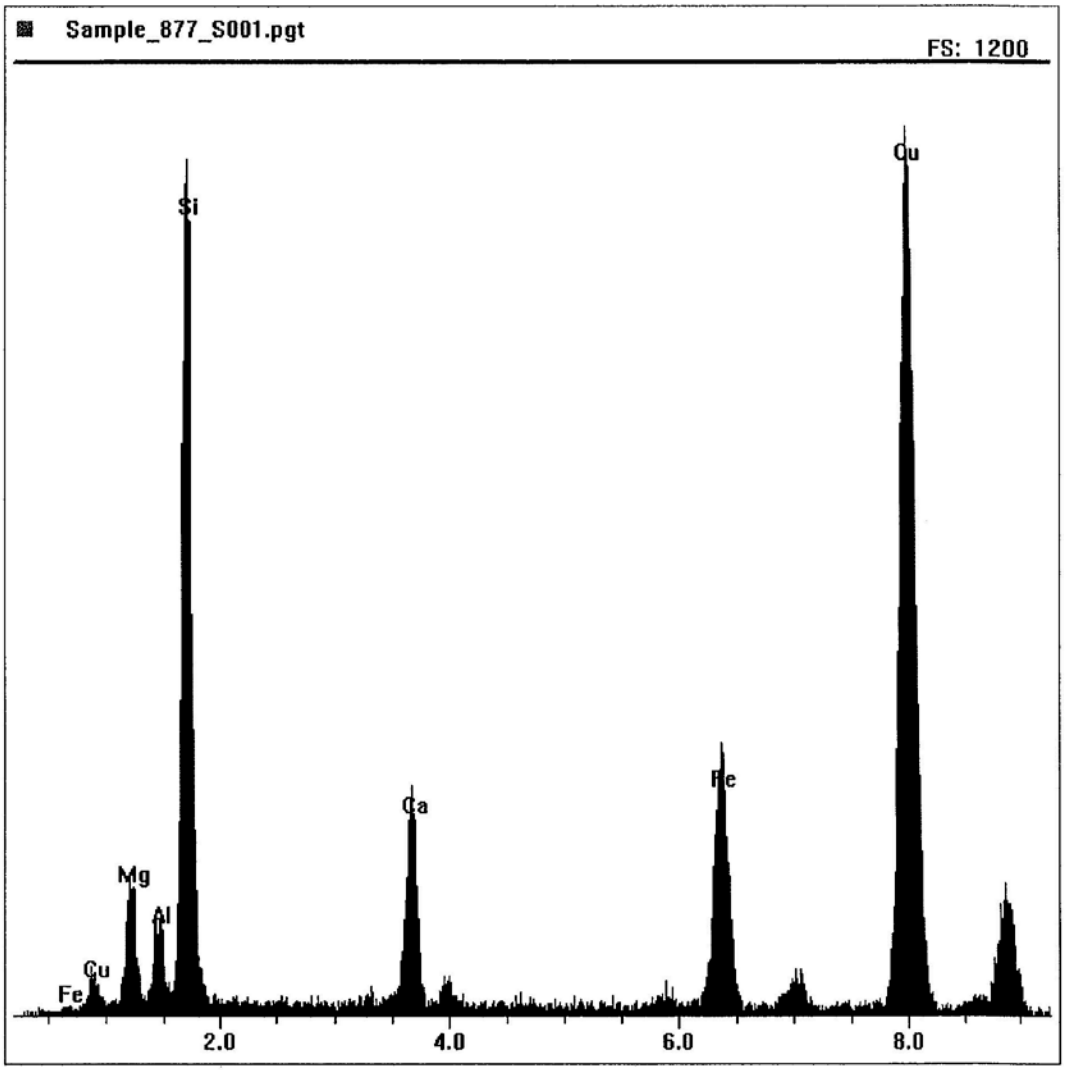
Energy Dispersive X-Ray Analysis
Qualitative Spectrum

EMSL ANALYTICAL, INC.

File: 041216273 PA-ATV2-AA-02 J2 J7 NAM
Collected: July 10, 2012 18:51:25

Live Time:	93.90	Count Rate:	1258	Dead Time:	24.44 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00



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TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID:	041216273-0034	Volume (L):	396.8	Scope:	03-01
Customer Sample:	PA-ATV2-AA-03	Prepped By:	A. FOLGAR	GO area (mm²):	0.0130
Sample Description:	Ambient	Prepped Date:	7/2/2012	Magnification:	10,000X
Pore Size (micron):	0.45	Grid Box :	0312-ERRG-02	Analyzed By:	Evie Sioukri
EFA (mm²):	385	Grid Location:	K (1-3)	Analysis Date:	7/10/12

Analysis Information

Target Sensitivity:	0.002	s/cc	Minimum Aspect Ratio: (circle one)		
GO Required:	38 ~~37~~ ES 7/10/12		none	**3:1**	5:1
GO Analyzed:	38				
Level of Analysis Chrysotile:	CD		Min Length:	>5	micron
Level of Analysis Amphibole:	ADX		Min Width:	0.25	micron

Comments:

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
K2	F2	ND									
	F4	↓									
	F6										
	F8										
	F10										
	G1										
	G3										
	G5										
	G7										
	G9										

ND= None Detected

NAM= Non Asbestos Material

Traverse Direction: Vertical
Particulate Loading: 1-3%

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID: 041216273-0034

Customer Sample ID: PA-ATV2-AA-03

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
K2	H2	ND									
	H4										
	H6										
	H8										
	I3										
	I5										
	I7										
	J2										
	J4										
	J6										
K3	A3	ND									
	A5										
	A7										
	A9										
	B2										

ND = None Detected

NAM = Non Asbestos Material

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID: 041216273-0034

Customer Sample ID: PA-ATV2-AA-03

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
K3	B4	ND									
	B6	↓									
	B8										
	B10										
	C1										
	C3										
	C5										
	C7										
	C9										
	D4										
	D6										
	D8										
	D10										

ND = None Detected

NAM = Non Asbestos Material

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID:	041216273-0035	Volume (L):	425	Scope:	03-01
Customer Sample:	PA-ATV2-AA-04	Prepped By:	AF	GO area (mm²):	0.013
Sample Description:	Ambient	Prepped Date:	7/2/12	Magnification:	10,000
Pore Size (micron):	0.45	Grid Box :	0312-ERRG-02	Analyzed By:	G. Lannuzzi
EFA (mm²):	385	Grid Location:	L1-3	Analysis Date:	7/11/12

Analysis Information

Target Sensitivity:	0.002 s/cc	Minimum Aspect Ratio: (circle one)			***Comments:***
GO Required:	~~35~~ 36 JC 7/11/12	none	**3:1**	5:1	
GO Analyzed:	36				
Level of Analysis Chrysotile:	**CD**	Min Length:	**>5**	micron	
Level of Analysis Amphibole:	**ADX**	Min Width:	**0.25**	micron	

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
L1	B2	ND									
	B4	F	Ø	Ø	9.03	1.65	NAM	NAM	//		YES
	B6	ND									
	B8	ND									
	E2	ND									
	E4	ND									
	E6	ND									
	E8	ND									
	G4	ND									
	G6	ND									

ND= None Detected NAM= Non Asbestos Material

EMSL Analytical, Inc

Particulate Loading: 3-5%
Transverse Direction: Vertical

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID: 041216273-0035

Customer Sample ID: PA-ATV2-AA-04

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
	G8	ND									
	I3	ND									
L2	B2	ND									
	B4	ND									
	B6	ND									
	B8	ND									
	D1	ND									
	D4	ND									
	D8	ND									
	F1	ND									
	F4	ND									
	F6	ND									
	H3	B	Ø	Ø	5.35	0.70	NAM	NAM	O	63147 63148	YES
	~~H5~~ 7/12	F	Ø	Ø	19.44	1.41	NAM	NAM		63149	
	H5	ND									

ND = None Detected

NAM = Non Asbestos Material

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID: 041216273-0035

Customer Sample ID: PA-ATV2-AA-04

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
B3	J7	ND									
	J5	F	Ø	Ø	5.90	1.10	NAM	NAM	▭		
	J3	ND									
	J1	ND									
	H7	ND									
	H5	ND									
	H3	ND									
	F6	ND									
	F4	ND									
	F2	ND									
	D6	ND									
	D4	ND									

ND = None Detected

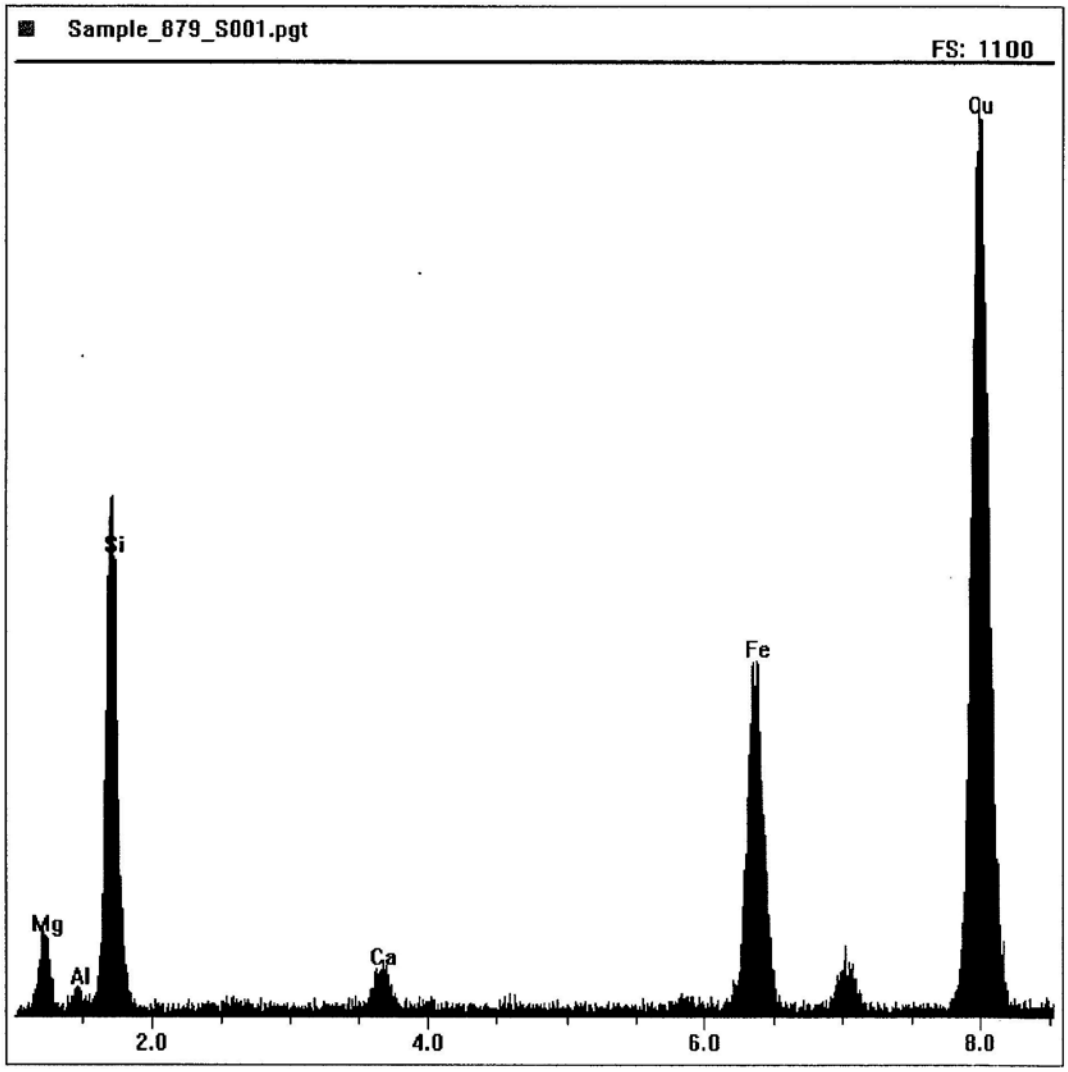
NAM = Non Asbestos Material

Energy Dispersive X-Ray Analysis
Qualitative Spectrum

EMSL ANALYTICAL, INC.

File: 041216273 PA-ATV2-AA-04 L1 B4 NAM
Collected: July 11, 2012 08:36:43

Live Time:	59.33	Count Rate:	1608	Dead Time:	31.36 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00



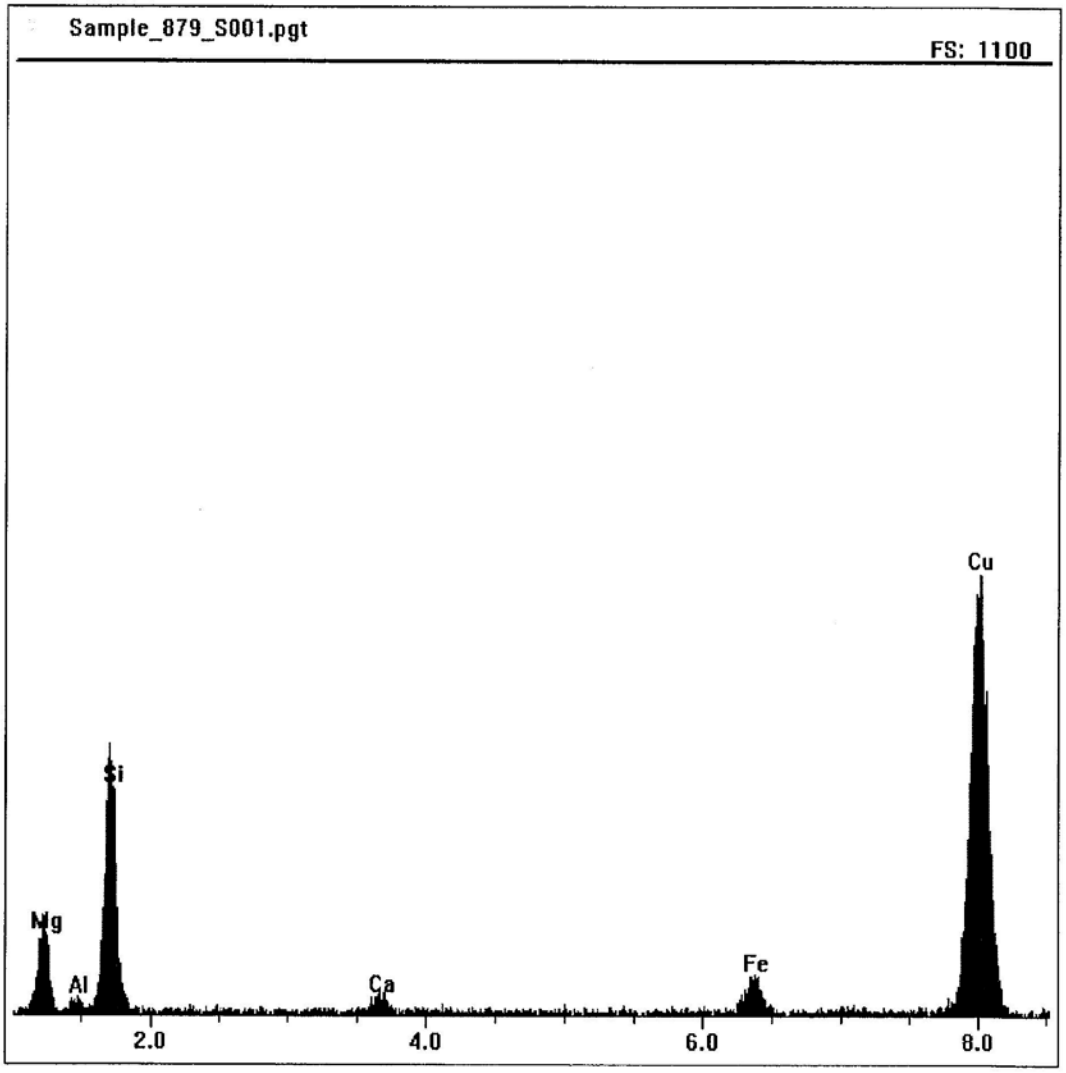
Energy Dispersive X-Ray Analysis
Qualitative Spectrum

EMSL ANALYTICAL, INC.

File: 041216273 PA-ATV2-AA-04 L2 H3 NAM

Collected: July 11, 2012 08:36:43

Live Time:	66.92	Count Rate:	591	Dead Time:	13.58 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00



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TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID:	041216273-0036	Volume (L):	513.36	Scope:	03-01
Customer Sample:	PA-ATV2-AA-05	Prepped By:	AF	GO area (mm²):	0.013
Sample Description:	Ambient	Prepped Date:	7/2/12	Magnification:	10,000
Pore Size (micron):	0.45	Grid Box :	0312 ERRG02	Analyzed By:	G. Lunnozzi
EFA (mm²):	385	Grid Location:	M1-3	Analysis Date:	7/11/12

Analysis Information

Target Sensitivity:	0.002 s/cc	Minimum Aspect Ratio: (circle one)			***Comments:***
GO Required:	~~29~~ 30 ~~28~~ 7/11/12	none	**3:1**	5:1	
GO Analyzed:	30				
Level of Analysis Chrysotile:	**CD**	Min Length:	**>5**	micron	
Level of Analysis Amphibole:	**ADX**	Min Width:	**0.25**	micron	

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
M1	B2	ND									
	B4	↓									
	B6										
	B8										
	B10										
	D2										
	D4										
	D6										
	D8										
	D10	✓									

ND= None Detected

NAM= Non Asbestos Material

EMSL Analytical, Inc

Particulate loading: 1-3%
Transverse Direction: Vertical

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID: 041216273-0036

Customer Sample ID: PA-ATV2-AA-05

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
M2	B2	ND									
	B4										
	B6										
	B8										
	F3										
	F5										
	F7										
	H2										
	H4										
	H6										
M3	J7										
	J5										
	J3										
	H10										
	H5										

ND = None Detected

NAM = Non Asbestos Material

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID: 041216273-0036

Customer Sample ID: PA-ATV2-AA-05

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
	H2	ND									
	D8	↓									
	D6	↓									
	D3	↓									
	B7	↓									

ND = None Detected

NAM = Non Asbestos Material

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID:	041216273-0037	Volume (L):	432.18	Scope:	03-01
Customer Sample:	PA-ATV2-AM-01	Prepped By:	AF	GO area (mm²):	0.013
Sample Description:	ABS	Prepped Date:	7/11/12	Magnification:	10,000
Pore Size (micron):	0.45	Grid Box :	0312ERRG02	Analyzed By:	Glunnizzi
EFA (mm²):	385	Grid Location:	N 1-3	Analysis Date:	7/11/12

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)			**Comments:**
GO Required:	~~18~~ 19 ~~12~~ 7/11/12	none	**3:1**	5:1	
GO Analyzed:	19				
Level of Analysis Chrysotile:	**CD**	Min Length:	**>5**	micron	
Level of Analysis Amphibole:	**ADX**	Min Width:	**0.25**	micron	

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
N1	H8	ND									
	H6	ND									
	H4	ND									
	F8	ND									
	F6	ND									
	F4	ND									
	C7	MD11	1		13.10	9.03					
		MB		Ø	5.25	0.45	NAM	NAM			YES
N2	H9	ND									
	H7	ND									

ND= None Detected

NAM= Non Asbestos Material

EMSL Analytical, Inc

particulate loading: 1-3%
Transverse Direction: Vertical

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID: 041216273-0037

Customer Sample ID: PA-ATV2-AM-01

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
	H5	ND									
	F9	ND									
	F7	ND									
	F5	ND									
N3	B2	ND									
	B4	ND									
	B6	F	Ø	Ø	5.25	0.75	NAM	NAM			
		F	Ø	Ø	6.16	0.70	NAM	NAM			
	F2	ND									
	F4	F	Ø	Ø	31.61	1.41	NAM	NAM			
	H2	ND									

ND = None Detected

NAM = Non Asbestos Material

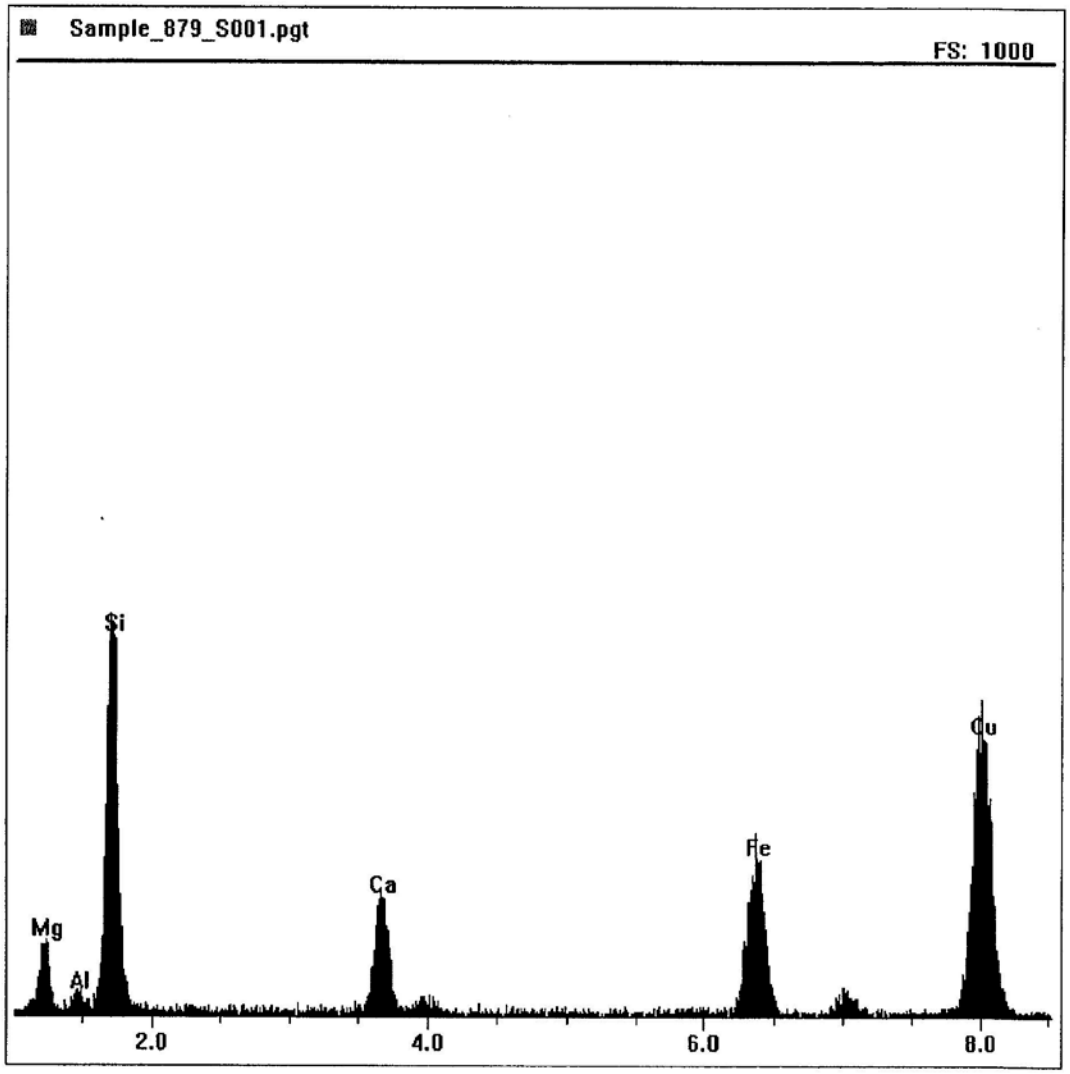
Energy Dispersive X-Ray Analysis
Qualitative Spectrum

EMSL ANALYTICAL, INC.

File: 041216273 PA-ATV2-AM-01 N1 C7 NAM

Collected: July 11, 2012 08:36:43

Live Time:	141.50	Count Rate:	301	Dead Time:	8.42 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00



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TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID:	041216273-0038	Volume (L):	390.96	Scope:	03-01
Customer Sample:	PA-ATV2-AM-02	Prepped By:	AF	GO area (mm²):	0.013
Sample Description:	ABS	Prepped Date:	7/2/12	Magnification:	10,000
Pore Size (micron):	0.45	Grid Box:	03MERR602	Analyzed By:	Glanner
EFA (mm²):	385	Grid Location:	01-3	Analysis Date:	7/11/12

Analysis Information

Target Sensitivity:	0.004	s/cc	Minimum Aspect Ratio: (circle one)		
GO Required:	~~18~~ 20 8 7/11/12		none	**3:1**	5:1
GO Analyzed:	20				
Level of Analysis Chrysotile:	CD		Min Length:	>5	micron
Level of Analysis Amphibole:	ADX		Min Width:	0.25	micron

Comments:

X^2 = 21.667 = Random

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
01	8 7/11 G9H9	ND									
	8 7/11 G7H7	ND									
	7/11 G5H5	ND									
	F9	ND									
	F7	F	Ø	Ø	9.35	0.65	NAM	NAM			YES
	F5	F	1	1	30.06	0.70	CD	CH		63150 63151	YES
	D8	ND									
02	C4	ND									
	C6	ND									
	C8	ND									

ND= None Detected

NAM= Non Asbestos Material

EMSL Analytical, Inc

Particulate loading 3-5%
Transverse Direction: Vertical

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID: 041216273-0038

Customer Sample ID: PA-ATV2-AM-02

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
	H3	ND									
	H5	ND									
	H7	ND									
03	H8	ND									
	H6	F	Ø	Ø	5.15	0.53	NAM	NAM			
		F	2	2	10.17	0.75	CD	CH			
	H4	ND									
	F8	ND									
	F6	ND									
	F4	ND									
	D6	ND									

ND = None Detected

NAM = Non Asbestos Material

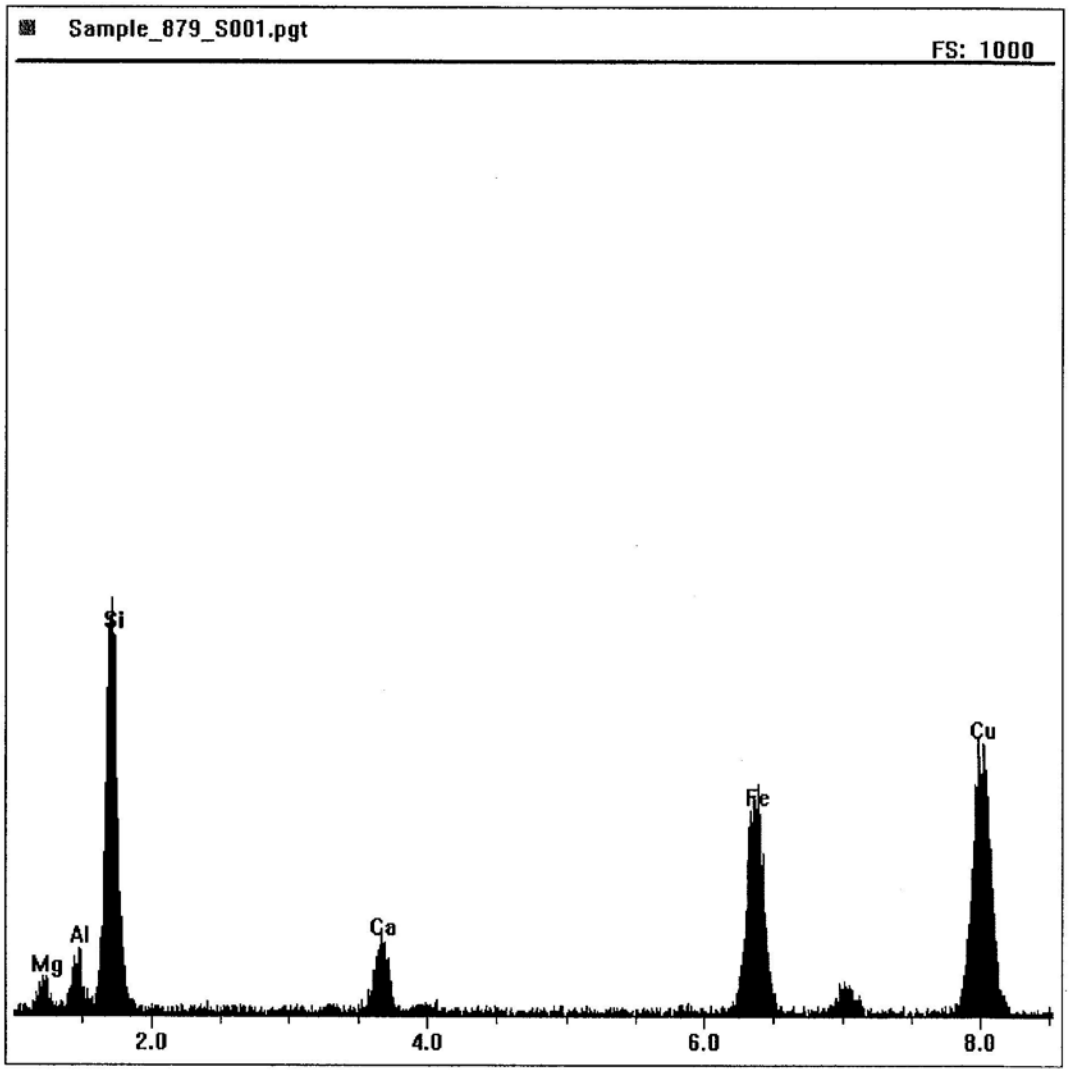
Energy Dispersive X-Ray Analysis
Qualitative Spectrum

EMSL ANALYTICAL, INC.

File: 041216273 PA-ATV2-AM-02 O1 F7 NAM

Collected: July 11, 2012 08:36:43

Live Time:	114.92	Count Rate:	380	Dead Time:	9.92 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00



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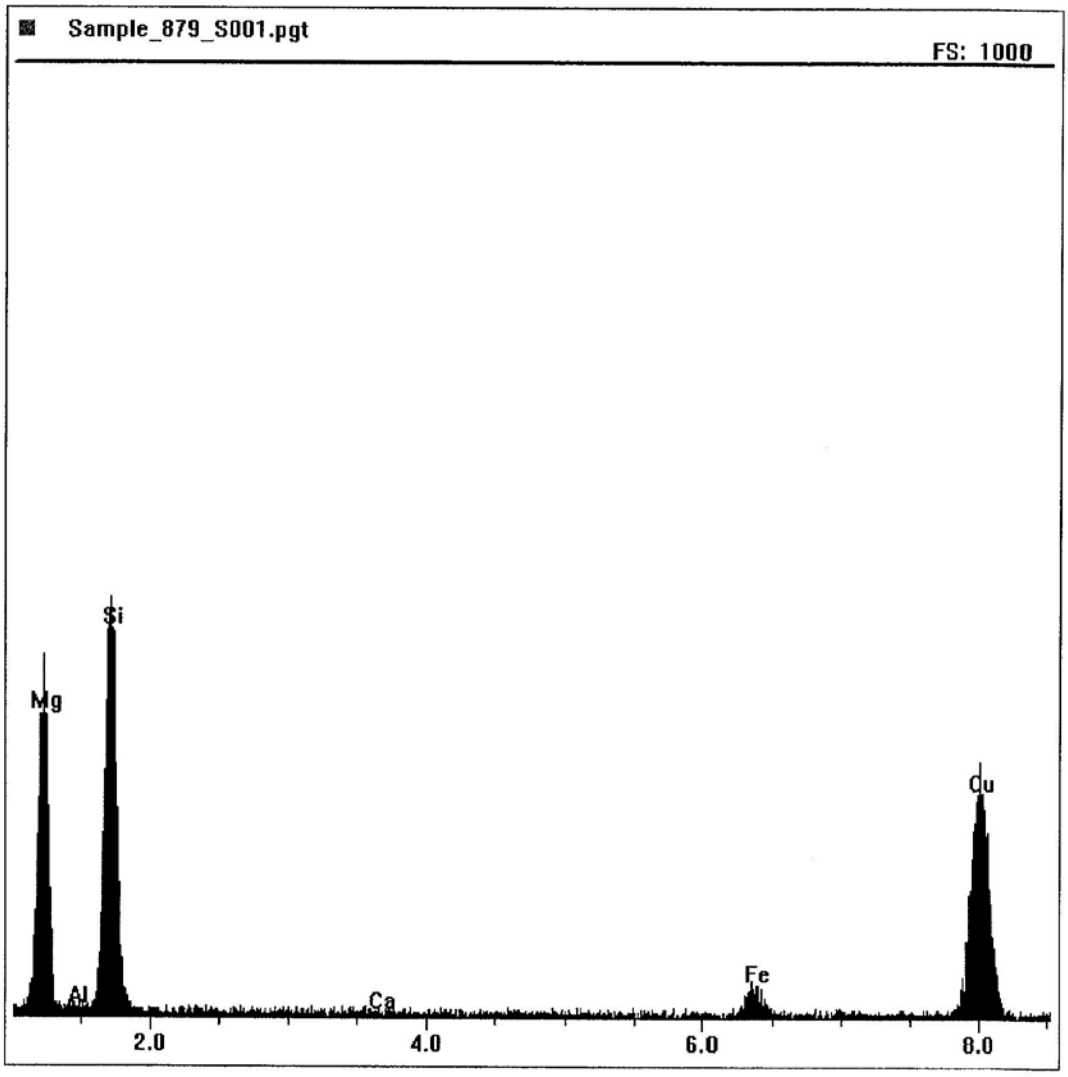
Energy Dispersive X-Ray Analysis
Qualitative Spectrum

EMSL ANALYTICAL, INC.

File: 041216273 PA-ATV2-AM-02 O1 F5 1 Chrysotile

Collected: July 11, 2012 08:36:43

Live Time:	56.77	Count Rate:	657	Dead Time:	14.28 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00



EMSL

CHRYSOTILE SAED INDEXING FORM

EMSL Order ID : 041216273 DATE: 07/11/12

Indexing of negative number: 63151 SCOPE #: 03-01

Reference / Sample Number: PA-ATV2-AM-02

Preliminary ID: Chrysotile By: GI

Using Camera Constant of: 21.89 mm Angstroms

Determined from negative number: 63094

Quick Check

Measured Inter-row spacing: 4 mm

110 reflections present? Enter Yes or No Yes

200 doublets present? Enter Yes or No Yes

Full Index

Measured distance, center spot to closest hk0 spot (002):	3.04	mm
Measured distance, center spot to closest hk1 spot (110):	4.60	mm

	Calculated	Ref	-5%	+5%
Inter-row spacing (Ångstroms)	**5.47**	**5.30**	**5.035**	**5.565**
Angle to 110 reflection (Measured °)	59.5	**60.0**	**57.0**	**63.0**
d2 or d hk 0 (002) (Angstroms)	**7.21**	**7.32**	**6.954**	**7.686**
d1 or d hk 1 (110) (Angstroms)	**4.76**	**4.58**	**4.351**	**4.809**

From SAED Reference Book, "unknown" diffraction pattern was found to be that of: Chrysotile By: DY

Preliminary Identification was: [X] CORRECT

[ ] INCORRECT

percent accuracy to date: 100

55:31:51

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID:	041216273-0039	Volume (L):	367.56	Scope:	03-01
Customer Sample:	PA-ATV2-AM-03	Prepped By:	AF	GO area (mm²):	0.013
Sample Description:	ABS	Prepped Date:	7/2/12	Magnification:	10,000
Pore Size (micron):	0.45	Grid Box :	0312ERRG02	Analyzed By:	Glannizzi
EFA (mm²):	385	Grid Location:	P1-3	Analysis Date:	7/11/12

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)			***Comments:***
GO Required:	~~24~~ 22 ~~8~~ 7/11	none	**3:1**	5:1	
GO Analyzed:	22				
Level of Analysis Chrysotile:	CD	Min Length:	>5	micron	
Level of Analysis Amphibole:	ADX	Min Width:	0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
P1	B2	ND									
	B4	ND									
	B6	ND									
	B8	ND									
	G2	ND									
	G4	ND									
	G6	ND									
	I3	ND									
P2	D3	ND									
	D5	ND									

ND= None Detected NAM= Non Asbestos Material

EMSL Analytical, Inc

Particulate Loading: 10-15%
Transverse Direction: Vertical

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID: 041216273-0039

Customer Sample ID: PA-ATV2-AM-03

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
	D7	ND									
	D9	ND									
	G3	ND									
	G5	ND									
	G7	ND									
P3	H9	ND									
	H7	ND									
	H5	ND									
	D9	ND									
	D7	ND									
	D5	ND									
	B8	ND									

ND = None Detected

NAM = Non Asbestos Material

TEM ISO 13794
Asbestos Count Sheet

EMSL Sample ID:	041216273-0040	Volume (L):	421.56	Scope:	JEOL 1200 EX (04-05)
Customer Sample:	PA-ATV2-AM-04	Prepped By:	D. Stanhope	GO area (mm²):	0.0132
Sample Description:	ABS	Prepped Date:	7/11/12	Magnification:	20kx
Pore Size (micron):	0.45	Grid Box :	Special Project	Analyzed By:	P. Harrison
EFA (mm²):	~~385~~ 364.9 7/23/12 DM	Grid Location:	E	Analysis Date:	7/20/12

Analysis Information

Target Sensitivity:	0.004	s/cc	Minimum Aspect Ratio: (circle one)			***Comments:***
GO Required:	10		none	**3:1**	5:1	Indirect prep, please check prep record for filter analysis.
GO Analyzed:	10					
Level of Analysis Chrysotile:	CD		Min Length:	>5	micron	Filter aliquot used: 5 mL
Level of Analysis Amphibole:	ADX		Min Width:	0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
E5	H9	ND									
E6	F5										
↓	D7										
E8	C6										
|	D4										
|	E6										
|	F2										
|	G6										
|	H4	PH 7/20/12									
✓	I6	FQ	0	0	15.8	2.1	NAM	NAM	[redacted]	03300	1

ND= None Detected

NAM= Non Asbestos Material

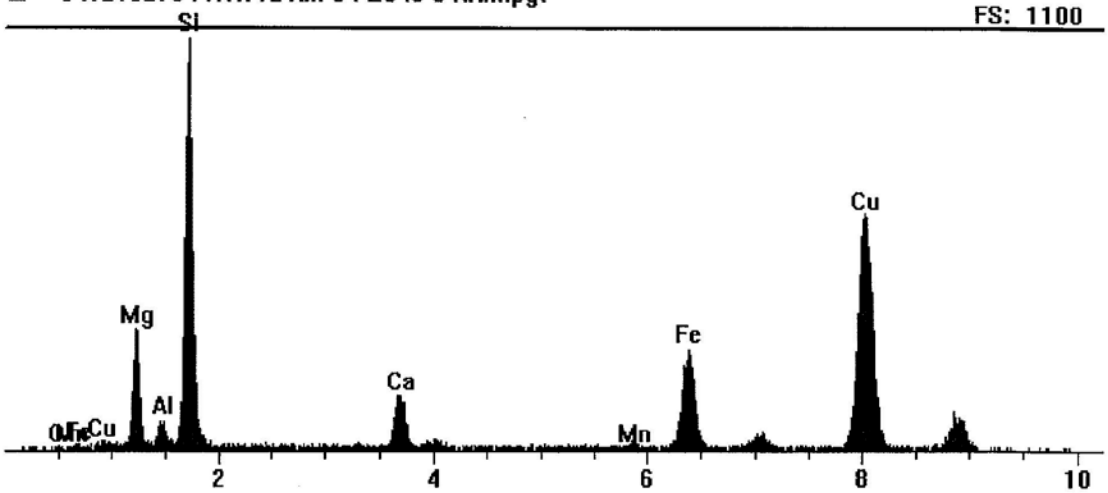
Energy Dispersive X-Ray Analysis
Quantitative Spectra & Data

EMSL ANALYTICAL, INC.

File: L:\EDS Spe...ope 04-03\2012\041216273 PA-ATV2-AM-04 E8 I6 0 NAM.pgt
Collected: July 20, 2012 08:38:41

Live Time:	187.88	Count Rate:	411	Dead Time:	8.40 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00
Thickness limit:	34899.81				

041216273 PA-ATV2-AM-04 E8 I6 0 NAM.pgt



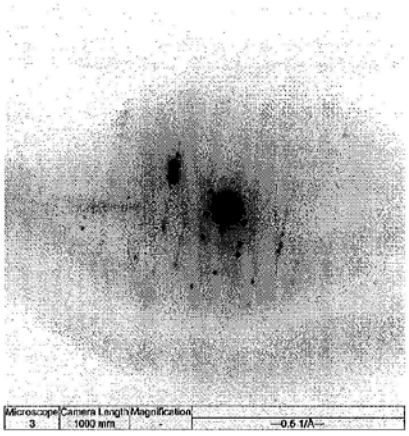
Element	Line	keV	CL Ratio	Wt%	At%	At Prop	Compound	Cmpd Wt%
Mg	KA1	1.254	0.9349	2.60	3.43	4.8	MgO	4.31
Al	KA1	1.487	0.9545	0.54	0.64	0.9	Al2O3	1.02
Si	KA1	1.740	1.0000	10.42	11.89	16.5	SiO	16.36
Ca	KA1	3.691	1.5184	2.91	2.32	3.2	CaO	4.07
Mn	KA1	5.898	2.5410	0.26	0.15	0.2	MnO	0.34
Fe	KA1	6.403	2.7559	11.58	6.64	9.2	Fe2O3	16.55
Cu	KA1	8.046	3.9376	45.81	23.10	32.1	CuO	57.35
O	KA1	0.523	0.0000	25.88	51.82	72.0		
Total			**0.0000**	**100.00**	**100.00**	**138.9**	**Total**	**100.00**

Element	Line	Gross (cps)	BKG (cps)	Net (cps)
Mg	KA1	23.0	1.9	21.1
Al	KA1	6.4	2.1	4.3
Si	KA1	81.1	2.1	78.9
Ca	KA1	16.0	1.5	14.5
Mn	KA1	2.3	1.5	0.8
Fe	KA1	33.4	1.5	31.8
Cu	KA1	89.8	1.7	88.1
O	KA1	0.5	0.4	0.0

AMPHIBOLE SAED INDEXING FORM

EMSL Order Number:	041216273	**Date:**	Jul 20, 2012
Image Number:	03300		
Reference / Sample Number:	0040		
Preliminary ID:	NRA		
Camera Constant:	1.875e-003	**1/A Pixels**	
Calibration Reference:	072012-04-03-03297_C		

	Measured	Reference	-5%	+5%
Inter-row Spacing:	5.270	5.300	5.035	5.565
d2 or hk0 (Camera K/zero row dist.):	N/A	N/A	-	-
d1 or hkl (Camera K/slant vector dist.):	N/A	N/A	-	-
Ratio of hk0/hkl:	N/A	N/A	-	-
Vector Angle:	N/A	N/A	-	-



From SAED Reference Book, "unknown" diffraction pattern was found to be that of: **NRA**

With a Zone Axis of: [**N/A**]

Preliminary Identification was:

- [ ] CORRECT
- [ ] INCORRECT

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID:	041216273-0041	Volume (L):	464.58	Scope:	03-01
Customer Sample:	PA-ATV2-AM-05	Prepped By:	A. Folgar	GO area (mm²):	0.013
Sample Description:	ABS	Prepped Date:	7/2/12	Magnification:	10,000x
Pore Size (micron):	0.45	Grid Box :	0312-ERRG-02	Analyzed By:	D. Young
EFA (mm²):	385	Grid Location:	Q(1-3)	Analysis Date:	7/11/12

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)			***Comments:***
GO Required:	~~16~~ 17 D. Young 7/11/12	none	**3:1**	5:1	
GO Analyzed:	17				
Level of Analysis Chrysotile:	CD	Min Length:	>5	micron	
Level of Analysis Amphibole:	ADX	Min Width:	0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
Q1	G10	ND									
	G8	↓									
	G6	↓									
	G4	↓									
	G2	↓									
	D1	↓									
	D3	↓									
	D5	↓									
	D7	↓									
	D9	↓									

ND= None Detected

NAM= Non Asbestos Material

Particulate Loading: 7-10%

Traverse Direction: Vertical

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID: 041216273-0041

Customer Sample ID: PA-ATV2-AM-05

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
Q2	E1	ND									
	E3										
	E5										
	E7										
	E9										
	H10										
	H8										

ND = None Detected

NAM = Non Asbestos Material

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID:	041216273-0042	Volume (L):	372.96	Scope:	03-01
Customer Sample:	PA-BG-AM-01	Prepped By:	A. Folgar	GO area (mm²):	0.013
Sample Description:	ABS	Prepped Date:	7/2/12	Magnification:	10,000x
Pore Size (micron):	0.45	Grid Box :	0312-ERRG-02	Analyzed By:	D. Young
EFA (mm²):	385	Grid Location:	B (1-3)	Analysis Date:	7/11/12

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)			***Comments:***
GO Required:	~~20~~ 21 D. Young 7/11/12	none	**3:1**	5:1	
GO Analyzed:	21				
Level of Analysis Chrysotile:	**CD**	Min Length:	**>5**	micron	
Level of Analysis Amphibole:	**ADX**	Min Width:	**0.25**	micron	

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
B1	H2	ND									
	H4										
	H6										
	H8										
	H10										
	D10										
	D8										
	D6										
	B2										
	B4										

ND= None Detected

NAM= Non Asbestos Material

EMSL Analytical, Inc

Traverse Direction: Vertical
Particulate Loading: 7-10%

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID: 041216273-0042

Customer Sample ID: PA-BG-AM-01

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
R2	F1	ND									
	F3										
	F5										
	F7										
	F9										
	B10										
	B8										
	B6										
	B4										
	B2										
	D2										

ND = None Detected

NAM = Non Asbestos Material

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID:	041216273-0043	Volume (L):	363.78	Scope:	03-01
Customer Sample:	PA-BG-AM-02	Prepped By:	AF	GO area (mm²):	0.013
Sample Description:	ABS	Prepped Date:	7/2/12	Magnification:	10,000
Pore Size (micron):	0.45	Grid Box :	0312ERRG-02	Analyzed By:	G. Lannozzi
EFA (mm²):	385	Grid Location:	S1-3	Analysis Date:	7/11/12

Analysis Information

Target Sensitivity:	**0.004** s/cc	Minimum Aspect Ratio: (circle one)			***Comments:***
GO Required:	~~21~~ 22 27/11/12	none	**3:1**	5:1	
GO Analyzed:	22				
Level of Analysis Chrysotile:	**CD**	Min Length:	**>5**	micron	
Level of Analysis Amphibole:	**ADX**	Min Width:	**0.25**	micron	X^2=24.846 = Random

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
S1	C2	ND									
	C4	ND									
	C6	ND									
	F2	ND									
	F4	ND									
	F6	ND									
	H4	ND									
	H6	ND									
S2	C3	ND									
	C5	ND									

ND= None Detected NAM= Non Asbestos Material

EMSL Analytical, Inc

Particulate loading: 5-7%
Transverse Direction: Vertical

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID: 041216273-0043

Customer Sample ID: PA-BG-AM-02

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
	C7	ND									
	G3	ND									
	G5	ND									
	G7	ND									
	I5	ND									
53	D4	ND									
	D6	ND									
	D8	ND									
	G3	MD11	1		148.99	9.72	CD	CH			
		MB		1	148.99	0.95	CD	CH		63152 63153	YES
	G5	ND									
	G7	ND									
	I6	ND									

ND = None Detected

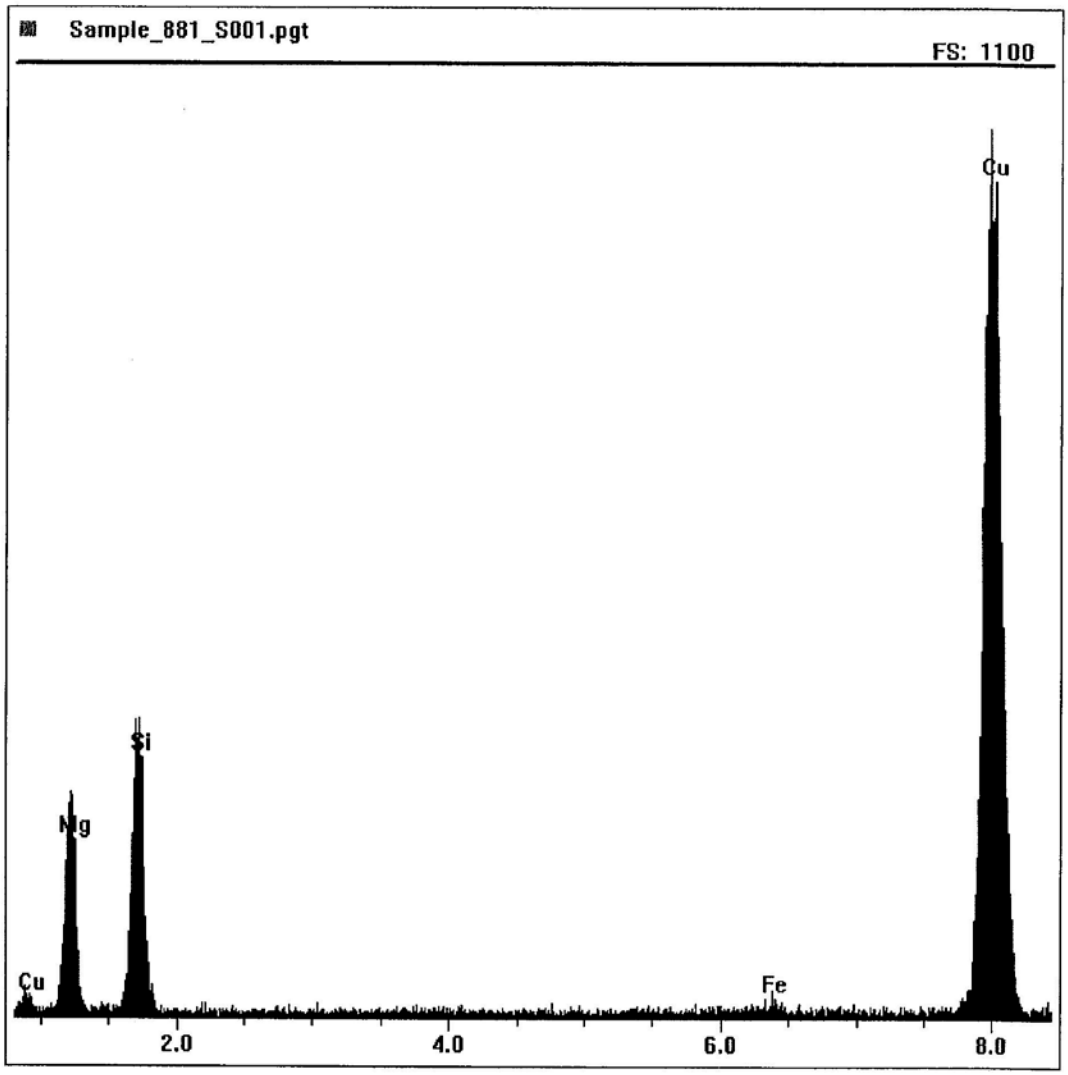
NAM = Non Asbestos Material

Energy Dispersive X-Ray Analysis
Qualitative Spectrum

EMSL ANALYTICAL, INC.

File: 041216273 PA-BG-AM-02 S3 G3 1 Chrysotile
Collected: July 11, 2012 14:33:10

Live Time:	16.03	Count Rate:	4351	Dead Time:	64.78 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00



EMSL Analytical Inc. 307 West 38th Street, New York, NY, 10118
TEL: (212) 290-0051 • FAX: (212) 290-0058 • www.EMSL.com
Locally Focused ... Nationally Recognized

CHRYSOTILE SAED INDEXING FORM

EMSL Order ID : 041216273 DATE: 07/11/12

Indexing of negative number: 63152 SCOPE #: 03-01

Reference / Sample Number: PA-BG-AM-02

Preliminary ID: Chrysotile By: GI

Using Camera Constant of: 21.89 mm Angstroms

Determined from negative number: 63094

Quick Check

Measured Inter-row spacing: 4 mm

110 reflections present? Enter Yes or No Yes

200 doublets present? Enter Yes or No Yes

Full Index

Measured distance, center spot to closest hk0 spot (002):	3.00	mm
Measured distance, center spot to closest hk1 spot (110):	4.75	mm

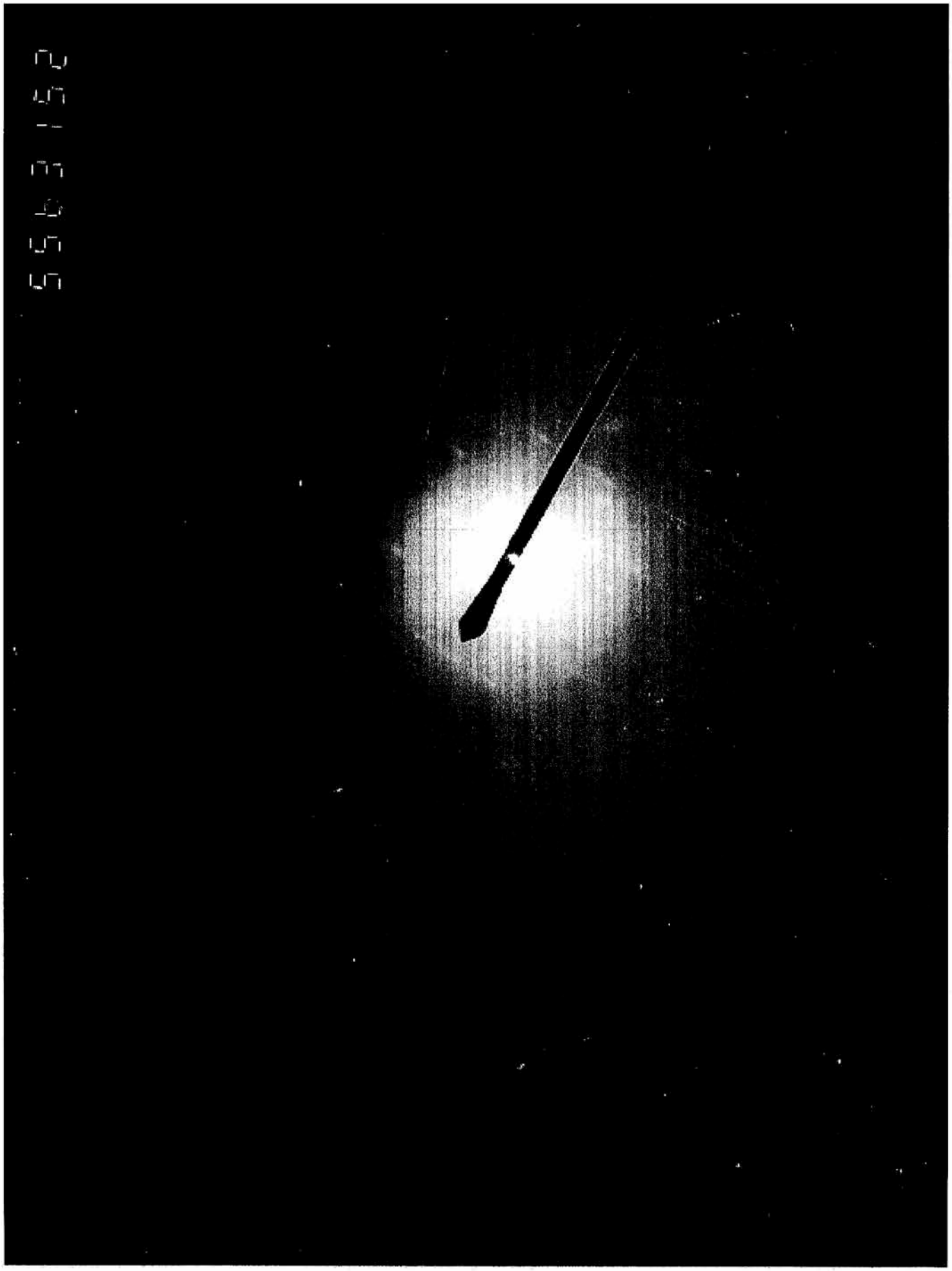
	Calculated	Ref	- 5%	+ 5%
Inter-row spacing (Ångstroms)	**5.47**	**5.30**	**5.035**	**5.565**
Angle to 110 reflection (Measured °)	63	**60.0**	**57.0**	**63.0**
d2 or d hk 0 (002) (Angstroms)	**7.30**	**7.32**	**6.954**	**7.686**
d1 or d hk 1 (110) (Angstroms)	**4.61**	**4.58**	**4.351**	**4.809**

From SAED Reference Book, "unknown" diffraction pattern was found to be that of: Chrysotile By: DY

Preliminary Identification was: [X] CORRECT

[ ] INCORRECT

percent accuracy to date: 100



TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID:	041216273-0044	Volume (L):	361.08	Scope:	03-01
Customer Sample:	PA-BG-AM-03	Prepped By:	AF	GO area (mm²):	0.013
Sample Description:	ABS	Prepped Date:	7/2/12	Magnification:	10,000
Pore Size (micron):	0.45	Grid Box :	0312ERRG-02	Analyzed By:	G. Lannozzi
EFA (mm²):	385	Grid Location:	T1-3	Analysis Date:	7/11/12

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)			**Comments:**
GO Required:	~~21~~ 22 AR 7/11	none	**3:1**	5:1	
GO Analyzed:	22				
Level of Analysis Chrysotile:	CD	Min Length:	>5	micron	
Level of Analysis Amphibole:	ADX	Min Width:	0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
T1	C2	ND									
	C4	ND									
	C6	ND									
	C8	ND									
	G2	ND									
	G4	ND									
	G6	ND									
	G8	ND									
T2	I7	ND									
	I5	ND									

ND= None Detected NAM= Non Asbestos Material

EMSL Analytical, Inc

Particulate loading: 1-3%
Transverse Direction: Vertical

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID: 041216273-0044

Customer Sample ID: PA-BG-AM-03

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
	I3	ND									
	C8	ND									
	C6	ND									
	C4	ND									
	C2	ND									
B	H8	ND									
	H6	ND									
	H4	ND									
	H2	ND									
	D8	ND									
	D6	ND									
	D4	ND									

ND = None Detected

NAM = Non Asbestos Material

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID:	041216273-0045	Volume (L):	512.28	Scope:	JEOL 1200 Ex (04-03)
Customer Sample:	PA-BG-AM-04	Prepped By:	SM	GO area (mm²):	0.0130
Sample Description:	ABS	Prepped Date:	6.25.12	Magnification:	20,000X
Pore Size (micron):	0.45	Grid Box :	Special Project	Analyzed By:	P Harrison
EFA (mm²):	385	Grid Location:	B	Analysis Date:	6/26/12

Analysis Information

Target Sensitivity:	0.004	s/cc	Minimum Aspect Ratio: (circle one)		
GO Required:	15		none	**3:1**	5:1
GO Analyzed:	15				
Level of Analysis Chrysotile:	CD		Min Length:	>5	micron
Level of Analysis Amphibole:	ADX		Min Width:	0.2	micron

Comments: 2% particulate loading vertical traverse

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
B7	J1	ND									
	I4										
	G6										
	F2										
	D1										
	A5										
B8	J1										
	I3										
	E4										
	D6										

ND= None Detected

NAM= Non Asbestos Material

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID: 041216273-0045

Customer Sample ID: PA-BG-AM-04

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
B8	A4	~~NST~~ PK	ND								
B9	E5	Fiber									
	D2										
	C7										
	B4										
	A1										

ND = None Detected

NAM = Non Asbestos Material

National Asbestos Data Entry Spreadsheet (NADES) for Air & Dust Analysis by Superfund TEM

SAMPLE/ANALYSIS INFORMATION

Enter Site or Project Name Here:	2011-149 Phillips Mine
State/Federal Site or Project Identifier:	

Site/Project Identifier Code:	2011-149

Laboratory name:		EMSL04
Instrument:		JEOL 1200 EX
Voltage (kV):		100
Magnification: Enter one or more (a)		20,000 x
Grid opening area (mm²):		0.0130
	High Mag:	Low Mag:
Scale: 1L =	1.000	1.000
Scale: 1D =	1.000	1.000
Filter Size (mm):		
Filter Pore Size (um):		
Method SOP (Revision No.):		
Grid Storage Location:		
Archive filter(s) storage location:		Cinnaminson

Client Sample Number:	PA-BG-AM-04
Date received by lab:	06/22/12
Lab Job Number:	041216273
Lab Sample Number:	041216273-~~0003~~ 0045
Chain of Custody Number:	RD 6-27-12
Sample Type: (FS=Field Sample, FB=Field Blank, LT=Lot Blank, QC=Lab QC)	FS
QC Sample Type: (Not QC, LB=Lab Blank, RS=Recount Same, RD, Recount Diff., RP=Reprep., VA=Verified Analysis, IL=Interlab)	Not QC
Media: (Air, Dust, Dustfall, N/A)	Air
Air volume (L), dust area (cm²), or dustfall container area (cm²):	512

Number of grids prepared:	3
Prepared by:	
Preparation date:	
Preparation Type: (D=Direct, I=Indirect, IA=Indirect, ashed)	
If sample type = air, is there loose material or debris in the cowl? (Y/N)	
Primary Filter Area (mm²):	385
Secondary Filter Area (mm²):	
F- factor:	
Filter Status: (A=Analyzed, O=Overloaded, D=Damaged, M=Missing, C=Cancelled)	A
Analyzed by:	PHarrison
Analysis date:	6/26/12

F-factor Input Parameters:

Indirect Prep Inputs

	Fraction of primary filter used for indirect prep or ashing [For dust and dustfall, enter 1.0]
	First resuspension volume or rinsate volume (mL)
	Volume applied to secondary filter (mL) or used for serial dilution

Inputs for Serial Dilutions

	Second resuspension volume (mL)
	Volume applied to secondary filter (mL) or used for serial dilution
	Third resuspension volume (mL)
	Volume applied to secondary filter (mL)

Input for Ashing of Secondary Filter:

	Fraction of secondary filter used for ashing

Project Stopping Rules:

Maximum Area Examined (mm²):	
Total Number of Asbestos Structures Observed Equals:	
Analytical Sensitivity is at least:	0.004

Project Recording Rules:

Minimum Aspect Ratio:	3:1
Minimum Length (µm):	>5.0
Minimum Width (µm):	>0.25

COMMENTS

2% particulate loading

(a) Enter one or both magnifications (high and/or low) in this box. Examples: 20,000x OR 5,000x OR 20,000/5,000x

If sample was analyzed using more than one TEM instrument, enter TEM Instrument details below.

	Instrument #2	Instrument #3
Instrument:		
Voltage (KV):		
Magnification:		

If sample was analyzed by more than one analyst or across multiple analysis dates, enter analysis details below.

	Analyst #2	Analyst #3
Analyzed by:		
Analysis date:		

IMPORTANT NOTE: If this sample was analyzed using more than one instrument, by more than one analyst, or across multiple analysis dates, be sure to complete the column labeled "Multiple" when entering raw structure results for each grid opening.

National Asbestos Data Entry Spreadsheet (NADES) for Air & Dust Analysis by Superfund TEM

STRUCTURE INFORMATION

Client Sample No.:	PA-BG-AM-04	Sample Type	FS	Preparation Type	
Lab Sample No.:	041216273-0003	QC Sample Type	Not QC	Analysis Date	6/26/12

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (a)		Identification Code (b)	Mineral Type (c)	Other Mineral Description	1 = yes, blank = no			Multiple (d)	Low Mag	Comments
			Primary	Total	Length	Width				Sketch	Photo	EDS			
B7	J1	ND													
	I4	ND													
	G6	ND													
	F2	ND													
	D1	ND													
	A5	ND													
B8	J1	ND													
	I3	ND													
	E4	ND													
	D6	ND													
	A4	ND													
B9	E5	ND													
	D2	ND													
	C7	ND													
	B4	ND													
	A1	ND													
						PA									
						6/26/12									

(a) Enter dimensions either in absolute units (um) or in screen units. If reported as screen units, confirm that the Length & Dimension Scales are set as appropriate.
(b) See Annex D of ISO 10312 for identification codes.
(c) Valid Mineral Types:

AC	actinolite	CH	chrysotile	LA	Libby amphibole	OM	other mineral type (specify in "other mineral description" field)
AM	amosite	CR	crocidolite	OA	other amphibole	Amosite	Solid solution series: Amosite, cummingtonite-grunerite
AN	anthophyllite	TR	tremolite	NAM	non-asbestos material	Trem-Act	Solid solution series: Tremolite-Actinolite

(d) Populate this field only if sample was analyzed using more than one instrument, by more than one analyst, or across multiple analysis dates.
(e) If the analyst changes to low magnification, populate this field with a numerical value for what the analysts has chosen.

Grid opening traverse direction (circle one):
H Horizontal
V Vertical

Are prepped grids acceptable for analysis? (circle one) Yes No
If No, explain:

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID:	**041216273-0046**	Volume (L):	429.3	Scope:	03-01
Customer Sample:	PA-BG-AA-01	Prepped By:	A. Folgar	GO area (mm²):	0.013
Sample Description:	Ambient	Prepped Date:	7-2-12	Magnification:	10,000 x
Pore Size (micron):	0.45	Grid Box :	0312-ERRG-02	Analyzed By:	José Arriaga
EFA (mm²):	385	Grid Location:	U (1-3)	Analysis Date:	7-11-12

Analysis Information

Target Sensitivity:	**0.002**	s/cc	Minimum Aspect Ratio: (circle one)		
GO Required:	~~35~~ 36 JC 7-11-12		none	**3:1**	5:1
GO Analyzed:	36				
Level of Analysis Chrysotile:	**CD**		Min Length:	**>5**	micron
Level of Analysis Amphibole:	**ADX**		Min Width:	**0.25**	micron

Comments:

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
U1	I8	ND									
	I6	↓									
	I2										
	G9										
	G7										
	G4										
	G2										
	E8										
	E6										
	E4	↓									

ND= None Detected NAM= Non Asbestos Material

Traverse Direction: Vertical
Particulate loading: 1-3 %

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID: 041216273-0046

Customer Sample ID: PA-BG-AA-01

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
U1	E2	ND									
	C9	↓									
	C7										
	C5										
	C3										
	A9										
	A7										
	A5	↓									
U2	I9	ND									
	I6	↓									
	I3										
	G9										
	G6										
	G4	↓									

ND = None Detected

NAM = Non Asbestos Material

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID: 041216273-0046

Customer Sample ID: PA-BG-AA-01

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
U2	E8	ND									
	E6										
	E4										
	C9										
	C7										
	C5										
	A8										
	A6										
	A4										
U3	I8										
	I5										
	G6										

ND = None Detected

NAM = Non Asbestos Material

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID:	041216273-0047	Volume (L):	492.48	Scope:	03-01
Customer Sample:	PA-BG-AA-02	Prepped By:	A. FOLGAR	GO area (mm²):	0.013
Sample Description:	Ambient	Prepped Date:	7-2-12	Magnification:	10,000 x
Pore Size (micron):	0.45	Grid Box :	0312-ERRG-03	Analyzed By:	José Arriaga
EFA (mm²):	385	Grid Location:	A (1-3)	Analysis Date:	7-11-12

Analysis Information

Target Sensitivity:	0.002 s/cc	Minimum Aspect Ratio: (circle one)			***Comments:***
GO Required:	~~30~~ 31 JA 7-11-12	none	**3:1**	5:1	
GO Analyzed:	31				
Level of Analysis Chrysotile:	CD	Min Length:	>5	micron	
Level of Analysis Amphibole:	ADX	Min Width:	0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
A1	I8	ND									
	I6	↓									
	I4										
	I2										
	G8										
	G6										
	G4										
	G2										
	E7										
	E5	↓									

ND= None Detected

NAM= Non Asbestos Material

EMSL Analytical, Inc

Traverse Direction: Vertical

Particulate Loading: 1-3 %

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID: 041216273-0047

Customer Sample ID: PA-BG-AA-02

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
A1	E3	ND									
	E1	↓									
	C8	↓									
	C6	↓									
	C4	↓									
	C2	↓									
A2	B4	ND									
	B6	↓									
	B8	↓									
	B10	↓									
	D4	↓									
	D6	↓									
	D8	↓									
	D10	↓									

ND = None Detected

NAM = Non Asbestos Material

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID: 041216273-0047

Customer Sample ID: PA-BG-AA-02

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
A2	F4	ND									
	F6	↓									
	F8										
	F10										
	H4										
	H6										
	H8										

ND = None Detected

NAM = Non Asbestos Material

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID:	041216273-0048	Volume (L):	0	Scope:	03-01
Customer Sample:	PA-BC-AA-01	Prepped By:	A. FOLGAR	GO area (mm²):	0.013
Sample Description:	Ambient	Prepped Date:	7-2-12	Magnification:	10,000X
Pore Size (micron):	0.45	Grid Box :	0312-ERRG-03	Analyzed By:	José Arriaga
EFA (mm²):	385	Grid Location:	B (1-3)	Analysis Date:	7-11-12

Analysis Information

Target Sensitivity:	0.002 s/cc	Minimum Aspect Ratio: (circle one)			***Comments:***
GO Required:	~~10~~ 11 Ja 7-11-12	none	**3:1**	5:1	
GO Analyzed:	11				
Level of Analysis Chrysotile:	CD	Min Length:	>5	micron	
Level of Analysis Amphibole:	ADX	Min Width:	0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
B1	C3	ND									
	C5	↓									
	C7										
	E3										
	E5										
	E7										
B2	I8	ND									
	I6	↓									
	I4										

ND= None Detected NAM= Non Asbestos Material

EMSL Analytical, Inc

Traverse Direction : Vertical
Particulate Loading : 0.5%

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID: 041216273-0048

Customer Sample ID: PA-BC-AA-01

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
B2	G8	ND									
	G6	↓									

ND = None Detected

NAM = Non Asbestos Material

TEM Air TEM Dust PCM
(Circle One)

Indirect Preparation Record

EFA 364.9 (mm2) LOT # Filter 6100510 PH # N/A
Funnel # N/A

INDIRECT PREPARATION RECORD
REVISION 1
FEBRUARY 9, 2009

		Indirect without ashing			Dilution Filtration						Indirect with Ashing			
pped by: DS	Date: 7/11/12	Fraction of filter used	1st Resuspend Volume	Volume applied to filter	Volume of 1st Resuspend used	2nd Re-suspend Volume	Volume applied to filter	Volume of 2nd Re-suspend used	3rd Re-suspend Volume	Volume applied to filter	Fraction of filter ashed	Volume used to resuspend residue	Volume applied to 2nd filter	OK to Prep to Grid?
Order ID	Sample #		mL	mL	mL	mL	mL	mL	mL	mL		mL	mL	Y/N
041216273	0016										1	40	1	✓
													5	✓
													34	
	0017										3/4	40	1	✓
													5	✓
													10	✗
													24	
	0040										1	40	1	✓
													5	✓
													34	
	Ash BK										1	40	40	✓
	Filtration BK	—	100	100										✓

Controlled Document
Confidential Business Information/Property of EMSL Analytical, INC.

4. QC Data Reports/Logs

EMSL ANALYTICAL, INC.

Quality Control Report
ISO 10312, ISO 13794, ASTM 6281
-Blanks-

	Order ID	Analysis	Blank Type	Analyst	Total Str	No. GO analyzed	GO area	Conc str/mm²	Conclusion*
1	041216273	ISO 10312	Lab Blank # 1	DY	0	10	0.0130	None Detected	PASS
2	041216273	ISO 10312	Lab Blank # 2	AF	0	10	0.0130	None Detected	PASS
3	041216273	ISO 10312	Lab Blank # 3	DY	0	10	0.0130	None Detected	PASS
4	041216273	ISO 10312	Lab Blank # 4	DY	0	10	0.0130	None Detected	PASS
5	041216273	ISO 10312	Lab Blank # 5	DY	0	10	0.0130	None Detected	PASS
6	041216273	ISO 13794	Ashing Blank	PH	0	10	0.0132	None Detected	PASS
7	041216273	ISO 13794	Filtration Blank	PH	0	10	0.0132	None Detected	PASS
8	041216273	ISO 13794	Hood Blank	PH	0	10	0.0132	None Detected	PASS

*Pass Fail Criteria

Unless Quality Control limits are specified by the client, EMSL will use in-house QC limits published in EMSL's Quality Assurance Manual.

*Air Blanks are considered passing if concentration is <5str/mm²

Quality Control Report
ISO 10312, ISO 13794, ASTM 6281

EMSL ANALYTICAL, INC.

8/6/2012

					Original		QC				
	Order ID	Sample ID	Analysis	QC Type	Analyst	Total Str	Analyst	Total Str.	LCL	UCL	Conclusion*
1	041216273-0004	PA-MC-AA-02	ISO 10312	Inter Analyst	DY	0	AF.	0	NA	2.99	PASS
2	041216273-0023	PA-MC-AM-04	ISO 10312	Inter Analyst	JA	2	DY	3	NA	6.3	PASS
3	041216273-0027	PA-UW-AM-01	ISO 10312	Intra Analyst	GI	2	GI	2	NA	6.3	PASS

*Pass Fail Criteria

Unless Quality Control limits are specified by the client, EMSL will use in-house QC limits published in EMSL's Quality Assurance Manual.
Repeat results cannot differ at the 95% confidence interval.
For TEM Samples only grid openings that are still intact during QC analysis are evaluated and compared.

Attention: Samantha Caruthers-Knight
Engineering/Remediation Resources Group
4585 Pacheco Blvd.
Suite 200
Martinez, CA 94553
Phone: (925) 969-0750
Project: 2011-149 Phillips Mine

Customer ID: ERRG25
Customer PO:
Received: 6/22/12 9:30 AM

EMSL Order: 041216273
Analysis Date:
Report Date: 07/18/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:	041216273-0004QC	
Customer Sample #:	PA-MC-AA-02	
Date sampled:	6/16/2012	
Initials of Analyst:	AF	
Air volume:	641.325	Liters
Area of collection filter:	385	mm²
Level of analysis (chrysotile):	CD	
Level of analysis (amphibole):	ADX	
Magnification used for fiber counting:	~10,000	X
Aspect ratio for fiber definition:	3:1	
Minimum length to be counted:	> 5.0	microns
Minimum width to be counted:	0.25	microns
Mean dimension of grid openings:	0.013	mm²
Number of Grid Openings Analyzed:	24	
Analytical Sensitivity:	0.0019	Str/cc
Number of Primary Asbestos Structures Counted:	0	
Number of total asbestos structures counted:	0	
Number of Asbestos Structures > 5 microns:	0	
Number of Asbestos fibers and bundles > 5 microns:	0	
Number of PCM equivalent asbestos structures:	0	
Number of PCM equivalent asbestos fibers:	0	
Concentration of Chrysotile Asbestos:	< 0.0058	Str/cc
Concentration of Amphibole Asbestos:	< 0.0058	Str/cc
Lower 95% Confidence Limit (Chrysotile)	N/A	Str/cc
Upper 95% Confidence Limit (Chrysotile)	< 0.0058	Str/cc
Lower 95% Confidence Limit (Amphibole)	N/A	Str/cc
Upper 95% Confidence Limit (Amphibole)	< 0.0058	Str/cc
Concentration of Asbestos (total):	**< 0.0058**	**Str/cc**

Comments:
Inter Analyst QC

Robyn Denton
Approved Signatory

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID:	041216273-0004	Volume (L):	641.325	Scope:	03-01
Customer Sample:	PA-MC-AA-02	Prepped By:	A. FOLGAR	GO area (mm²):	.013
Sample Description:	Ambient	Prepped Date:	7/2/12	Magnification:	10,000 X
Pore Size (micron):	0.45	Grid Box :	0312. BRR. G. 01	Analyzed By:	A. FOLGAR
EFA (mm²):	385	Grid Location:	D (1-3)	Analysis Date:	7/13/12

Analysis Information

Target Sensitivity:	0.002 s/cc	Minimum Aspect Ratio: (circle one)			***Comments:***
GO Required:	24	none	**3:1**	5:1	~~Intra~~ INTER Analyst QC
GO Analyzed:					DY 7/13/12
Level of Analysis Chrysotile:	CD	Min Length:	>5	micron	
Level of Analysis Amphibole:	ADX	Min Width:	0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
D1	G1	ND									
	G3										
	G5										
	G7										
	G9										
	D10										
	D8										
	D6										
	D4										
	D2										

ND= None Detected NAM= Non Asbestos Material

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID: 041216273-0004

Customer Sample ID: PA-MC-AA-02

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
D2	H2	ND									
	H4										
	H6										
	H8										
	H10										
	E10										
	E8										
	E6										
	E4										
	E2										
	C1										
	C3										
	C5										
	C7										

ND = None Detected

NAM = Non Asbestos Material

Attention: Samantha Caruthers-Knight
Engineering/Remediation Resources Group
4585 Pacheco Blvd.
Suite 200
Martinez, CA 94553
Phone: (925) 969-0750
Project: 2011-149 Phillips Mine

Customer ID: ERRG25
Customer PO:
Received: 6/22/12 9:30 AM

EMSL Order: 041216273
Analysis Date: 7/9/2012
Report Date: 07/18/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		041216273-0023QC	
Customer Sample #:		PA-MA-AM-04	
Date sampled:		6/17/2012	
Initials of Analyst:		DY	
Air volume:		381.6	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~10,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5.0	microns
Minimum width to be counted:		0.25	microns
Mean dimension of grid openings:		0.0130	mm²
Number of Grid Openings Analyzed:		21	
Analytical Sensitivity:		0.0036	Str/cc
Number of Primary Asbestos Structures Counted:		3	
Number of total asbestos structures counted:		3	
Number of Asbestos Structures > 5 microns:		3	
Number of Asbestos fibers and bundles > 5 microns:		3	
Number of PCM equivalent asbestos structures:		1	
Number of PCM equivalent asbestos fibers:		3	
Concentration of Chrysotile Asbestos:	<	0.0279	Str/cc
Concentration of Amphibole Asbestos:	<	0.0108	Str/cc
Lower 95% Confidence Limit (Chrysotile)		N/A	Str/cc
Upper 95% Confidence Limit (Chrysotile)	<	0.0279	Str/cc
Lower 95% Confidence Limit (Amphibole)		N/A	Str/cc
Upper 95% Confidence Limit (Amphibole)	<	0.0279	Str/cc
Concentration of Asbestos (total):	**<**	0.0279	**Str/cc**

Comments:
Inter-Analyst QC

Robyn Denton
Approved Signatory

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID:	041216273-0023	Volume (L):	381.6	Scope:	03-01
Customer Sample:	PA-MA-AM-04	Prepped By:	A. Felgar	GO area (mm²):	0.013
Sample Description:	ABS	Prepped Date:	7/2/12	Magnification:	10,000x
Pore Size (micron):	0.45	Grid Box :	0312-ERRG-01	Analyzed By:	D. Fawry
EFA (mm²):	385	Grid Location:	u(1-3)	Analysis Date:	7/13/12

Analysis Information

Target Sensitivity:	0.004	s/cc	Minimum Aspect Ratio: (circle one)			***Comments:***
GO Required:	21		none	**3:1**	5:1	Inter-Analyst QC
GO Analyzed:	21					
Level of Analysis Chrysotile:	CD		Min Length:	>5	micron	
Level of Analysis Amphibole:	ADX		Min Width:	0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
u1	B2	ND									
	B4	MD11	1		15.5	7.25	nam	nam			
		MB		0	15.5	0.75	nam	nam	AT PRESENT QUESTIONABLE Morphology		
	B6	ND									
	B8	↓									
	D2	↓									
	D4	↓									
	D6	MD11	2		35.0	10.0	nam	nam	[redacted]		
		MF		0	35.0	4.75	nam	nam			
	D8	B	3	1	8.0	0.3	CD	CH			

ND= None Detected NAM= Non Asbestos Material

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID: 041216273-0023

Customer Sample ID: PA-MA-AM-04

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
U1	D10	ND									
	F2	↓									
	F4	↓									
U2	J9	ND									
	J7	↓									
	J5	↓									
	J3	↓									
	J1	MD11	4		8.75	4.5	CD	CH			
		MB		2	8.75	1.75	CD	CH			
	G9	MD11	5		33.0	7.25	CD	CH			
		MB		3	33.0	1.15	CD	CH			
		MD11	6		24.25	6.75	nam	nam	AI PRESENT		
		MB		0	24.25	1.15	nam	nam			
	G7	ND									
	G5	↓									

ND = None Detected

NAM = Non Asbestos Material

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID: 041216273-0023

Customer Sample ID: PA-MA-AM-04

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
U2	G3	ND									
	G1	↓									

ND = None Detected

NAM = Non Asbestos Material

EMSL Analytical, Inc

Attention: Samantha Caruthers-Knight
Engineering/Remediation Resources Group
4585 Pacheco Blvd.
Suite 200
Martinez, CA 94553
Phone: (925) 969-0750
Project: 2011-149 Phillips Mine

Customer ID: ERRG25
Customer PO:
Received: 6/22/12 9:30 AM

EMSL Order: 041216273
Analysis Date: 7/12/2012
Report Date: 07/18/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		041216273-0027QC	
Customer Sample #:		PA-UW-AM-01	
Date sampled:		6/18/2012	
Initials of Analyst:		GI	
Air volume:		468.195	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~10,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5.0	microns
Minimum width to be counted:		0.25	microns
Mean dimension of grid openings:		0.0130	mm²
Number of Grid Openings Analyzed:		17	
Analytical Sensitivity:		0.0036	Str/cc
Number of Primary Asbestos Structures Counted:		2	
Number of total asbestos structures counted:		2	
Number of Asbestos Structures > 5 microns:		2	
Number of Asbestos fibers and bundles > 5 microns:		2	
Number of PCM equivalent asbestos structures:		1	
Number of PCM equivalent asbestos fibers:		1	
Concentration of Chrysotile Asbestos:	<	0.0243	Str/cc
Concentration of Amphibole Asbestos:	<	0.0108	Str/cc
Lower 95% Confidence Limit (Chrysotile)		N/A	Str/cc
Upper 95% Confidence Limit (Chrysotile)	<	0.0243	Str/cc
Lower 95% Confidence Limit (Amphibole)		N/A	Str/cc
Upper 95% Confidence Limit (Amphibole)	<	0.0108	Str/cc
Concentration of Asbestos (total):	**<**	**0.0243**	**Str/cc**

Comments:
Intra Analyst QC

Robyn Denton
Approved Signatory

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID:	041216273-0027	Volume (L):	468.195	Scope:	03-01
Customer Sample:	PA-UW-AM-01	Prepped By:	AF	GO area (mm²):	0.013
Sample Description:	ABS	Prepped Date:	7/2/12	Magnification:	10,000
Pore Size (micron):	0.45	Grid Box :	0312 EPRG-02	Analyzed By:	G. Lunnzzi
EFA (mm²):	385	Grid Location:	D 1-3	Analysis Date:	7/12/12

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)			***Comments:***
GO Required:	17	none	**3:1**	5:1	~~Inter~~ INTRA-Analyst QC
GO Analyzed:	17				D.Y 7/13/12
Level of Analysis Chrysotile:	CD	Min Length:	>5	micron	
Level of Analysis Amphibole:	ADX	Min Width:	0.25	micron	$x^2 = 18.619$ = Random

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
D1	I8	ND									
	I6	ND									
	I4	ND									
	C8	ND									
	C6	ND									
	Q4	MD11	1		10.69	3.65					
		MB		1	10.69	0.35	CD	CH			
D2	C3	ND									
	C5	ND									
	C7	ND									

ND= None Detected NAM= Non Asbestos Material

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID: 041216273-0027

Customer Sample ID: PA-UW-AM-01

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
	F3	F	2	2	24.30	0.90	CO	CH		63156	YES
	F5	ND									
	F7	ND									
D3	D3	ND									
	D5	ND									
	D7	ND									
	H4	ND									
	H6	ND									

ND = None Detected

NAM = Non Asbestos Material

EMSL Analytical, Inc

Attention: Samantha Caruthers-Knight
Engineering/Remediation Resources Group
4585 Pacheco Blvd.
Suite 200
Martinez, CA 94553
Phone: (925) 969-0750
Project: 2011-149 Phillips Mine

Customer ID: ERRG25
Customer PO:
Received: 6/22/12 9:30 AM

EMSL Order: 041216273
Analysis Date:
Report Date: 07/18/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		041216273-0034QC	
Customer Sample #:		PA-ATV2-AA-03	
Date sampled:		6/18/2012	
Initials of Analyst:		DY	
Air volume:		396.8	Liters
Area of collection filter:		385	mm^2
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~10,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5.0	microns
Minimum width to be counted:		0.25	microns
Mean dimension of grid openings:		0.0130	mm^2
Number of Grid Openings Analyzed:		38	
Analytical Sensitivity:		0.0019	Str/cc
Number of Primary Asbestos Structures Counted:		0	
Number of total asbestos structures counted:		0	
Number of Asbestos Structures > 5 microns:		0	
Number of Asbestos fibers and bundles > 5 microns:		0	
Number of PCM equivalent asbestos structures:		0	
Number of PCM equivalent asbestos fibers:		0	
Concentration of Chrysotile Asbestos:	<	0.0057	Str/cc
Concentration of Amphibole Asbestos:	<	0.0057	Str/cc
Lower 95% Confidence Limit (Chrysotile)		N/A	Str/cc
Upper 95% Confidence Limit (Chrysotile)	<	0.0057	Str/cc
Lower 95% Confidence Limit (Amphibole)		N/A	Str/cc
Upper 95% Confidence Limit (Amphibole)	<	0.0057	Str/cc
Concentration of Asbestos (total):	**<**	0.0057	**Str/cc**

Comments:
Inter-Analyst QC

Robyn Denton
Approved Signatory

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID:	**041216273-0034**	Volume (L):	396.8	Scope:	03-01
Customer Sample:	PA-ATV2-AA-03	Prepped By:	A. Folgar	GO area (mm²):	0.130
Sample Description:	Ambient	Prepped Date:	7/2/12	Magnification:	10,000X
Pore Size (micron):	0.45	Grid Box :	D312-ERRG-02	Analyzed By:	D. Young
EFA (mm²):	385	Grid Location:	K(1-3)	Analysis Date:	7/13/12

Analysis Information

Target Sensitivity:	**0.002**	s/cc	Minimum Aspect Ratio: (circle one)			***Comments:***
GO Required:	**38**		none	**3:1**	5:1	Inter-Analyst QC
GO Analyzed:	38					
Level of Analysis Chrysotile:	**CD**		Min Length:	**>5**	micron	
Level of Analysis Amphibole:	**ADX**		Min Width:	**0.25**	micron	

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
K2	F2	ND									
	F4										
	F6										
	F8										
	F10										
	G1										
	G3										
	G5										
	G7										
	G9										

ND= None Detected NAM= Non Asbestos Material

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID: 041216273-0034

Customer Sample ID: PA-ATV2-AA-03

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
K2	H2	ND									
	H4										
	H6										
	H8										
	J3										
	J5										
	J7										
	J2										
	J4										
	J6										
K3	A3										
	A5										
	A7										
	A9										
	B2										

ND = None Detected

NAM = Non Asbestos Material

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID: 041216273-0034

Customer Sample ID: PA-ATV2-AA-03

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
K3	B4	ND									
	B6										
	B8										
	B10										
	C1										
	C3										
	C5										
	C7										
	C9										
	D4										
	D6										
	D8										
	D10										
		✓									

ND = None Detected

NAM = Non Asbestos Material

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID:	041216273	Volume (L):	0	Scope:	03-01
Customer Sample:		Prepped By:	A. Folgar	GO area (mm²):	0.0130
Sample Description:	Lab Blank #1	Prepped Date:	7/2/12	Magnification:	10,000x
Pore Size (micron):	0.45	Grid Box :	0312-EBRG-01	Analyzed By:	D. Young
EFA (mm²):	385	Grid Location:	A (1-2)	Analysis Date:	7/5/12

Analysis Information

Target Sensitivity:		s/cc	Minimum Aspect Ratio: (circle one)		
GO Required:	10		none	**3:1**	5:1
GO Analyzed:	10				
Level of Analysis Chrysotile:	CD		Min Length:	>5	micron
Level of Analysis Amphibole:	ADX		Min Width:	0.25	micron

Comments:

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
A1	G9	ND									
	G7										
	G5										
	G3										
	G1										
A2	G10										
	G8										
	G6										
	G4										
	G2										

ND= None Detected

NAM= Non Asbestos Material

EMSL Analytical, Inc

Transmission Direction: Vertical
Particulate Loading: 1%

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID:	041216273	Volume (L):	0	Scope:	03-01
Customer Sample:		Prepped By:	A. Felgar	GO area (mm²):	0.0130
Sample Description:	Lab Blank #2	Prepped Date:	7/2/12	Magnification:	10,000 x
Pore Size (micron):	0.45	Grid Box :	0312-ERRG-01	Analyzed By:	D. Young
EFA (mm²):	385	Grid Location:	A (3-4)	Analysis Date:	7/5/12

Analysis Information

Target Sensitivity:		s/cc	Minimum Aspect Ratio: (circle one)		
GO Required:	10		none	**3:1**	5:1
GO Analyzed:	10				
Level of Analysis Chrysotile:	CD		Min Length:	>5	micron
Level of Analysis Amphibole:	ADX		Min Width:	0.25	micron

Comments:

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
A3	H2	ND									
	H4	↓									
	H6	↓									
	H8	↓									
	H10	↓									
A4	A10	↓									
	A8	↓									
	A6	↓									
	A4	↓									
	A2	↓									

ND= None Detected

NAM= Non Asbestos Material

Traverse Direction: Vertical

Particulate Loading: 1%

EMSL

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID:	041216273	Volume (L):	0	Scope:	03-01
Customer Sample:		Prepped By:	A. Folger	GO area (mm²):	0.0130
Sample Description:	Lab Blank #3	Prepped Date:	7/2/12	Magnification:	10,000X
Pore Size (micron):	0.45	Grid Box :	0312-ERBG-01	Analyzed By:	D. Young
EFA (mm²):	385	Grid Location:	A (5-6)	Analysis Date:	7/5/12

Analysis Information

Target Sensitivity:		s/cc	Minimum Aspect Ratio: (circle one)		
GO Required:	10		none	**3:1**	5:1
GO Analyzed:	10				
Level of Analysis Chrysotile:	CD		Min Length:	>5	micron
Level of Analysis Amphibole:	ADX		Min Width:	0.25	micron

Comments:

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
A5	C1	ND									
	C3	↓									
	C5										
	C7										
	C9										
A6	G10										
	G8										
	G6										
	G4										
	G2	↓									

ND= None Detected

NAM= Non Asbestos Material

EMSL Analytical, Inc

Traverse Direction: Vertical

Particulate Loading: 1%

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID:	041216273	Volume (L):	0	Scope:	03-01
Customer Sample:		Prepped By:	A. Folger	GO area (mm²):	0.0130
Sample Description:	Lab Blank #4	Prepped Date:	7/2/12	Magnification:	10,000 X
Pore Size (micron):	0.45	Grid Box :	0312-ERRG-01	Analyzed By:	D. Young
EFA (mm²):	385	Grid Location:	A(7-8)	Analysis Date:	7/5/12

Analysis Information

Target Sensitivity:		s/cc	Minimum Aspect Ratio: (circle one)		
GO Required:	10		none	**3:1**	5:1
GO Analyzed:	10				
Level of Analysis Chrysotile:	CD		Min Length:	>5	micron
Level of Analysis Amphibole:	ADX		Min Width:	0.25	micron

Comments:

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
A7	L10	ND									
	L8										
	L6										
	L4										
	L2										
A8	H1										
	H3										
	H5										
	H7										
	H9										

ND= None Detected NAM= Non Asbestos Material

EMSL Analytical, Inc

Traverse Direction: Vertical

Particulate Loading: 1%

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID:	041216273	Volume (L):	0	Scope:	JEOL 1200 EX (04-03)
Customer Sample:		Prepped By:		GO area (mm²):	0.0132
Sample Description:	Lab Blank	Prepped Date:		Magnification:	20kx
Pore Size (micron):	0.45	Grid Box :	Special Project	Analyzed By:	P. Harrison
EFA (mm²):	385	Grid Location:	F G	Analysis Date:	7/20/12

PH 7/20/12

Analysis Information

Target Sensitivity: s/cc

GO Required: **10**

GO Analyzed: 10

Level of Analysis Chrysotile: **CD**

Level of Analysis Amphibole: **ADX**

Minimum Aspect Ratio: (circle one)

none **3:1** 5:1

Min Length: **>5** micron

Min Width: **0.2** micron

Comments:

Indirect - Ashing Blank

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
PH 7/20/12 G1 ~~F1~~	J2	ND									
G2	J3										
	I6										
	G4										
	B5										
	A3										
G3	C8										
	E6										
	F4										
	I5										

ND= None Detected

NAM= Non Asbestos Material

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID:	041216273	Volume (L):	0	Scope:	JEOL 1200 EX (04-03)
Customer Sample:		Prepped By:		GO area (mm²):	0.0132
Sample Description:	Lab Blank	Prepped Date:		Magnification:	20k x
Pore Size (micron):	0.45	Grid Box :	Special Project	Analyzed By:	P. Harrison
EFA (mm²):	385	Grid Location:	F G	Analysis Date:	7/20/12

Analysis Information PH 7/20/12

Target Sensitivity:		s/cc	Minimum Aspect Ratio: (circle one)		**Comments:** Indirect · Filtration Blank
GO Required:	10		none	**3:1**	5:1
GO Analyzed:	10				
Level of Analysis Chrysotile:	CD		Min Length:	>5	micron
Level of Analysis Amphibole:	ADX		Min Width:	0.2	micron

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
G4	H6	ND									
	H8										
	F1										
	E1										
	C5										
G5	H10										
	E3										
G6	C7										
	H5										
	H1										

ND= None Detected NAM= Non Asbestos Material

TEM ISO 10312
Asbestos Count Sheet

EMSL Sample ID:	041216273	Volume (L):	0	Scope:	JEOL 2000 EX (04-03)
Customer Sample:		Prepped By:		GO area (mm²):	0.0132
Sample Description:	Lab Blank	Prepped Date:		Magnification:	20k x
Pore Size (micron):	0.45	Grid Box :	Special Project	Analyzed By:	P. Harrison
EFA (mm²):	385	Grid Location:	F	Analysis Date:	7/20/12

Analysis Information

Target Sensitivity:		s/cc	Minimum Aspect Ratio: (circle one)		
GO Required:	10		none	**3:1**	5:1
GO Analyzed:	10				
Level of Analysis Chrysotile:	CD		Min Length:	>5	micron
Level of Analysis Amphibole:	ADX		Min Width:	0.2	micron

Comments:

Indirect - Hood Blank

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
F7	A8	ND									
↓	D5	↓									
↓	E10	↓									
↓	F8	↓									
↓	I9	↓									
F8	B4	↓									
↓	C6	↓									
↓	D8	↓									
↓	G2	↓									
↓	H5	✓									

ND= None Detected

NAM= Non Asbestos Material

5. Client and EMSL Internal Chains of Custody

EMSL ANALYTICAL, INC.
LABORATORY • PRODUCTS • TRAINING

~~Microbiology~~ Chain of Custody

EMSL Order Number (*Lab Use Only*): 361201904

0412 16273

EMSL ANALYTICAL, INC.
3356 W. CATALINA DR.
PHOENIX, AZ 85017
PHONE: (602) 276-4344
FAX: (602) 276-4053

Company: Engineering/Remediation Resources Group	**EMSL-Bill to:** ☑ Same ☐ Different If Bill to is Different note instructions in Comments**
Street: 4585 Pacheco Blvd	*Third Party Billing requires written authorization from third party*
City: Martinez **State/Province:** CA	**Zip/Postal Code:** 94553 **Country:** USA
Report To (Name): Samantha Caruthers-Knight	**Telephone #:** 925 969 0750
Email Address: samantha.knight@errg.com	**Fax #:** 925 969 0751 **Purchase Order:**
Project Name/Number: 2011-149	**Please Provide Results:** ☐ Fax ☑ Email
U.S. State Samples Taken: AZ	**Connecticut Samples:** ☐ Commercial ☐ Residential

Turnaround Time (TAT) Options* - Please Check

☐ 3 Hour ☐ 6 Hour ☐ 24 Hour ☐ 48 Hour ☐ 72 Hour ☐ 96 Hour ☐ 1 Week ☒ 2 Week

*Analysis completed in accordance with EMSL's Terms and Conditions located in the Analytical Price Guide. TATs are subject to methodology requirements

Non Culturable Air Samples (Spore Traps)

- **M001** Air-O-Cell
- **M049** BioSIS
- **M030** Micro 5
- **M173** Allegro M2
- **M003** Burkard
- **M174** MoldSnap
- **M004** Allergenco
- **M043** Cyclex
- **M176** Relle Smart
- **M032** Allergenco-D
- **M002** Cyclex-d
- **M130** Via-Cell
- **M172** Versa Trap

Other Microbiology Test Codes

- **M041** Fungal Direct Examination
- **M005** Viable Fungi ID and Count
- **M006** Viable Fungi ID and Count (Speciation)
- **M007** Culturable Fungi
- **M008** Culturable Fungi (Speciation)
- **M009** Gram Stain Culturable Bacteria
- **M010** Bacterial Count and ID – 3 Most Prominent
- **M011** Bacterial Count and ID – 5 Most Prominent
- **M013** Sewage Contamination in Buildings
- **M014** Endotoxin Analysis
- **M015** Heterotrophic Plate Count
- **M180** Real Time Q-PCR-ERMI 36 Panel
- **M018** Total Coliform (Membrane Filtration)
- **M020** Fecal *Streptococcus* (Membrane Filtration)
- **M210-215** *Legionella* Detection
- **M026** Recreational Water Screen
- **M027** Mycotoxin Analysis
- **M029** *Enterococci*
- **M019** Fecal Coliform
- **M133** MRSA Analysis
- **M028** *Cryptococcus neoformans* Detection
- **M120** *Histoplasma capsulatum* Detection
- **M033-39** Allergen Testing
- **M044** Group Allergen (Cat, Dog, Cockroach, Dustmites)
- **Other** See Analytical Price Guide

Preservation Method (Water):

Name of Sampler: Samantha Caruthers-Knight **Signature of Sampler:**

Sample #	Sample Location	Sample Type	Test Code	Volume/Area	Date/Time Collected
PA-MC-AA-01	Phillips Mine	Air	ISO 10312	791.1	06/16/12 1030-1500
PA-MC-AA-03				709.155	06/16/12 1045-1500
PA-MC-AM-04				483.975	06/16/12 1030-1415
PA-MC-AA-02				641.325	06/16/12 1045-1500
PA-MC-AM-01				487.575	06/16/12 1030-1415
PA-MC-AM-03				561.6	06/16/12 1030-1415
PA-MC-AM-02				584.55	06/16/12 1030-1415
PA-ATV-AA-01				493.2	06/17/12 1445-1745
PA-ATV-AA-02				374.94	06/17/12 1445/1745
PA-ATV-AA-03				375.85	06/17/12 1445-1745

Client Sample # (s): **Total # of Samples:** 48

Relinquished (Client): **Date:** 6/20/12 **Time:** 1250

Received (Client): Andrea Moman **Date:** 6/20/12 **Time:** 1250

Comments: 1 in 10 samples analyze SEM as well

RECEIVED JUN 22 2012

receive ~DMcDani fx 6/22/12 9:30 AM Page 1 of 3 pages

48xC

EMSL ANALYTICAL, INC.
LABORATORY•PRODUCTS•TRAINING

Microbiology Chain of Custody

EMSL Order Number *(Lab Use Only)*:

361201904

041216273

EMSL ANALYTICAL, INC.
3356 WEST CATALINA DR
PHOENIX, AZ 85017

PHONE: (602) 276-4344
FAX:(602 276-4053

Additional Pages of the Chain of Custody are only necessary if needed for additional sample information

Sample #	Sample Location	Sample Type	Test Code	Volume/Area	Date/Time Collected
PA-ATV1-AA-04	Phillips Mine	Air	DS010312	377.1	06/17/12 1445-1745
PA-ATV1-AA-05				385.38	06/17/12 1445-1745
PA-ATV1-AA-06				512.28	06/17/12 1445-1745
PA-ATV1-AM-01				430.2	06/17/12 1445-1745
PA-ATV1-AM-02				~~458.82~~ 403.2	06/17/12 1445-1745
PA-ATV1-AM-03				396.36	06/17/12 1445-1745
PA-ATV1-AM-04				381.6	06/17/12 1445-1745
PA-MA-AA-01				~~493.2~~ 374.94	06/17/12 1000-1300
PA-MA-AA-02				375.84	06/17/12 1000-1300
PA-MA-AM-01				430.2	06/17/12 1000-1300
PA-MA-AM-02				458.82	06/17/12 1000-1300
PA-MA-AM-03				396.36	06/17/12 1000-1300
PA-MA-AM-04				381.6	06/17/12 1000-1300
PA-MA-AM-05				403.2	06/17/12 1000-1300
PA-UW-AA-01				393.9	06/18/12 0900-1245
PA-UW-AA-02				406.9	06/18/12 0900-1245
PA-UW-AM-01				~~432.18~~ 468.195	06/18/12 0900-1245
PA-UW-AM-02				423.54	06/18/12 0900-1245
PA-UW-AM-03				398.19	06/18/12 0900-1245
PA-UW-AM-04				456.69	06/18/12 0900-1245
PA-UW-AM-05				503.295	06/18/12 0900-1245
PA-ATV2-AA-01				424.2	06/18/12 1430-1800
PA-ATV2-AA-02				438.27	06/18/12 1430-1800
PA-ATV2-AA-03				396.8	06/18/12 1430-1800

**Comments/Special Instructions

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Controlled Document – Microbiology COC – R1 – 3/18/2009

EMSL ANALYTICAL, INC.
LABORATORY • PRODUCTS • TRAINING

Microbiology Chain of Custody

EMSL Order Number *(Lab Use Only)*:

361201904

0412116273

EMSL ANALYTICAL, INC.
3356 WEST CATALINA DR
PHOENIX, AZ 85017

PHONE: (602) 276-4344
FAX:(602 276-4053

Additional Pages of the Chain of Custody are only necessary if needed for additional sample information

Sample #	Sample Location	Sample Type	Test Code	Volume/Area	Date/Time Collected
PA-ATV2-AA-04	Phillips Mine	Air	ISO 10312	425.0	06/18/12 1430-1750
PA-ATV2-AA-05				513.36	06/18/12 1430-1730
PA-ATV2-AM-01				432.18	06/18/12 1430-1730
PA-ATV2-AM-02				390.96	06/18/12 1430-1730
PA-ATV2-AM-03				367.56	06/18/12 1430-1730
PA-ATV2-AM-04				421.56	06/18/12 1430-1730
PA-ATV2-AM-05				464.58	06/18/12 1430-1730
PA-BC1-AM-01				372.96	06/19/12 0830-1130
PA-BC1-AM-02				363.78	06/19/12 0830-1130
PA-BC1-AM-03				361.08	06/19/12 0830-1130
PA-BC1-AM-04				512.28	06/19/12 0830-1130
PA-BC1-AA-01				429.3	06/19/12 0830-1130
PA-BC1-AA-02				492.48	06/19/12 0830-1130
PA-BC-AA-01				—	06/20/12 1215

**Comments/Special Instructions

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Page 3 of 3 pages

INTERNAL CHAIN OF CUSTODY

Order ID: 041216273 *6/28/2012 4:19:36 PM*

Attn: Samantha Caruthers-Knight
Engineering/Remediation Resources Group
4585 Pacheco Blvd
Suite 200
Martinez, CA 94553

Fax: Phone: (925) 969-0750

Project: **2011-149 Phillips Mine**

Customer ID: ERRG25
Customer PO:
Received: 06/22/12 9:30 AM

EMSL Order: 041216273
EMSL Proj ID:
Cust COC ID

REPORT TO INSTRUCTIONS

- [x] Send Receipt Confirmation Emails
- [ ] Email Report Only-Do not send hard copy
- [ ] No electronic signatures
- [ ] Project ID required
- [ ] Cust. COC ID required
- [ ] Miscellaneous account

Sales Rep and Comment: imurdock

Instructions

Note: Sample 3,5;45 analyzed at Corporate.
Note: Sample 16 & 40 not prepped due to non-unif. deposition.

BILL TO INSTRUCTIONS

- [ ] Exempt from prep charge
- [ ] Exempt from off hour min charges
- [ ] Exempt from layer/aliquot charges
- [ ] Email Invoice Only- Do not send hard copy.
- [ ] Credit Card on File
- [ ] P.O. Required

Billing Frequency

--

Use Billing Contact:

Accounting Terms: N30

Payment Directions:

Instructions

Internal Comment

Test: **TEM ISO 10312** **Matrix** Air **TAT:** 2 Week **Qty:** 48

- [ ] Lab Opening Exempt For Test
- [ ] Prep Charge Exempt For Test
- [ ] Layer/Aliquot Charge Exempt For Test

Logged: dmcdaniel **Date:** 6/22/2012

Sample Condition: [x] Acceptable [ ] Unacceptable

Comments

Prepped: SM **Date** 6/28/12
Analyzed: JA, D Young, GT, AF, ES, RH **Date** 7/5/12-7/11/12
Data Entry ✓ **Date** ✓
Screened: RD **Date** 8.6.12
Mailed: YMM **Date** 8/7/12

Special Test Instructions

Lab Sample #	Cust. Sample #	Location	Due Date
✓ 041216273-0001	PA-MC-AA-01	Phillips Mine	7/6/2012 9:30:00 AM
✓ 041216273-0002	PA-MC-AA-03	Phillips Mine	7/6/2012 9:30:00 AM
[redacted]	[redacted] already analyzed not prepped	Phillips Mine	7/6/2012 9:30:00 AM
✓ 041216273-0004	PA-MC-AA-02	Phillips Mine	7/6/2012 9:30:00 AM
✓ [redacted]	[redacted] - already analyzed not prepped	Phillips Mine	7/6/2012 9:30:00 AM
✓ 041216273-0006	PA-MC-AM-03	Phillips Mine	7/6/2012 9:30:00 AM
✓ 041216273-0007	PA-MC-AM-02	Phillips Mine	7/6/2012 9:30:00 AM
✓ 041216273-0008	PA-ATV1-AA-01	Phillips Mine Not Sci	7/6/2012 9:30:00 AM

INTERNAL CHAIN OF CUSTODY

Order ID: 041216273 *6/28/2012 4:19:36 PM*

Attn: Samantha Caruthers-Knight
Engineering/Remediation Resources Group
4585 Pacheco Blvd
Suite 200
Martinez, CA 94553

Customer ID: ERRG25
Customer PO:
Received: 06/22/12 9:30 AM

Fax: Phone: (925) 969-0750

Project: **2011-149 Phillips Mine**

EMSL Order: 041216273
EMSL Proj ID:
Cust COC ID

✓041216273-0009	PA-ATV1-AA-02	Phillips Mine	7/6/2012 9:30:00 AM
✓041216273-0010	PA-ATV1-AA-03	Phillips Mine	7/6/2012 9:30:00 AM
✓041216273-0011	PA-ATV1-AA-04	Phillips Mine	7/6/2012 9:30:00 AM
✓041216273-0012	PA-ATV1-AA-05	Phillips Mine	7/6/2012 9:30:00 AM
✓041216273-0013	PA-ATV1-AA-06	Phillips Mine	7/6/2012 9:30:00 AM
✓041216273-0014	PA-ATV1-AM-01	Phillips Mine	7/6/2012 9:30:00 AM
✓041216273-0015	PA-ATV1-AM-02	Phillips Mine	7/6/2012 9:30:00 AM
✓041216273-0016	PA-ATV1-AM-03 - non uniformed deposition Not prepped - Mat Sci	Phillips Mine	7/6/2012 9:30:00 AM
✓041216273-0017	PA-ATV1-AM-04 - non uniformed deposition	Phillips Mine	7/6/2012 9:30:00 AM
✓041216273-0018	PA-MA-AA-01	Phillips Mine	7/6/2012 9:30:00 AM
✓041216273-0019	PA-MA-AA-02	Phillips Mine	7/6/2012 9:30:00 AM
✓041216273-0020	PA-MA-AM-01	Phillips Mine	7/6/2012 9:30:00 AM
✓041216273-0021	PA-MA-AM-02	Phillips Mine	7/6/2012 9:30:00 AM
✓041216273-0022	PA-MA-AM-03	Phillips Mine	7/6/2012 9:30:00 AM
✓041216273-0023	PA-MA-AM-04	Phillips Mine	7/6/2012 9:30:00 AM
✓041216273-0024	PA-MA-AM-05	Phillips Mine	7/6/2012 9:30:00 AM
✓041216273-0025	PA-UW-AA-01	Phillips Mine	7/6/2012 9:30:00 AM
✓041216273-0026	PA-UW-AA-02	Phillips Mine	7/6/2012 9:30:00 AM
✓041216273-0027	PA-UW-AM-01	Phillips Mine	7/6/2012 9:30:00 AM
✓041216273-0028	PA-UW-AM-02	Phillips Mine	7/6/2012 9:30:00 AM
✓041216273-0029	PA-UW-AM-03	Phillips Mine	7/6/2012 9:30:00 AM
✓041216273-0030	PA-UW-AM-04 - Non uniformed deposition. - Mat Sci	Phillips Mine	7/6/2012 9:30:00 AM
✓041216273-0031	PA-UW-AM-05	Phillips Mine	7/6/2012 9:30:00 AM
✓041216273-0032	PA-ATV2-AA-01	Phillips Mine	7/6/2012 9:30:00 AM
✓041216273-0033	PA-ATV2-AA-02	Phillips Mine	7/6/2012 9:30:00 AM
✓041216273-0034	PA-ATV2-AA-03	Phillips Mine	7/6/2012 9:30:00 AM
✓041216273-0035	PA-ATV2-AA-04	Phillips Mine	7/6/2012 9:30:00 AM
✓041216273-0036	PA-ATV2-AA-05 - MatSci	Phillips Mine	7/6/2012 9:30:00 AM
✓041216273-0037	PA-ATV2-AM-01	Phillips Mine	7/6/2012 9:30:00 AM
✓041216273-0038	PA-ATV2-AM-02 - ~~Slight non uniformed deposition~~	Phillips Mine	7/6/2012 9:30:00 AM
✓041216273-0039	PA-ATV2-AM-03 - Slight non uniformed deposition	Phillips Mine	7/6/2012 9:30:00 AM
✓041216273-0040	PA-ATV2-AM-04 - non uniformed deposition - Not prepped	Phillips Mine	7/6/2012 9:30:00 AM
✓041216273-0041	PA-ATV2-AM-05	Phillips Mine	7/6/2012 9:30:00 AM
✓041216273-0042	PA-BG-AM-01	Phillips Mine	7/6/2012 9:30:00 AM
✓041216273-0043	PA-BG-AM-02	Phillips Mine	7/6/2012 9:30:00 AM
✓041216273-0044	PA-BG-AM-03	Phillips Mine	7/6/2012 9:30:00 AM
✓041216273-0045	PA-BG-AM-04 - already analyzed not prepped	Phillips Mine	7/6/2012 9:30:00 AM

INTERNAL CHAIN OF CUSTODY

Order ID: 041216273 *6/28/2012 4:19:36 PM*

Attn: Samantha Caruthers-Knight
Engineering/Remediation Resources Group
4585 Pacheco Blvd
Suite 200
Martinez, CA 94553

Fax: Phone: (925) 969-0750

Project: **2011-149 Phillips Mine**

Customer ID: ERRG25
Customer PO:
Received: 06/22/12 9:30 AM

EMSL Order: 041216273
EMSL Proj ID:
Cust COC ID

✓041216273-0046	PA-BG-AA-01	Phillips Mine	7/6/2012 9:30:00 AM
✓ 041216273-0047	PA-BG-AA-02 -matsci	Phillips Mine	7/6/2012 9:30:00 AM
✓ 041216273-0048	PA-BC-AA-01	Phillips Mine	7/6/2012 9:30:00 AM

INTERNAL CHAIN OF CUSTODY

Order ID: 041216273 *7/11/2012 10:16:30 AM*

Attn: Samantha Caruthers-Knight
Engineering/Remediation Resources Group
4585 Pacheco Blvd
Suite 200
Martinez, CA 94553

Fax: Phone: (510) 851-3279

Project: **2011-149 Phillips Mine**

Customer ID: ERRG25
Customer PO:
Received: 06/22/12 9:30 AM

EMSL Order: 041216273
EMSL Proj ID:
Cust COC ID

Test: **TEM ISO 13794** **Matrix** Air **TAT:** 2 Week **Qty:** 3

☐ Lab Opening Exempt For Test
☐ Prep Charge Exempt For Test
☐ Layer/Aliquot Charge Exempt For Test

Logged: dmcdaniel **Date:** 6/22/2012
Sample Condition: ☑ Acceptable ☐ Unacceptable

Comments

Prepped: DS **Date** 7/11/12
Analyzed: PK **Date** 7/20/12
Data Entry ↓ **Date**
Screened: RD **Date** 8.6.12
Mailed: DM **Date** 8/7/12

Special Project C-F

Special Test Instructions

Lab Sample #	Cust. Sample #	Location	Due Date
041216273-0016	PA-ATV1-AM-03	Phillips Mine	7/6/2012 9:30:00 AM
041216273-0017	PA-ATV1-AM-04	Phillips Mine	7/6/2012 9:30:00 AM
041216273-0040	PA-ATV2-AM-04	Phillips Mine	7/6/2012 9:30:00 AM

Prepped 1 and 5ml for each sample

6. Equipment Performance Checks

Daily TEM Calibration Sheet

Month: July Year: 2012 Scope: 03-01

Day (1-31)	Analyst Initials	Scope Align.	LN Dewar Filled	Al Peak Actual	Al Peak Accepted Limit	Cu Peak Actual	Cu Peak Accepted Limit	Pass/Fail* (circle)
1	[illegible]	✓		1.494	1.47-1.49	8.046	8.03-8.05	Pass/Fail
2	ES/RG	✓		1.482	1.47-1.49	8.043	8.03-8.05	Pass/Fail
3	CSE/RG	✓		1.476	1.47-1.49	8.042	8.03-8.05	Pass/Fail
4	CSE	✓	CSE	1.483	1.47-1.49	8.041	8.03-8.05	Pass/Fail
5	RG	✓		1.470	1.47-1.49	8.034	8.03-8.05	Pass/Fail
6	[illegible]	✓		1.480	1.47-1.49	8.042	8.03-8.05	Pass/Fail
7	CSE	✓		1.471	1.47-1.49	8.038	8.03-8.05	Pass/Fail
8	GI	✓		1.477	1.47-1.49	8.043	8.03-8.05	Pass/Fail
9	GI	✓	RG	1.472	1.47-1.49	8.038	8.03-8.05	Pass/Fail
10	GI	✓		1.473	1.47-1.49	8.042	8.03-8.05	Pass/Fail
11	GI/[illegible]	✓		1.487	1.47-1.49	8.043	8.03-8.05	Pass/Fail
12	CSE	✓	GI	1.474	1.47-1.49	8.038	8.03-8.05	Pass/Fail
13	[illegible]	✓		1.473	1.47-1.49	8.041	8.03-8.05	Pass/Fail
14					1.47-1.49		8.03-8.05	Pass/Fail
15					1.47-1.49		8.03-8.05	Pass/Fail
16					1.47-1.49		8.03-8.05	Pass/Fail
17					1.47-1.49		8.03-8.05	Pass/Fail
18					1.47-1.49		8.03-8.05	Pass/Fail
19					1.47-1.49		8.03-8.05	Pass/Fail
20					1.47-1.49		8.03-8.05	Pass/Fail
21					1.47-1.49		8.03-8.05	Pass/Fail
22					1.47-1.49		8.03-8.05	Pass/Fail
23					1.47-1.49		8.03-8.05	Pass/Fail
24					1.47-1.49		8.03-8.05	Pass/Fail
25					1.47-1.49		8.03-8.05	Pass/Fail
26					1.47-1.49		8.03-8.05	Pass/Fail
27					1.47-1.49		8.03-8.05	Pass/Fail
28					1.47-1.49		8.03-8.05	Pass/Fail
29					1.47-1.49		8.03-8.05	Pass/Fail
30					1.47-1.49		8.03-8.05	Pass/Fail
31					1.47-1.49		8.03-8.05	Pass/Fail

*** Any failing results need immediate corrective action**

EMSL

Daily TEM Calibration Sheet

Month: July Year: 2012 Scope: 04-03

Day (1-31)	Analyst Initials	Scope Align.	LN Dewar Filled	Al Peak Actual	Al Peak Accepted Limit	Cu Peak Actual	Cu Peak Accepted Limit	Pass/Fail* (circle)
1	~~PH~~	~~PH~~	~~PH 6/21/12~~	~~1.48~~	1.47-1.49	~~8.04~~	8.03-8.05	~~Pass~~/Fail
2	PH	PH	PH	1.48	1.47-1.49	8.04	8.03-8.05	~~Pass~~/Fail
3	PH	PH	PH	1.48	1.47-1.49	8.04	8.03-8.05	~~Pass~~/Fail
4					1.47-1.49		8.03-8.05	Pass/Fail
5	PH	PH		1.48	1.47-1.49	8.04	8.03-8.05	~~Pass~~/Fail
6	PH	PH	PH	1.48	1.47-1.49	8.04	8.03-8.05	~~Pass~~/Fail
7					1.47-1.49		8.03-8.05	Pass/Fail
8			FC		1.47-1.49		8.03-8.05	Pass/Fail
9	PH	PH	PH	1.48	1.47-1.49	8.04	8.03-8.05	~~Pass~~/Fail
10	PH	PH	PH	1.48	1.47-1.49	8.04	8.03-8.05	~~Pass~~/Fail
11	PH	PH	FC	1.48	1.47-1.49	8.04	8.03-8.05	~~Pass~~/Fail
12	PH	PH	PH	1.48	1.47-1.49	8.04	8.03-8.05	~~Pass~~/Fail
13	PH	PH	PH	1.48	1.47-1.49	8.04	8.03-8.05	~~Pass~~/Fail
14					1.47-1.49		8.03-8.05	Pass/Fail
15					1.47-1.49		8.03-8.05	Pass/Fail
16			FC		1.47-1.49		8.03-8.05	Pass/Fail
17	RD	RD		1.48	1.47-1.49	8.03	8.03-8.05	Pass/Fail
18	RD	RD	FC	1.48	1.47-1.49	8.03	8.03-8.05	Pass/Fail
19					1.47-1.49		8.03-8.05	Pass/Fail
20	PH	PH	PH	1.48	1.47-1.49	8.04	8.03-8.05	~~Pass~~/Fail
21	PH	PH	PH	1.48	1.47-1.49	8.04	8.03-8.05	~~Pass~~/Fail
22					1.47-1.49		8.03-8.05	Pass/Fail
23	PH	PH	PH	1.48	1.47-1.49	8.04	8.03-8.05	~~Pass~~/Fail
24	PH	PH	PH	1.48	1.47-1.49	8.04	8.03-8.05	~~Pass~~/Fail
25	PH	PH	FC	1.48	1.47-1.49	8.04	8.03-8.05	~~Pass~~/Fail
26	PH	PH	PH	1.48	1.47-1.49	8.04	8.03-8.05	~~Pass~~/Fail
27	PH	PH	PH	1.48	1.47-1.49	8.04	8.03-8.05	~~Pass~~/Fail
28					1.47-1.49		8.03-8.05	Pass/Fail
29					1.47-1.49		8.03-8.05	Pass/Fail
30	PH	PH	PH	1.48	1.47-1.49	8.04	8.03-8.05	Pass/Fail
31	PH	PH		1.48	1.47-1.49	8.04	8.03-8.05	~~Pass~~/Fail

changed filament

*** Any failing results need immediate corrective action**

Controlled Document
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Monthly Report for TEM Calibrations

Laboratory: Manhattan

Scope: 03-01

Detector: 3324

Chrysotile Beam Dose Sensitivity

(Quarterly)

Date	Initials	Negative Numbers		At least 90% of patterns >15 seconds ?
		SAED	Morphology	
12/15/2009	ES	62077	62078	PASS
3/17/2010	ES	62287	62288	PASS
6/25/2010	JA	62497	62498	PASS
9/16/2010	DY	62592	62594	PASS
12/6/2010	DY	62669	62670	PASS
1/10/2011	DY	62694	62695	PASS
3/12/2011	DY	62728	62729	PASS
6/8/2011	DY	62799	62800	PASS
9/9/2011	DY	62864	62865	PASS
12/12/2011	DY	62912	62913	PASS
3/1/2012	DY	62981	62982	PASS
6/23/2012	DY	63097	63098	PASS

Comments:

Camera Constant Calibrations

(Monthly / Weekly when Water Analysis is performed)

Negative (Camera)					
Date	Initials	Negative Number	Camera Length	Camera Constant	Is 2 Standard Dev. < 5% Mean?
8/23/2011	DY	62853	55	21.82	PASS
9/16/2011	DY	62863	55	21.82	PASS
9/21/2011	DY	62870	55	22.10	PASS
9/26/2011	DY	62872	55	21.79	PASS
10/6/2011	DY	62885	55	21.76	PASS
10/14/2011	DY	62888	55	22.21	PASS
10/25/2011	DY	62901	55	21.44	PASS
11/3/2011	AF	62903	55	21.50	PASS
11/8/2011	DY	62904	55	21.71	PASS
11/21/2011	DY	62908	55	22.27	PASS
12/12/2011	DY	62915	55	21.68	PASS
12/19/2011	DY	62919	55	21.53	PASS
1/16/2012	DY	62929	55	21.76	PASS
2/1/2012	DY	62937	55	21.50	PASS
2/24/2012	DY	62967	55	22.12	PASS
3/1/2012	DY	62978	55	21.92	PASS
3/9/2012	DY	62993	55	21.87	PASS
4/9/2012	DY	63055	55	21.81	PASS
5/4/2012	DY	63076	55	22.04	PASS
6/23/2012	DY	63094	55	21.89	PASS

Comments:

Monthly Report for TEM Calibrations

Laboratory: Manhattan

Scope: 03-01
Detector: 3324

Camera Constant Calibrations

(Monthly / Weekly when Water Analysis is performed)

On Screen					
Date	Initials	Camera Length	Aperture #	Aperture Diameter	Is 2 Standard Dev. < 5% Mean?
12/28/2010	DY	22	1	2.65	PASS
1/10/2011	DY	22	1	2.65	PASS
2/7/2011	DY	22	1	2.65	PASS
3/12/2011	DY	22	1	2.65	PASS
4/11/2011	DY	22	1	2.65	PASS
5/16/2011	DY	22	1	2.65	PASS
6/20/2011	DY	22	1	2.65	PASS
7/19/2011	DY	22	1	2.65	PASS
8/15/2011	DY	22	1	2.65	PASS
9/16/2011	DY	22	1	2.65	PASS
10/25/2011	DY	22	1	2.86	PASS
11/21/2011	DY	22	1	2.86	PASS
12/12/2011	DY	22	1	2.70	PASS
1/10/2012	DY	22	1	2.65	PASS
2/1/2012	DY	22	1	2.65	PASS
3/1/2012	DY	22	1	2.65	PASS
3/9/2012	DY	22	1	2.65	PASS
4/9/2012	DY	22	1	2.65	PASS
5/4/2012	DY	22	1	2.65	PASS
6/23/2012	DY	22	1	2.65	PASS

The above aperture diameter represents the on screen diameter in reciprocal space. Multiply this number times the number of layer lines seen to get layer line spacing.

Comments:

Plasma Asher Calibration

(Quarterly)

Time To Ash 5% of Collapsed MCE Filter			
Date	Initials	Min	Sec
2/3/2010	ES	6	52
5/11/2010	SJS	5	52
8/6/2010	ES	5	07
11/6/2010	CV	3	55
2/11/2011	CV	7	15
5/12/2011	CV	7	03
8/12/2011	CV	8	46
11/30/2011	CV	7	56
3/5/2012	WB	6	22
6/12/2012	WB	5	15

Comments:

Monthly Report for TEM Calibrations

Laboratory: Manhattan

Scope: 03-01
Detector: 3324

Magnification Calibrations
(Monthly)

20,000x - Negative

Date	Initials	Target Mag	Actual Mag	Is 2 SD <5% of Mean?
11/2/2010	AF	19164	19440	PASS
12/1/2010	DY	19164	19008	PASS
1/10/2011	DY	19164	19008	PASS
2/1/2011	DY	19164	19008	PASS
3/12/2011	DY	19164	19008	PASS
4/5/2011	DY	19164	19008	PASS
5/3/2011	DY	19164	19440	PASS
6/27/2011	DY	19164	18900	PASS
7/7/2011	DY	19164	19116	PASS
8/15/2011	DY	19164	19116	PASS
9/16/2011	DY	19164	19062	PASS
10/14/2011	DY	19164	19008	PASS
11/8/2011	DY	19164	19548	PASS
12/12/2011	DY	19164	19656	PASS
1/10/2012	DY	19164	19548	PASS
2/1/2012	DY	19164	18900	PASS
3/1/2012	DY	19164	19116	PASS
4/9/2012	DY	19164	19224	PASS
5/4/2012	DY	19164	19008	PASS
6/23/2012	DY	19164	18684	PASS

Comments:

20,000x - Screen

Date	Initials	Target Mag	Actual Mag	Is 2 SD <5% of Mean?
11/2/2010	AF	15368	15309	PASS
12/1/2010	DY	15368	15383	PASS
1/10/2011	DY	15368	15017	PASS
2/1/2011	DY	15368	15017	PASS
3/12/2011	DY	15368	15017	PASS
4/5/2011	DY	15368	15612	PASS
5/3/2011	DY	15368	15017	PASS
6/27/2011	DY	15368	15383	PASS
7/7/2011	DY	15368	15612	PASS
8/15/2011	DY	15368	15017	PASS
9/16/2011	DY	15368	15459	PASS
10/14/2011	DY	15368	15459	PASS
11/8/2011	DY	15368	15459	PASS
12/12/2011	DY	15368	15768	PASS
1/10/2012	DY	15368	15768	PASS
2/1/2012	DY	15368	15768	PASS
3/1/2012	DY	15368	15383	PASS
4/9/2012	DY	15368	15535	PASS
5/4/2012	DY	15368	15017	PASS
6/23/2012	DY	15368	15017	PASS

Comments:

10,000x - Negative

Date	Initials	Target Mag	Actual Mag	Is 2 SD <5% of Mean?
11/2/2010	AF	10087	9855	PASS
12/1/2010	DY	10087	10125	PASS
1/10/2011	DY	10087	10044	PASS
2/1/2011	DY	10087	10098	PASS
3/12/2011	DY	10087	10044	PASS
4/5/2011	DY	10087	10152	PASS
5/3/2011	DY	10087	10260	PASS
6/27/2011	DY	10087	9936	PASS
7/7/2011	DY	10087	10071	PASS
8/15/2011	DY	10087	10017	PASS
9/16/2011	DY	10087	10017	PASS
10/14/2011	DY	10087	9936	PASS
11/8/2011	DY	10087	10152	PASS
12/12/2011	DY	10087	10206	PASS
1/10/2012	DY	10087	10152	PASS
2/1/2012	DY	10087	10179	PASS
3/1/2012	DY	10087	10098	PASS
4/9/2012	DY	10087	10152	PASS
5/4/2012	DY	10087	10152	PASS
6/23/2012	DY	10087	10152	PASS

Comments:

10,000x - Screen

Date	Initials	Target Mag	Actual Mag	Is 2 SD <5% of Mean?
11/2/2010	AF	8071	7884	PASS
12/1/2010	DY	8071	7884	PASS
1/10/2011	DY	8071	7984	PASS
2/1/2011	DY	8071	8086	PASS
3/12/2011	DY	8071	7984	PASS
4/5/2011	DY	8071	8170	PASS
5/3/2011	DY	8071	7984	PASS
6/27/2011	DY	8071	8086	PASS
7/7/2011	DY	8071	8086	PASS
8/15/2011	DY	8071	7984	PASS
9/16/2011	DY	8071	7984	PASS
10/14/2011	DY	8071	7884	PASS
11/8/2011	DY	8071	8299	PASS
12/12/2011	DY	8071	8410	PASS
1/10/2012	DY	8071	8299	PASS
2/1/2012	DY	8071	8086	PASS
3/1/2012	DY	8071	8086	PASS
4/9/2012	DY	8071	8086	PASS
5/4/2012	DY	8071	8086	PASS
6/23/2012	DY	8071	8086	PASS

Comments:

Monthly Report for TEM Calibrations

Laboratory: Manhattan

Scope: 03-01

Detector: 3324

Calibration of On Screen 0.5 and 5µm Measuring Aids at EPA AHERA Magnification

(Monthly)

Date	Initials	Small Circle microns	Large Circle microns
11/2/2010	AF	0.46	4.77
12/1/2010	DY	0.46	4.75
1/10/2011	DY	0.47	4.86
2/1/2011	DY	0.47	4.86
3/12/2011	DY	0.47	4.86
4/5/2011	DY	0.45	4.68
5/3/2011	DY	0.47	4.86
6/27/2011	DY	0.46	4.75
7/7/2011	DY	0.45	4.68
8/15/2011	DY	0.47	4.86
9/16/2011	DY	0.45	4.72
10/14/2011	DY	0.45	4.72
11/8/2011	DY	0.45	4.72
12/12/2011	DY	0.44	4.63
1/10/2012	DY	0.44	4.63
2/1/2012	DY	0.44	4.63
3/1/2012	DY	0.46	4.75
4/9/2012	DY	0.45	4.70
5/4/2012	DY	0.47	4.86
6/23/2012	DY	0.47	4.86

Comments:

Calibration of On Screen 1.0 and 10µm Measuring Aids at EPA 100.2 Magnification

(Monthly)

Date	Initials	Small Circle microns	Large Circle microns
11/2/2010	AF	0.89	9.26
12/1/2010	DY	0.89	9.26
1/10/2011	DY	0.88	9.14
2/1/2011	DY	0.87	9.03
3/12/2011	DY	0.88	9.14
4/5/2011	DY	0.86	8.94
5/3/2011	DY	0.88	9.14
6/27/2011	DY	0.87	9.03
7/7/2011	DY	0.87	9.03
8/15/2011	DY	0.88	9.14
9/16/2011	DY	0.88	9.14
10/14/2011	DY	0.89	9.26
11/8/2011	DY	0.84	8.80
12/12/2011	DY	0.83	8.68
1/10/2012	DY	0.84	8.80
2/1/2012	DY	0.87	9.03
3/1/2012	DY	0.87	9.03
4/9/2012	DY	0.87	9.03
5/4/2012	DY	0.87	9.03
6/23/2012	DY	0.87	9.03

Comments:

Spot Size Measurements

(Quarterly)

Date	Initials	Actual Spot	Target Spot Size	FAIL ≤250nm =	Is 2 SD <25% of
6/25/2009	ES	206.91	≤ 250 nm	PASS	PASS
6/29/2009	ES	206.91	≤ 250 nm	PASS	PASS
6/30/2009	ES	206.91	≤ 250 nm	PASS	PASS
7/8/2009	ES	206.91	≤ 250 nm	PASS	PASS
7/17/2009	ES	181.05	≤ 250 nm	PASS	PASS
7/25/2009	ES	182.06	≤ 250 nm	PASS	PASS
7/31/2009	ES	182.06	≤ 250 nm	PASS	PASS
8/3/2009	ES	236.07	< 250 nm	PASS	PASS
11/11/2009	ES	211.04	≤ 250 nm	PASS	PASS
1/21/2010	GI	155.18	≤ 250 nm	PASS	PASS
3/24/2010	GI	205.76	≤ 250 nm	PASS	PASS
6/25/2010	JA	211.64	≤ 250 nm	PASS	PASS
9/3/2010	DY	219.84	≤ 250 nm	PASS	PASS
12/1/2010	DY	197.29	≤ 250 nm	PASS	PASS
3/12/2011	DY	210.44	≤ 250 nm	PASS	PASS
6/27/2011	DY	238.10	≤ 250 nm	PASS	PASS
9/16/2011	DY	157.38	≤ 250 nm	PASS	PASS
12/12/2011	DY	228.94	≤ 250 nm	PASS	PASS
3/1/2012	DY	209.25	≤ 250 nm	PASS	PASS
6/23/2012	DY	214.09	≤ 250 nm	PASS	PASS

Comments:

Monthly Report for TEM Calibrations

Laboratory: Manhattan

Scope: 03-01

Detector: 3324

K Factors

(Semi-Annually)

Test Dates	Initials	Mean K Factor	Pass Criteria	Actual	PASS FAIL	Acceptance Criteria	PASS/FAIL
11/20/2011	DY	Mg:Si	1.0 - 2.0	1.74	PASS	2SD < 10% Mean	PASS
6/24/2012	DY	Ca:Si	1.0 - 1.75	1.17	PASS	2SD < 10% Mean	PASS
----		Fe:Si	1.0 - 2.0	1.51	PASS	2SD < 10% Mean	PASS
----		Mg:Fe	1.5 or less	1.16	PASS	N / A	N / A
11/20/2011	DY	Na:Si	1.0 - 4.0	3.14	PASS	2SD < 20% Mean	PASS
6/24/2012	DY	Al:Si	1.0 - 1.75	1.27	PASS	2SD < 10% Mean	PASS

Comments:

Detector Resolution

(Semi-Annually / Quarterly when necessary to meet TNI Standard)

Date	@Mn Kα Peak Initials	Resolution	<175?	Resolution + 2(s) <180?
3/20/2009	ES	150.2	Pass	Pass
6/12/2009	ES	155.6	Pass	Pass
11/17/2009	ES	140.2	Pass	Pass
5/17/2010	ES/AF	149.3	Pass	Pass
11/11/2010	ES	151.8	Pass	Pass
5/31/2011	DY	128.6	Pass	Pass
10/4/2011	DY	131.0	Pass	Pass
10/14/2011	DY	132.0	Pass	Pass
1/10/2012	DY	126.4	Pass	Pass
4/9/2012	DY	138.4	Pass	Pass

Comments:

Significant Na and Resolvable Mg-Si Peaks

(Quarterly)

Date	Initials	Significant Na		Date	Initials	Resolvable Mg	Resolvable Si
3/17/2010	ES	Pass		3/17/10	ES	Yes	Yes
6/28/2010	ES	Pass		6/30/10	JA	Yes	Yes
9/3/2010	DY	Pass		9/16/10	DY	Yes	Yes
12/1/2010	DY	Pass		12/1/10	DY	Yes	Yes
3/12/2011	DY	Pass		3/12/11	DY	Yes	Yes
6/8/2011	DY	Pass		6/8/11	DY	Yes	Yes
9/9/2011	DY	Pass		9/9/11	DY	Yes	Yes
12/20/2011	DY	Pass		12/20/11	DY	Yes	Yes
3/1/2012	DY	Pass		3/1/12	DY	Yes	Yes
6/23/2012	DY	Pass		6/23/12	DY	Yes	Yes

Comments:

Monthly Report for TEM Calibrations

Laboratory: Cinnaminson

Scope: 04-03

Detector: PGT Avalon

Chrysotile Beam Dose Sensitivity

(Quarterly)

Date	Initials	Negative Numbers		At least 90% of patterns >15 seconds ?
		SAED	Morphology	
11/3/2009	KLB	03-356	03-357	PASS
2/8/2010	DY	03_372	03_373	PASS
5/18/2010	DY	03373	03374	PASS
8/16/2010	DY	03030	03031	PASS
11/5/2010	CG	11-5-10CG6	11-5-10CG5	PASS
2/18/2011	CG	03125	03126	PASS
5/20/2011	CG	03155	03154	PASS
8/18/2011	CG	03227	03228	PASS
11/4/2011	CG	03316	03317	PASS
2/7/2012	RD	MSL 0403 12	EMSL 0403 129	PASS
4/30/2012	PH	03128	03129	PASS
7/23/2012	PH	03303	03304	PASS

Comments:

Camera Constant Calibrations

(Monthly / Weekly when Water Analysis is performed)

Negative (Camera)					
Date	Initials	Negative Number	Camera Length	Camera Constant	Is 2 Standard Dev. < 5% Mean?
4/13/2012	PH	03108	100	520.42	PASS
4/20/2012	PH	03117	100	523.40	PASS
4/27/2012	PH	03127	100	521.30	PASS
5/4/2012	PH	03131	100	516.78	PASS
5/11/2012	PH	03135	100	517.01	PASS
5/18/2012	PH	03140	100	515.10	PASS
5/25/2012	PH	03173	100	516.15	PASS
5/30/2012	PH	03187	100	521.56	PASS
6/6/2012	PH	03188	100	522.45	PASS
6/12/2012	PH	03203	100	522.34	PASS
6/18/2012	PH	03255	100	524.45	PASS
6/25/2012	PH	03261	100	521.42	PASS
6/29/2012	PH	03282	100	532.98	PASS
7/2/2012	PH	03286	100	536.29	PASS
7/9/2012	PH	03287	100	539.13	PASS
7/13/2012	PH	03294	100	523.68	PASS
7/20/2012	PH	03297	100	534.25	PASS
7/23/2012	PH	03305	100	533.52	PASS
7/30/2012	PH	03311	100	533.18	PASS
8/6/2012	PH	03316	100	533.04	PASS

Comments: Scope down for repair 2/23/12 through 2/29/12. Weekly calibrations not done during this time.

Monthly Report for TEM Calibrations

Laboratory: Cinnaminson

Scope: 04-03

Detector: PGT Avalon

Camera Constant Calibrations

(Monthly / Weekly when Water Analysis is performed)

On Screen					
Date	Initials	Camera Length	Aperture #	Aperture Diameter	Is 2 Standard Dev. < 5% Mean?
4/13/2012	PH	24	1	1.18	PASS
4/20/2012	PH	24	1	1.20	PASS
4/27/2012	PH	24	1	1.18	PASS
5/4/2012	PH	24	1	1.18	PASS
5/11/2012	PH	24	1	1.20	PASS
5/18/2012	PH	24	1	1.20	PASS
5/25/2012	PH	24	1	1.18	PASS
5/30/2012	PH	24	1	1.18	PASS
6/6/2012	PH	24	1	1.18	PASS
6/12/2012	PH	24	1	1.18	PASS
6/18/2012	PH	24	1	1.20	PASS
6/25/2012	PH	24	1	1.20	PASS
6/29/2012	PH	24	1	1.20	PASS
7/2/2012	PH	24	1	1.18	PASS
7/9/2012	PH	24	1	1.18	PASS
7/13/2012	PH	24	1	1.20	PASS
7/20/2012	PH	24	1	1.20	PASS
7/23/2012	PH	24	1	1.18	PASS
7/30/2012	PH	24	1	1.20	PASS
8/6/2012	PH	24	1	1.20	PASS

The above aperture diameter represents the on screen diameter in reciprocal space. Multiply this number times the number of layer lines seen to get layer line spacing.

Comments: Scope down for repair 2/23/12 through 2/29/12, Weekly calibrations not done during that time.

Plasma Asher Calibration

(Quarterly)

Time To Ash 5% of Collapsed MCE Filter			
Date	Initials	Min	Sec
10/28/2009	SNS	3	18
2/2/2010	SNS	6	49
5/12/2010	DY	7	28
8/20/2010	DS	9	32
9/13/2010	WP	4	15

Comments: This asher is no longer in use as of Dec 2010. The asher currently in use for TEM prep is on the Scope 0401 calibration report.

Monthly Report for TEM Calibrations

Laboratory: Cinnaminson

Scope: 04-03

Detector: PGT Avalon

Magnification Calibrations
(Monthly)

20,000x - Negative

Date	Initials	Target Mag	Actual Mag	Is 2 SD <5% of Mean?
2/17/2011	CG	20848	21330	PASS
3/18/2011	CG	20848	21330	PASS
4/15/2011	CG	20848	21330	PASS
5/20/2011	CG	20848	20790	PASS
6/13/2011	CG	20848	20304	PASS
7/12/2011	CG	20848	20790	PASS
8/11/2011	CG	20848	21276	PASS
9/15/2011	CG	20848	20385	PASS
10/12/2011	CG	20848	20925	PASS
11/4/2011	CG	20848	21060	PASS
12/4/2011	CG	20848	20925	PASS
1/4/2012	CG	20848	21060	PASS
2/7/2012	RD	20848	19764	PASS
3/2/2012	PH	20848	20844	PASS
3/30/2012	PH	20848	20628	PASS
4/27/2012	PH	20848	20412	PASS
5/25/2012	PH	20848	21060	PASS
6/18/2012	PH	20848	20952	PASS
7/13/2012	PH	20848	20952	PASS
8/6/2012	PH	20848	20628	PASS

Comments:

20,000x - Screen

Date	Initials	Target Mag	Actual Mag	Is 2 SD <5% of Mean?
2/17/2011	CG	14408	14521	PASS
3/18/2011	CG	14408	14644	PASS
4/15/2011	CG	14408	14644	PASS
5/20/2011	CG	14408	14400	PASS
6/13/2011	CG	14408	14521	PASS
7/12/2011	CG	14408	14400	PASS
8/11/2011	CG	14408	14521	PASS
9/15/2011	CG	14408	14521	PASS
10/11/2011	CG	14408	14281	PASS
11/4/2011	CG	14408	14400	PASS
12/4/2011	CG	14408	14281	PASS
1/4/2012	CG	14408	14281	PASS
2/7/2012	RD	14408	14281	PASS
3/2/2012	PH	14408	14400	PASS
3/30/2012	PH	14408	14164	PASS
4/27/2012	PH	14408	14281	PASS
5/25/2012	PH	14408	14281	PASS
6/18/2012	PH	14408	14521	PASS
7/13/2012	PH	14408	14400	PASS
8/6/2012	PH	14408	14281	PASS

Comments:

10,000x - Negative

Date	Initials	Target Mag	Actual Mag	Is 2 SD <5% of Mean?
2/17/2011	CG	10486	10584	PASS
3/18/2011	CG	10486	10843	PASS
4/15/2011	CG	10486	10692	PASS
5/20/2011	CG	10486	10584	PASS
6/13/2011	CG	10486	10303	PASS
7/12/2011	CG	10486	10368	PASS
8/11/2011	CG	10486	10627	PASS
9/15/2011	CG	10486	10152	PASS
10/12/2011	CG	10486	10584	PASS
11/4/2011	CG	10486	10541	PASS
12/4/2011	CG	10486	10476	PASS
1/4/2012	CG	10486	10584	PASS
2/7/2012	RD	10486	9936	PASS
3/2/2012	PH	10486	10584	PASS
3/30/2012	PH	10486	10476	PASS
4/27/2012	PH	10486	10476	PASS
5/25/2012	PH	10486	10368	PASS
6/18/2012	PH	10486	10476	PASS
7/13/2012	PH	10486	10584	PASS
8/6/2012	PH	10486	10476	PASS

Comments:

10,000x - Screen

Date	Initials	Target Mag	Actual Mag	Is 2 SD <5% of Mean?
2/17/2011	CG	7249	7261	PASS
3/18/2011	CG	7249	7448	PASS
4/15/2011	CG	7249	7448	PASS
5/20/2011	CG	7249	7291	PASS
6/13/2011	CG	7249	7353	PASS
7/12/2011	CG	7249	7291	PASS
8/11/2011	CG	7249	7322	PASS
9/15/2011	CG	7249	7200	PASS
10/11/2011	CG	7249	7140	PASS
11/4/2011	CG	7249	7140	PASS
12/4/2011	CG	7249	7170	PASS
1/4/2012	CG	7249	7170	PASS
2/7/2012	RD	7249	7170	PASS
3/2/2012	PH	7249	7261	PASS
3/30/2012	PH	7249	7111	PASS
4/27/2012	PH	7249	7200	PASS
5/25/2012	PH	7249	7230	PASS
6/18/2012	PH	7249	7291	PASS
7/13/2012	PH	7249	7230	PASS
8/6/2012	PH	7249	7200	PASS

Comments:

Monthly Report for TEM Calibrations

Laboratory: Cinnaminson

Scope: 04-03

Detector: PGT Avalon

Calibration of On Screen 0.5 and 5µm
Measuring Aids at EPA AHERA Magnification
(Monthly)

Date	Initials	Small Circle microns	Large Circle microns
2/17/2011	CG	0.55	5.51
3/18/2011	CG	0.55	5.46
4/15/2011	CG	0.55	5.46
5/20/2011	CG	0.56	5.56
6/13/2011	CG	0.55	5.51
7/12/2011	CG	0.56	5.56
8/11/2011	CG	0.55	5.51
9/15/2011	CG	0.55	5.51
10/11/2011	CG	0.56	5.60
11/4/2011	CG	0.56	5.56
12/4/2011	CG	0.56	5.60
1/4/2012	CG	0.56	5.60
2/7/2012	RD	0.56	5.60
3/2/2012	PH	0.56	5.56
3/30/2012	PH	0.56	5.65
4/27/2012	PH	0.56	5.60
5/25/2012	PH	0.56	5.60
6/18/2012	PH	0.55	5.51
7/13/2012	PH	0.56	5.56
8/6/2012	PH	0.56	5.60

Comments:

Calibration of On Screen 1.0 and 10µm
Measuring Aids at EPA 100.2 Magnification
(Monthly)

Date	Initials	Small Circle microns	Large Circle microns
2/17/2011	CG	1.10	11.02
3/18/2011	CG	1.07	10.74
4/15/2011	CG	1.07	10.74
5/20/2011	CG	1.10	10.97
6/13/2011	CG	1.09	10.88
7/12/2011	CG	1.10	10.97
8/11/2011	CG	1.09	10.93
9/15/2011	CG	1.11	11.11
10/11/2011	CG	1.12	11.20
11/4/2011	CG	1.12	11.20
12/4/2011	CG	1.12	11.16
1/4/2012	CG	1.12	11.16
2/7/2012	RD	1.12	11.16
3/2/2012	PH	1.10	11.02
3/30/2012	PH	1.13	11.25
4/27/2012	PH	1.11	11.11
5/25/2012	PH	1.11	11.06
6/18/2012	PH	1.10	10.97
7/13/2012	PH	1.11	11.06
8/6/2012	PH	1.11	11.11

Comments:

Spot Size Measurements
(Quarterly)

Date	Initials	Actual Spot	Target Spot Size	FAIL ≤250nm =	Is 2 SD <25% of
3/8/2011	CG	216.38	≤ 250 nm	PASS	PASS
3/18/2011	CG	192.34	≤ 250 nm	PASS	PASS
4/15/2011	CG	201.95	≤ 250 nm	PASS	PASS
5/20/2011	CG	240.42	≤ 250 nm	PASS	PASS
6/13/2011	CG	231.48	≤ 250 nm	PASS	PASS
7/12/2011	CG	216.45	≤ 250 nm	PASS	PASS
8/11/2011	CG	197.41	≤ 250 nm	PASS	PASS
9/15/2011	CG	245.28	< 250 nm	PASS	PASS
10/12/2011	CG	215.05	≤ 250 nm	PASS	PASS
11/4/2011	CG	223.17	≤ 250 nm	PASS	PASS
12/4/2011	CG	219.83	≤ 250 nm	PASS	PASS
1/4/2012	CG	213.68	≤ 250 nm	PASS	PASS
2/7/2012	RD	207.45	≤ 250 nm	PASS	PASS
3/2/2012	PH	191.90	≤ 250 nm	PASS	PASS
3/30/2012	PH	184.22	≤ 250 nm	PASS	PASS
4/27/2012	PH	195.96	≤ 250 nm	PASS	PASS
5/25/2012	PH	189.93	≤ 250 nm	PASS	PASS
6/18/2012	PH	167.05	≤ 250 nm	PASS	PASS
7/13/2012	PH	181.37	≤ 250 nm	PASS	PASS
8/6/2012	PH	169.67	≤ 250 nm	PASS	PASS

Comments:

Monthly Report for TEM Calibrations

Laboratory: Cinnaminson

Scope: 04-03

Detector: PGT Avalon

K Factors

(Semi-Annually)

Test Dates	Initials	Mean K Factor	Pass Criteria	Actual	PASS FAIL	Acceptance Criteria	PASS/FAIL
5/21/2012	PH	Mg:Si	1.0 - 2.0	1.72	PASS	2SD < 10% Mean	PASS
5/21/2012	PH	Ca:Si	1.0 - 1.75	1.14	PASS	2SD < 10% Mean	PASS
----		Fe:Si	1.0 - 2.0	1.53	PASS	2SD < 10% Mean	PASS
----		Mg:Fe	1.5 or less	1.13	PASS	N / A	N / A
11/25/2011	CG	Na:Si	1.0 - 4.0	2.81	PASS	2SD < 20% Mean	PASS
5/21/2012	PH	Al:Si	1.0 - 1.75	1.15	PASS	2SD < 10% Mean	PASS

Comments:

Detector Resolution

(Semi-Annually / Quarterly when necessary to meet TNI Standard)

Date	@Mn Kα Peak Initials	Resolution	<175?	Resolution + 2(s) <180?
11/3/2009	KLB	141.0	Pass	Pass
4/28/2010	DY	131.0	Pass	Pass
11/4/2010	CG	120.0	Pass	Pass
5/20/2011	CG	135.0	Pass	Pass
8/18/2011	CG	125.0	Pass	Pass
11/4/2011	CG	135.0	Pass	Pass
2/7/2012	GPA	134.8	Pass	Pass
2/7/2012	RD	117.3	Pass	Pass
4/30/2012	PH	127.7	Pass	Pass
7/23/2012	PH	124.4	Pass	Pass

Comments:

Significant Na and Resolvable Mg-Si Peaks

(Quarterly)

Date	Initials	Significant Na		Date	Initials	Resolvable Mg	Resolvable Si
4/28/2010	DY	Pass		4/28/10	DY	Yes	Yes
7/28/2010	DY	Pass		7/28/10	DY	Yes	Yes
11/5/2010	CG	Pass		11/4/10	CG	Yes	Yes
2/18/2011	CG	Pass		2/18/11	CG	Yes	Yes
5/20/2011	CG	Pass		5/20/11	CG	Yes	Yes
8/18/2011	CG	Pass		8/18/11	CG	Yes	Yes
11/4/2011	CG	Pass		11/4/11	CG	Yes	Yes
2/7/2012	RD	Pass		2/7/12	RD	Yes	Yes
4/30/2012	PH	Pass		4/30/12	PH	Yes	Yes
7/23/2012	PH	Pass		7/23/12	PH	Yes	Yes

Comments:

7. NVLAP/AIHA Certifications

United States Department of Commerce
National Institute of Standards and Technology

NVLAP®

Certificate of Accreditation to ISO/IEC 17025:2005

NVLAP LAB CODE: 101048-0

EMSL Analytical, Inc.

Cinnaminson, NJ

is accredited by the National Voluntary Laboratory Accreditation Program for specific services, listed on the Scope of Accreditation, for:

AIRBORNE ASBESTOS FIBER ANALYSIS

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communique dated January 2009).

2012-07-01 through 2013-06-30

Effective dates

For the National Institute of Standards and Technology

NVLAP-01C (REV. 2009-01-28)

National Voluntary
Laboratory Accreditation Program

SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005

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AIRBORNE ASBESTOS FIBER ANALYSIS (TEM) **NVLAP LAB CODE 101048-0**

NVLAP Code	*Designation / Description*
18/A02	U.S. EPA's "Interim Transmission Electron Microscopy Analytical Methods-Mandatory and Nonmandatory-and Mandatory Section to Determine Completion of Response Actions" as found in 40 CFR, Part 763, Subpart E, Appendix A.

2012-07-01 through 2013-06-30
Effective dates

For the National Institute of Standards and Technology

NVLAP-01S (REV. 2005-05-19)

United States Department of Commerce
National Institute of Standards and Technology

NVLAP®

Certificate of Accreditation to ISO/IEC 17025:2005

NVLAP LAB CODE: 101048-0

EMSL Analytical, Inc.

Cinnaminson, NJ

is accredited by the National Voluntary Laboratory Accreditation Program for specific services, listed on the Scope of Accreditation, for:

BULK ASBESTOS FIBER ANALYSIS

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communique dated January 2009).

2012-07-01 through 2013-06-30

Effective dates

For the National Institute of Standards and Technology

NVLAP-01C (REV. 2009-01-28)

National Voluntary Laboratory Accreditation Program

SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005

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BULK ASBESTOS FIBER ANALYSIS (PLM) **NVLAP LAB CODE 101048-0**

NVLAP Code	*Designation / Description*
18/A01	EPA-600/M4-82-020: Interim Method for the Determination of Asbestos in Bulk Insulation Samples

2012-07-01 through 2013-06-30

Effective dates

For the National Institute of Standards and Technology

NVLAP-01S (REV. 2005-05-19)

AIHA

Laboratory Accreditation Programs, LLC

AIHA Laboratory Accreditation Programs, LLC

acknowledges that

EMSL Analytical Inc.

200 Route 130 North, Cinnaminson, NJ 08077

Laboratory ID: 100194

has fulfilled the requirements of the AIHA Laboratory Accreditation Programs (AIHA-LAP), LLC thereby conforming to the ISO/IEC 17025:2005 international standard, *General Requirements for the Competence of Testing and Calibration Laboratories.* The above named laboratory, along with all premises from which key activities are performed, as listed above, have been accredited by AIHA-LAP, LLC in the following:

LABORATORY ACCREDITATION PROGRAMS

√	**INDUSTRIAL HYGIENE**	Accreditation Expires: July 01, 2012
√	**ENVIRONMENTAL LEAD**	Accreditation Expires: July 01, 2012
√	**ENVIRONMENTAL MICROBIOLOGY**	Accreditation Expires: July 01, 2012
☐	**FOOD**	Accreditation Expires:

Specific Field(s) of Testing (FoT)/Method(s) within each Accreditation Program for which the above named laboratory maintains accreditation is outlined on the attached **Scope of Accreditation.** Continued accreditation is contingent upon successful on-going compliance with AIHA-LAP, LLC requirements. This certificate is not valid without the attached **Scope of Accreditation.** Please review the AIHA-LAP, LLC website (www.aihaaccreditedlabs.org) for the most current scope of accreditation.

Dave Sandusky

Dave Sandusky, CIH
Chairperson, Analytical Accreditation Board

Date Issued: 07/01/2010

AIHA Laboratory Accreditation Programs, LLC
SCOPE OF ACCREDITATION

EMSL Analytical, Inc.
107 Haddon Avenue, Westmont, NJ 08108

Laboratory ID: 100194
Issue Date: 07/01/2010

The laboratory is approved for those specific field(s) of testing/methods listed in the table below. Clients are urged to verify the laboratory's current accreditation status for the particular field(s) of testing/Methods, since these can change due to proficiency status, suspension and/or revocation. A complete listing of currently accredited Industrial Hygiene laboratories is available on the AIHA-LAP, LLC website at: http://www.aihaaccreditedlabs.org

Industrial Hygiene Laboratory Accreditation Program (IHLAP)

Initial Accreditation Date: 02/01/1989

IHLAP Category	Field of Testing (FoT)	Method	Method Description *(for internal methods only)*
Core Program Testing	Gas Chromatography	NIOSH 1003	
		NIOSH 1005	
		NIOSH 1400	
		NIOSH 1500	
		NIOSH 1550	
		NIOSH 1603	
		NIOSH 2000	
		NIOSH 2551	
		NIOSH 5502	
		NIOSH 5503	
		NIOSH 5510	
		OSHA 1010	
	GC (Diffusive Samplers)	NIOSH 1003	
		NIOSH 1005	
		NIOSH 1501	
	GC/MS	EPA TO-15	
	HPLC	NIOSH 2016	
		NIOSH 5506	
		OSHA 47	
		OSHA 58	
	AA	NIOSH 6009	
		NIOSH 7105	
		OSHA ID-140	
		OSHA ID-145	
	ICP	NIOSH 7300	
	XRD	NIOSH 7500	
	Ion Chromatography	NIOSH 6004	
		NIOSH 6011	
		NIOSH 7903	

AIHA
Laboratory Accreditation Programs, LLC

IHLAP Category	Field of Testing (FoT)	Method	Method Description *(for internal methods only)*
Core Program Testing	Ion Chromatography	OSHA ID-214	
		OSHA ID-215	
	Gravimetric	NIOSH 0500	
		NIOSH 0600	
	UV/VIS (Colorimetric)	NIOSH 6010	
	Thermal Optical Analyzer	NIOSH 5040	
	Polarized Light Microscopy (PLM)	EPA 600/R-93/116	
	Phase Contrast Microscopy (PCM)	NIOSH 7400	
	Transmission Electron Microscopy (TEM)	EPA AHERA - 40 CFR Part 763	
		NIOSH 7402	

The laboratory participates in the following AIHA-LAP, LLC-approved proficiency testing programs:

- ✓ Metals*
- ✓ Silica*
- ✓ Asbestos*
- ☐ Bulk Asbestos*
- ✓ Beryllium
- ✓ Organic Solvents*
- ✓ Diffusive Sampler (3M)*
- ☐ Diffusive Sampler (SKC)*
- ☐ Diffusive Sampler (AT)
- ✓ WASP[1] (Formaldehyde)
- ☐ WASP[1] (Thermal Desorption Tubes)
- ☐ Pharmaceutical Round Robin
- ☐ Compressed/Breathing Air Round Robin
- ☐ NVLAP (determined at the time of site assessment)

[1] Workplace Analytical Scheme for Proficiency

8. Customer Correspondence

McDaniel, Debrah

Subject: FW: Phillips Mine SAP

From: Samantha Caruthers-Knight [mailto:Samantha.Caruthers-Knight@errg.com]
Sent: Thursday, June 21, 2012 5:06 PM
To: Denton, Robyn
Subject: RE: Phillips Mine SAP

Samples designated with AA are ambient air and samples with AM are activity based (air monitoring).

From: Denton, Robyn [mailto:rdenton@EMSL.com]
Sent: Thursday, June 21, 2012 2:01 PM
To: Samantha Caruthers-Knight
Subject: RE: Phillips Mine SAP

Hi Samantha, Just one final Question so I can get this cost quote out to you.

The cost quote will be determined by the type of sample, Ambient Air or Activity Based, since they have different analytical sensitivities.

These aren't denoted on your COC, can you tell me which samples are activity based and which are ambient air?
Thanks

Robyn Denton | *Laboratory Manager*
EMSL Analytical, Inc. | 200 Route 130 North | Cinnaminson, NJ 08077
Phone: 856-303-2556 | Fax: 856-786-5974 | Toll Free: 800-220-3675
Lab Hours: Mon-Friday 7AM-10PM, Saturday 8AM-5PM, Sunday On-Call

Some of the resources EMSL Analytical, Inc. offers to our clients:
LABConnect | Order Products | Client Corner | Training | Additional Resources

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From: Samantha Caruthers-Knight [mailto:Samantha.Caruthers-Knight@errg.com]
Sent: Thursday, June 21, 2012 3:05 PM
To: Denton, Robyn
Subject: Phillips Mine SAP

Here is our workplan/SAP for the Phillips project. Please have a look and then we can discuss the proper sampling methods etc.

Samantha

McDaniel, Debrah

Subject: FW: ISO

From: Cahill, Ed
Sent: Friday, June 22, 2012 4:36 PM
To: 'Samantha Caruthers-Knight'
Cc: Denton, Robyn; Murdock, Ian
Subject: ISO

Samantha:
I have instructed the lab to begin prep and analysis of 3 ABS samples (3,5,45 from the cost estimate spreadsheet).
By close of business Monday or early Tuesday we should be able to give you at least a verbal estimation of fiber loading.
Hopefully that information will help us to chart a course forward.
If you have any questions my direct number is below.

Ed Cahill | Vice President, Asbestos Division
200 Route 130 North | Cinnaminson, NJ 08077
Phone: 856-303-2565

From: Samantha Caruthers-Knight [mailto:Samantha.Caruthers-Knight@errg.com]
Sent: Friday, June 22, 2012 3:14 PM
To: Cahill, Ed
Subject: RE:

Ok, so I'm working on figuring out what the sensitivity level we need for these samples is. According to our work plan (attached for your reference) we are trying to determine if there is either >1%, between 1% and 0.25% or less than 0.25% (see section 5). I'm not sure how that translates to the sensitivity levels or the number of grid openings. I would assume if we do see anything over 1% we could quit counting and minimize the number of grid openings that need to be counted. Perhaps this gives you something to go off of? I think the best plan might be for me to flag a few of the samples which I expect to have either the highest or lowest concentrations and see where we are, and go from there? A I mentioned on the phone yesterday, I'm not really sure how all this works so maybe we can talk things over on the phone this afternoon. Once you have had a change to look over the work plan and think a bit please give me a call on my cell at : 510-851-3279

Thanks,
Samantha

From: Cahill, Ed [mailto:ECahill@EMSL.com]
Sent: Thursday, June 21, 2012 3:39 PM
To: Samantha Caruthers-Knight
Subject: FW:

Hi Samantha:
As discussed, ISO Analysis cost estimate attached

Ed Cahill | Vice President, Asbestos Division
200 Route 130 North | Cinnaminson, NJ 08077
Phone: 856-303-2565

EMSL Analytical, Inc.

200North, Route 130, Cinnaminson, NJ. 08077
Phone: (800) 220-3675

Attn.: Samantha Caruthers-Knight	EMSL Case No.: 361201904
Engineering/Remediation Resources Group	Sample(s) Received: 6/22/2012
4585 Pacheco Blvd	Date of Analysis: 7/10/2012
Suite 200	Date Printed: 7/10/2012
Martinez, CA. 94553	Reported By: J.Newton
Phone: 925-969-0750 Fax: 925-969-0751	Email: Samanth.knight@errg.com

- Laboratory Report -

Project: 2011-149

Conclusions:

- No Asbestiform minerals were observed in the samples.

Procurement of Samples and Analytical Overview:

The material for analysis arrived at EMSL Analytical (Cinnaminson, NJ) on 6/22/2012. The package arrived in satisfactory condition with no evidence of damage to the contents. The samples reported herein have been analyzed for Asbestos Fibers per the following equipment and methodologies.

Instruments/Methods:	Scanning Electron Microscope, JEOL 6400 Energy Dispersive X-Ray Spectrometer, EVEX Nano
Definitions:	Asbestos: Any of a group of six regulated naturally occurring, fibrous minerals. ND: None Detected LOQ: Limit of Quantitation str/L: Structures per liter

Analyzed by: *John Newton*, *Senior Materials Scientist* — 10 July 2012 *Date*

Reviewed/Approved by : *Shannon Kauffman*, *Approved Signatory* — 10 July 2012 *Date*

EMSL Analytical, Inc.

200North, Route 130, Cinnaminson, NJ. 08077
Phone: (800) 220-3675

Attn.: Samantha Caruthers-Knight
Engineering/Remediation Resources Group
4585 Pacheco Blvd
Suite 200
Martinez, CA. 94553
Phone: 925-969-0750 Fax: 925-969-0751 Email: Samanth.knight@errg.com

EMSL Case No.: 361201904
Sample(s) Received: 6/22/2012
Date of Analysis: 7/10/2012
Date Printed: 7/10/2012
Reported By: J.Newton

Summary of Results:

Sample ID	*Description*	*Fiber Type*	*Number of Structures*	*Concentration (str/cc)*	*Limits (LOQ/LOD)*
PA-ATVI-AA-01	Phillips Mine	Chrysotile	0	<LOQ	LOQ (str/cc)
		Amphibole	0	<LOQ	*0.0056*
Volume (L)=	791.1	Cleavage Frag.	0	<LOQ	
Area Analyzed (mm^2)=	0.216	Other	0	<LOQ	LOD (str/mm^2)
		Total	0	<LOQ	*4.63*
PA-ATVI-AM-02	Phillips Mine	Chrysotile	0	<LOQ	LOQ (str/cc)
		Amphibole	0	<LOQ	*0.0090*
Volume (L)=	396.1	Cleavage Frag.	0	<LOQ	
Area Analyzed (mm^2)=	0.270	Other	2 (A)	0.018	LOD (str/mm^2)
		Total	2	0.018	*3.70*
PA-UW-AM-04	Phillips Mine	Chrysotile	0	<LOQ	LOQ (str/cc)
		Amphibole	0	<LOQ	*0.0098*
Volume (L)=	456.7	Cleavage Frag.	0	<LOQ	
Area Analyzed (mm^2)=	0.216 (C)	Other	11 (A,B)	0.107	LOD (str/mm^2)
		Total	11	0.107	*4.63*
PA-ATV2-AA-05	Phillips Mine	Chrysotile	0	<LOQ	LOQ (str/cc)
		Amphibole	0	<LOQ	*0.0087*
Volume (L)=	513.4	Cleavage Frag.	0	<LOQ	
Area Analyzed (mm^2)=	0.216	Other	1 (A)	0.0087	LOD (str/mm^2)
		Total	1	0.0087	*4.63*
PA-BG-AA-02	Phillips Mine	Chrysotile	0	<LOQ	LOQ (str/cc)
		Amphibole	0	<LOQ	*0.0090*
Volume (L)=	492.5	Cleavage Frag.	0	<LOQ	
Area Analyzed (mm^2)=	0.216	Other	0	<LOQ	LOD (str/mm^2)
		Total	0	<LOQ	*4.63*

A. Organic fibers consistent with plant matter.
B. One fiber consisting of iron oxide
C. Additional field area was analyzed to compensate for the low sample volume.

EMSL Analytical, Inc.

200North, Route 130, Cinnaminson, NJ. 08077
Phone: (800) 220-3675

Attn.: Samantha Caruthers-Knight
Engineering/Remediation Resources Group
4585 Pacheco Blvd
Suite 200
Martinez, CA. 94553
Phone: 925-969-0750 Fax: 925-969-0751 Email: Samanth.knight@errg.com

EMSL Case No.: 361201904
Sample(s) Received: 6/22/2012
Date of Analysis: 7/10/2012
Date Printed: 7/10/2012
Reported By: J.Newton

Important Terms, Conditions, and Limitations:

Sample Retention: Samples analyzed by EMSL will be retained for 60 days after analysis date. Storage beyond this period is available for a fee with written request prior to the initial 30 day period. Samples containing hazardous/toxic substances which require special handling may be returned to the client immediately. EMSL reserves the right to charge a sample disposal or return shipping fee.

Change Orders and Cancellation: All changes in the scope of work or turnaround time requested by the client after sample acceptance must be made in writing and confirmed in writing by EMSL. If requested changes result in a change in cost the client must accept payment responsibility. In the event work is cancelled by a client, EMSL will complete work in progress and invoice for work completed to the point of cancellation notice. EMSL is not responsible for holding times that are exceeded due to such changes.

Warranty: EMSL warrants to its clients that all services provided hereunder shall be performed in accordance with established and recognized analytical testing procedures and with reasonable care in accordance with applicable federal, state and local laws. The foregoing express warranty is exclusive and is given in lieu of all other warranties, expressed or implied. EMSL disclaims any other warranties, express or implied, including a warranty of fitness for particular purpose and warranty of merchantability.

Limits of Liability: In no event shall EMSL be liable for indirect, special, consequential, or incidental damages, including, but not limited to, damages for loss of profit or goodwill regardless of the negligence (either sole or concurrent) of EMSL and whether EMSL has been informed of the possibility of such damages, arising out of or in connection with EMSL's services thereunder or the delivery, use, reliance upon or interpretation of test results by client or any third party. We accept no legal responsibility for the purposes for which the client uses the test results. EMSL will not be held responsible for the improper selection of sampling devices even if we supply the device to the user. The user of the sampling device has the sole responsibility to select the proper sampler and sampling conditions to insure that a valid sample is taken for analysis. Any resampling performed will be at the sole discretion of EMSL, the cost of which shall be limited to the reasonable value of the original sample delivery group (SDG) samples. In no event shall EMSL be liable to a client or any third party, whether based upon theories of tort, contract or any other legal or equitable theory, in excess of the amount paid to EMSL by client thereunder.

The data and other information contained in this report, as well as any accompanying documents, represent only the samples analyzed. They are reported upon the condition that they are not to be reproduced wholly or in part for advertising or other purposes without the written approval from the laboratory.

Appendix D. Alternative Cost Estimate Summary

Table D-1. Alternatives Cost Estimate Summary

Site: Phillips Asbestos Mine Site
Location: Tonto National Forest, Gila County, Arizona
Phase: EE/CA (-30% / +50%)

Remedial Alternative	Total Capital Cost	Total O&M Cost (30 Years)	Total Periodic Cost	Period of Analysis[2]	Total Cost[3]	Present Worth Cost[4]	Range for -30% / +50%
1	$ -	$ -	$ -	30 years	$ -	$ -	$ - to $ -
2	$ 797,852	$ 319,200	$ 105,000	30 years	$ 1,222,052	$ 1,110,932	$ 777,653 to $ 1,666,398
3A	$ 1,289,593	$ 478,800	$ 234,000	30 years	$ 2,002,393	$ 1,896,628	$ 1,327,640 to $ 2,844,942
3B	$ 1,210,465	$ 547,200	$ 279,000	30 years	$ 2,036,665	$ 1,817,501	$ 1,272,250 to $ 2,726,251
4	$ 13,580,792	$ 478,800	$ 210,000	30 years	$ 14,269,592	$ 14,088,016	$ 9,861,611 to $ 21,132,024

Notes:

(1) Appended tables summarize backup calculations for all cost estimates provided.

(2) Period of analysis assumes the base year is 2012.

(3) Total cost includes a 25 percent contingency factor to account for changes in scope, changes to bid quantites, and inflation.

(4) Based on a 2.0 percent discount factor for projects with a 30-year (or greater) duration, as specified for federal facility sites in Appendix C of Office of Management and Budget Circular A-94 (effective December 2011) at http://www.whitehouse.gov/omb/circulars/a094/a94_appx-c.html.

Table D-2. Alternative 2 - Cost Summary

CAPITAL COSTS: DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL	SOURCE/NOTES
Implementation Plans/Setup	1	LS	$25,000	$25,000	Includes pre-mobilization archeological survey, to be conducted prior to other planning documents. Includes 10 days for Technical Staff to complete pre-mobilization plans (including Work Plan and HASP with graphics, review, and production).
Design	1	LS	$8,500	$8,500	Includes 4 days for Technical Staff to complete the design of institutional controls, including a preconstruction survey.
Mobilization and demobilization	1	LS	$35,000	$35,000	Mobilization and demobilization of crew, materials, and equipment. Craft trade crew of four plus one technical person for 2 days. Includes airfare and hotel costs for the duration of work.
Site Work					
Purchase of road closure gates	4	EA	$73.18	$292.71	RS Means Heavy Construction Cost Data 2012, 32 31 13.20 Gate, 4' wide, 5' high, 2" frame, galvanized steel, in concrete, material bare cost.
Purchase of post mounted signs	5	EA	$82.05	$410.24	RS Means Heavy Construction Cost Data 2012, 10 14 0600 Guide and directional signs, 18" x 24" reflectorized, high intensity, material bare cost + 10 14 1500 Steel posts, galvanized, material bare cost.
Purchase of fencing	2,500	LF	$20.40	$51,002.50	RS Means Heavy Construction Cost Data 2012, 32 31 13.20 0600 Fence, chain link industrial, 3 strands barb wire, 2" post @ 10' O.C., set in concrete, 6' H, 6 ga. wire, galv. aluminized steel, material bare cost.
Scarify roads and block access	1	LS	$95,000.00	$95,000.00	10 days of work using a dozer, tracked skidsteer with grapple bucket, backhoe, water truck, and hand tools. Includes installation of fence, road gates and signage.
Adit Closure	1	LS	$280,000.00	$280,000.00	Bat survey of 16 adits, bat gates at 8 adits, safety closures at 8 adits. Backfill safety closures with native soil.
After Action Report	1	LS	$20,000	$20,000	Includes 10 days for Technical Staff to write a completion report, including graphics, review, and production.
SUBTOTAL				**$515,205**	
Contingency	25%			$128,801	15% scope + 10% bid
SUBTOTAL				**$644,007**	
Project Management	10%			$51,520.54	Includes project management during all phases of construction, regulatory interface, permitting, and crew per diems.
Construction Management	12%			$61,824.65	Includes construction management, quality control, surveying, geotechnical testing, and quality control testing.
SUBTOTAL					
Institutional Controls	1	LS	$40,500	$40,500	Forest Plan amendment, legal description for ARIC, and legal fees. Includes reproduction.
	TOTAL CAPITAL CONSTRUCTION COSTS:			**$797,852**	

Table D-2. Alternative 2 - Cost Summary

CAPITAL COSTS: DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL	SOURCE/NOTES
Inspections and Maintenance					
Biannual Inspections	2	LS	$ 2,000	$ 4,000	Biannual inspections to evaluate the integrity of all instutional control elements and stormwater BMPs.
Minor Repairs	1	LS	$ 3,000	$ 3,000	Replacement fence, gates and/or signs
SUBTOTAL				**$7,000**	
Contingency	25%			$ 1,750	10% scope + 15% bid
SUBTOTAL				**$8,750**	
Project Management	10%			$700	
Contractor Overhead	7%			$490	
Profit	10%			$700	
			TOTAL ANNUAL O&M COSTS:	**$10,640**	per year
			TOTAL ANNUAL O&M COSTS:	**$319,200**	Years 1-30
PERIODIC COSTS	**Year**				
Five-Year Review Report	5	1	LS	$10,000	$10,000.00 Preparation of one report at the end of Year 5
Significant Repairs	5	1	LS	$5,000	$5,000.00 Costs for replacement of fence, gates and signs
SUBTOTAL (YEAR 5)					**$15,000.00**
Five-Year Review Report	10	1	LS	$10,000	$10,000.00 Preparation of one report at the end of Year 10
Major Repairs	10	1	LS	$10,000	$10,000.00 Costs for Major Replacement of fence, gates and signs
SUBTOTAL (YEAR 10)					**$20,000.00**
Five-Year Review Report	15	1	LS	$10,000	$10,000.00 Preparation of one report at the end of Year 15
Significant Repairs	15	1	LS	$5,000	$5,000.00 Costs for replacement of fence, gates and signs
SUBTOTAL (YEAR 15)					**$15,000.00**
Five-Year Review Report	20	1	LS	$10,000	$10,000.00 Preparation of one report at the end of Year 20
Major Repairs	20	1	LS	$10,000	$10,000.00 Costs for Major Replacement of fence, gates and signs
SUBTOTAL (YEAR 20)					**$20,000.00**
Five-Year Review Report	15	1	LS	$10,000	$10,000.00 Preparation of one report at the end of Year 25
Significant Repairs	15	1	LS	$5,000	$5,000.00 Costs for replacement of fence, gates and signs
SUBTOTAL (YEAR 25)					**$15,000.00**
Five-Year Review Report	20	1	LS	$10,000	$10,000.00 Preparation of one report at the end of Year 30
Major Repairs	20	1	LS	$10,000	$10,000.00 Costs for Major Replacement of fence, gates and signs
SUBTOTAL (YEAR 30)					**$20,000.00**

Table D-2. Alternative 2 - Cost Summary

CAPITAL COSTS: DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL	SOURCE/NOTES

PRESENT VALUE ANALYSIS:

COST TYPE	YEAR	TOTAL COST	TOTAL COST PER YEAR	DISCOUNT FACTOR (2.0%)	PRESENT VALUE
Capital Cost	0	$ 797,852	$ 797,852	1.000	$ 797,852
Annual O&M Cost	1-30	$ 319,200	$10,640	0.747	$238,298.29
Periodic Cost	5	$15,000.00	$ 15,000	0.906	$ 13,586
Periodic Cost	10	$20,000.00	$ 20,000	0.820	$ 16,407
Periodic Cost	15	$15,000.00	$ 15,000	0.743	$ 11,145
Periodic Cost	20	$20,000.00	$ 20,000	0.673	$ 13,459
Periodic Cost	25	$15,000.00	$ 15,000	0.610	$ 9,143
Periodic Cost	30	$20,000.00	$ 20,000	0.552	$ 11,041
		$1,222,052			$ 1,110,932

TOTAL PRESENT VALUE OF SELECTED REMEDY **$1,110,932**

Notes:

1. Source: Office of Management and Budget, 2008. OMB Circular No. A-94. January. Online at: <http://www.whitehouse.gov/omb/circulars/a094/a94_appx-c.html>.
2. Source: RS Means Heavy Construction Cost Data 2012
3. RS Means Costs were multiplied by a factor of .887 to account for a Flagstaff, AZ localization factor. (p. 588)
4. Based on a 2.0 percent discount factor for projects with a 30-year (or greater) duration, as specified for federal facility sites in Appendix C of Office of Management and Budget Circular A-94 (effective December 2012)

AC= Acre

BCY= Bank Cubic Yard

CY = cubic yards

ea = each

LCY= Loose Cubic Yard

LF = linear feet

LS = lump sum

LUC = land use control

O&M = operation and maintenance

SF = square feet

SY = square yard

TN= Ton

Table D-3. Alternative 2 - Cash Flow Analysis

Year	Periodic Cost	Annual Cost	Discount Factor	Actual Periodic Cost	Actual Annual Cost
1		$10,640	0.980392157		$10,431.37
2		$10,640	0.961168781		$10,226.84
3		$10,640	0.942322335		$10,026.31
4		$10,640	0.923845426		$9,829.72
5	$15,000	$10,640	0.90573081	$13,585.96	$9,636.98
6		$10,640	0.887971382		$9,448.02
7		$10,640	0.870560179		$9,262.76
8		$10,640	0.853490371		$9,081.14
9		$10,640	0.836755266		$8,903.08
10	$20,000	$10,640	0.8203483	$16,406.97	$8,728.51
11		$10,640	0.804263039		$8,557.36
12		$10,640	0.788493176		$8,389.57
13		$10,640	0.773032525		$8,225.07
14		$10,640	0.757875025		$8,063.79
15	$15,000	$10,640	0.74301473	$11,145.22	$7,905.68
16		$10,640	0.728445814		$7,750.66
17		$10,640	0.714162562		$7,598.69
18		$10,640	0.700159375		$7,449.70
19		$10,640	0.68643076		$7,303.62
20	$20,000	$10,640	0.672971333	$13,459.43	$7,160.41
21		$10,640	0.659775817		$7,020.01
22		$10,640	0.646839036		$6,882.37
23		$10,640	0.634155918		$6,747.42
24		$10,640	0.621721488		$6,615.12
25	$15,000	$10,640	0.609530871	$9,142.96	$6,485.41
26		$10,640	0.597579285		$6,358.24
27		$10,640	0.585862044		$6,233.57
28		$10,640	0.574374553		$6,111.35
29		$10,640	0.563112307		$5,991.51
30	$20,000	$10,640	0.552070889	$11,041.42	$5,874.03

Table D-4. Alternative 3A - Cost Summary

CAPITAL COSTS:

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL	SOURCE/NOTES
Implementation Plans/Setup	1	LS	$75,000	$75,000.00	Includes pre-mobilization archeological survey, to be conducted prior to other planning documents. Includes 10 days for Technical Staff to complete pre-mobilization plans (including Work Plan and HASP with graphics, review, and production).
Design	1	LS	$50,000	$50,000.00	Includes 20 days for Technical Staff to complete the design of road grades, repository, and restored grades. Includes surveys.
Mobilization and demobilization	1	LS	$100,000	$100,000.00	Mobilization and demobilization of crew, materials, and equipment. Craft trade crew of nine plus one technical person for 4 days. Includes airfare and hotel costs for the duration of work.
Site Work					
Road grading	1	LS	$105,000.00	$105,000.00	8 days of work, includes use of an excavator, dozer, and backhoe.
Excavation of repository	14,000	BCY	$2.18	$30,548.28	RS Means Heavy Construction Cost Data 2012, 31 23 16.13 1030 Excavating, trench, 10' to 14' deep, 3 cy excavator.
Hauling clean spoils	12,000	BCY	$2.74	$32,889.96	RS Means Heavy Construction Cost Data 2012, 31 23 23.20 5170 Hauling, 22 cy off-road, 15 min wait, 15 mph, cycle 1 mile. Clean spoils hauled for use as borrow material for road repairs and restoration.
Load and haul waste to repository	11,500	BCY	$8.08	$92,875.55	RS Means Heavy Construction Cost Data 2012, G1030 140 3400 Load and haul common earth, 3.5 cy track loader, four 20 cy dump trailers, 1 mi round trip. Multiply by 1.5 for grade at Upper Workings Area.
Encapsulation of repository	5,500	BCY	$1.96	$10,781.49	RS Means Heavy Construction Cost Data 2012, 31 23 23.13 4220 Backfill, structural, 200 HP dozer, 150' haul, common earth + 31 23 23.23 5060 Compaction, riding, vibrating roller, 12" lifts, two passes.
Demarcation fabric	3,000	SY	$1.52	$4,560.00	Quote from Eagle Environmental Products, Inc., Mesa, AZ.
Grading disturbed waste removal areas	8,000	SY	$0.51	$4,044.72	RS Means Heavy Construction Cost Data 2012, 31 22 16.10 3300 Finish Grading slopes, gentle. Multiply by 3 for grade.
Erosion control fabric	11,000	SY	$1.17	$12,879.24	RS Means Heavy Construction Cost Data 2012, 31 25 14.16 0020 Rolled erosion control mats and blankets, jute mesh, 100 sy per roll, 4' wide, stapled.
Hydroseeding with native plants	99	MSF	$71.40	$7,068.95	RS Means Heavy Construction Cost Data 2012, 32 92 19.14 4600 Seeding, slope mix, 6#/MSF, hydro or air seeding, with mulch and fertilizer.
Adit Closure	1	LS	$280,000.00	$280,000.00	Bat survey of 16 adits, bat gates at 8 adits, safety closures at 8 adits. Backfill safety closures with native soil.
4,000 gallon water truck	15	WK	$1,605.00	$24,075.00	Water truck use for dust suppression during all construction activities.
After Action Report	1	LS	$20,000	$20,000.00	Includes 10 Days for Technical Staff to write a completion report, including graphics, review, and production.
SUBTOTAL				**$849,723**	
Contingency	25%			$212,431	15% scope + 10% bid
SUBTOTAL				**$1,062,154**	
Project Management	10%			$84,972.32	Includes project management during all phases of construction, regulatory interface, permitting, and crew per diems.
Construction Management	12%			$101,966.78	Includes construction management, quality control, geotechnical testing, and quality control testing.
SUBTOTAL					
Institutional Controls	1	LS	$40,500	$40,500	Forest Plan amendment, legal description for ARIC, and legal fees. Includes reproduction.
	TOTAL CAPITAL CONSTRUCTION COSTS:			**$1,289,593**	

Table D-4. Alternative 3A - Cost Summary

CAPITAL COSTS:

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL	SOURCE/NOTES
Inspections and Maintenance					
Biannual Inspections	2	LS	$ 2,000	$ 4,000	Biannual inspections to evaluate the integrity of all cover elements and stormwater BMPs.
Minor Repairs	1	LS	$ 6,500	$ 6,500	Replace erosion control fabric or other BMPs
SUBTOTAL				**$10,500**	
Contingency	25%			$ 2,625	10% scope + 15% bid
SUBTOTAL				**$13,125**	
Project Management	10%			$1,050	
Contractor Overhead	7%			$735	
Profit	10%			$1,050	
		TOTAL ANNUAL O&M COSTS:		**$15,960**	per year
		TOTAL ANNUAL O&M COSTS:		**$478,800**	Years 1-30

PERIODIC COSTS	Year					
Five-Year Review Report	5	1	LS	$19,000	$19,000.00	Preparation of one report at the end of Year 5
Significant Repairs	5	1	LS	$15,000	$15,000.00	Costs for significant repairs and encapsulation BMPs
SUBTOTAL (YEAR 5)					**$34,000.00**	
Five-Year Review Report	10	1	LS	$19,000	$19,000.00	Preparation of one report at the end of Year 10
Major Repairs	10	1	LS	$25,000	$25,000.00	Costs for major repairs to encapsulation
SUBTOTAL (YEAR 10)					**$44,000.00**	
Five-Year Review Report	15	1	LS	$19,000	$19,000.00	Preparation of one report at the end of Year 15
Significant Repairs	15	1	LS	$15,000	$15,000.00	Costs for significant repairs and encapsulation BMPs
SUBTOTAL (YEAR 15)					**$34,000.00**	
Five-Year Review Report	20	1	LS	$19,000	$19,000.00	Preparation of one report at the end of Year 20
Major Repairs	20	1	LS	$25,000	$25,000.00	Costs for major repairs to encapsulation
SUBTOTAL (YEAR 20)					**$44,000.00**	
Five-Year Review Report	15	1	LS	$19,000	$19,000.00	Preparation of one report at the end of Year 25
Significant Repairs	15	1	LS	$15,000	$15,000.00	Costs for significant repairs and encapsulation BMPs
SUBTOTAL (YEAR 25)					**$34,000.00**	
Five-Year Review Report	20	1	LS	$19,000	$19,000.00	Preparation of one report at the end of Year 30
Major Repairs	20	1	LS	$25,000	$25,000.00	Costs for major repairs to encapsulation
SUBTOTAL (YEAR 30)					**$44,000.00**	

Table D-4. Alternative 3A - Cost Summary

CAPITAL COSTS:

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL	SOURCE/NOTES

PRESENT VALUE ANALYSIS:

COST TYPE	YEAR	TOTAL COST	TOTAL COST PER YEAR	DISCOUNT FACTOR (2.0%)	PRESENT VALUE
Capital Cost	0	$ 1,289,593	$ 1,289,593	1.000	$ 1,289,593
Annual O&M Cost	1-30	$ 478,800	$15,960	0.747	$408,511.35
Periodic Cost	5	$34,000.00	$ 34,000	0.906	$ 35,324
Periodic Cost	10	$44,000.00	$ 44,000	0.820	$ 44,299
Periodic Cost	15	$34,000.00	$ 34,000	0.743	$ 28,978
Periodic Cost	20	$44,000.00	$ 44,000	0.673	$ 36,340
Periodic Cost	25	$34,000.00	$ 34,000	0.610	$ 23,772
Periodic Cost	30	$44,000.00	$ 44,000	0.552	$ 29,812
		$2,002,393			$1,896,628

TOTAL PRESENT VALUE OF SELECTED REMEDY **$1,896,628**

Notes:

1. Source: Office of Management and Budget, 2008. OMB Circular No. A-94. January. Online at: <http://www.whitehouse.gov/omb/circulars/a094/a94_appx-c.html>.
2. Source: RS Means Heavy Construction Cost Data 2012
3. RS Means Costs were multiplied by a factor of .887 to account for a Flagstaff, AZ localization factor. (p. 588)
4. Based on a 2.0 percent discount factor for projects with a 30-year (or greater) duration, as specified for federal facility sites in Appendix C of Office of Management and Budget Circular A-94 (effective December 2012)

AC= Acre
BCY= Bank Cubic Yard
CY = cubic yards
ea = each
LCY= Loose Cubic Yard
LF = linear feet
LS = lump sum
LUC = land use control
O&M = operation and maintenance
SF = square feet
SY = square yard
TN= Ton

Table D-5. Alternative 3A - Cash Flow Analysis

Year	Periodic Cost	Annual Cost	Discount Factor	Actual Periodic Cost	Actual Annual Cost
1		$18,240	0.980392157		$17,882.35
2		$18,240	0.961168781		$17,531.72
3		$18,240	0.942322335		$17,187.96
4		$18,240	0.923845426		$16,850.94
5	$39,000	$18,240	0.90573081	$35,323.50	$16,520.53
6		$18,240	0.887971382		$16,196.60
7		$18,240	0.870560179		$15,879.02
8		$18,240	0.853490371		$15,567.66
9		$18,240	0.836755266		$15,262.42
10	$54,000	$18,240	0.8203483	$44,298.81	$14,963.15
11		$18,240	0.804263039		$14,669.76
12		$18,240	0.788493176		$14,382.12
13		$18,240	0.773032525		$14,100.11
14		$18,240	0.757875025		$13,823.64
15	$39,000	$18,240	0.74301473	$28,977.57	$13,552.59
16		$18,240	0.728445814		$13,286.85
17		$18,240	0.714162562		$13,026.33
18		$18,240	0.700159375		$12,770.91
19		$18,240	0.68643076		$12,520.50
20	$54,000	$18,240	0.672971333	$36,340.45	$12,275.00
21		$18,240	0.659775817		$12,034.31
22		$18,240	0.646839036		$11,798.34
23		$18,240	0.634155918		$11,567.00
24		$18,240	0.621721488		$11,340.20
25	$39,000	$18,240	0.609530871	$23,771.70	$11,117.84
26		$18,240	0.597579285		$10,899.85
27		$18,240	0.585862044		$10,686.12
28		$18,240	0.574374553		$10,476.59
29		$18,240	0.563112307		$10,271.17
30	$54,000	$18,240	0.552070889	$29,811.83	$10,069.77

Table D-6. Alternative 3B - Cost Summary

CAPITAL COSTS:

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL	SOURCE/NOTES
Implementation Plans/Setup	1	LS	$75,000	$75,000.00	Includes pre-mobilization archeological survey, to be conducted prior to other planning documents. Includes 10 days for Technical Staff to complete pre-mobilization plans (including Work Plan and HASP with graphics, review, and production).
Design	1	LS	$75,000	$75,000.00	Includes 30 days for Technical Staff to complete the design of road grades, repository and Mill Area cap, and restored grades. Includes surveys.
Mobilization and demobilization	1	LS	$90,000	$90,000.00	Mobilization and demobilization of crew, materials, and equipment. Craft trade crew of nine plus one technical person for 4 days. Includes airfare and hotel costs for the duration of work.
Site Work					
Road grading	1	LS	$105,000.00	$105,000.00	8 days of work, includes use of an excavator, dozer, and backhoe.
Excavation of repository	7,500	BCY	$2.18	$16,365.15	RS Means Heavy Construction Cost Data 2012, 31 23 16.13 1030 Excavating, trench, 10' to 14' deep, 3 cy excavator.
Hauling clean spoils	6,000	BCY	$3.01	$18,041.58	RS Means Heavy Construction Cost Data 2012, 31 23 23.20 5170/5180 Hauling, 22 cy off-road, 15 min wait, 15 mph, cycle 1.5 mile. Clean spoils hauled for use as borrow material for road repairs and clean cover at Mill Area.
Load and haul waste to repository/cap area	6,300	BCY	$8.08	$50,879.65	RS Means Heavy Construction Cost Data 2012, G1030 140 3400 Load and haul common earth, 3.5 cy track loader, four 20 cy dump trailers, 1 mi round trip. Multiply by 1.5 for grade at Upper Workings Area.
Encapsulation of repository and Mill Area cap	5,500	BCY	$1.96	$10,781.49	RS Means Heavy Construction Cost Data 2012, 31 23 23.13 4220 Backfill, structural, 200 HP dozer, 150' haul, common earth + 31 23 23.23 5060 Compaction, riding, vibrating roller, 12" lifts, two passes.
Demarcation fabric	9,000	SY	$1.52	$13,680.00	Quote from Eagle Environmental Products, Inc., Mesa, AZ.
Grading disturbed waste removal areas	2,400	SY	$0.51	$1,213.42	RS Means Heavy Construction Cost Data 2012, 31 22 16.10 3300 Finish Grading slopes, gentle. Multiply by 3 for grade.
Erosion control fabric	11,400	SY	$1.17	$13,347.58	RS Means Heavy Construction Cost Data 2012, 31 25 14.16 0020 Rolled erosion control mats and blankets, jute mesh, 100 sy per roll, 4' wide, stapled.
Hydroseeding with native plants	103	MSF	$71.40	$7,326.00	RS Means Heavy Construction Cost Data 2012, 32 92 19.14 4600 Seeding, slope mix, 6#/MSF, hydro or air seeding, with mulch and fertilizer.
Adit Closure	1	LS	$280,000.00	$280,000.00	Bat survey of 16 adits, bat gates at 8 adits, safety closures at 8 adits. Backfill safety closures with native soil.
4,000 gallon water truck	12	WK	$1,605.00	$19,260.00	Water truck use for dust suppression during all construction activities.
After Action Report	1	LS	$20,000	$20,000.00	Includes 10 Days for Technical Staff to write a completion report, including graphics, review, and production.
SUBTOTAL				**$795,895**	
Contingency	25%			$198,974	15% scope + 10% bid
SUBTOTAL				**$994,869**	
Project Management	10%			$79,589.49	Includes project management during all phases of construction, regulatory interface, permitting, and crew per diems.
Construction Management	12%			$95,507.38	Includes construction management, quality control, geotechnical testing, and quality control testing.
SUBTOTAL					
Institutional Controls	1	LS	$40,500	$40,500	Forest Plan amendment, legal description for ARIC, and legal fees. Includes reproduction.
	TOTAL CAPITAL CONSTRUCTION COSTS:			**$1,210,465**	

Table D-6. Alternative 3B - Cost Summary

CAPITAL COSTS:

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL	SOURCE/NOTES
Inspections and Maintenance					
Biannual Inspections	2	LS	$ 2,000	$ 4,000	Biannual inspections to evaluate the integrity of all cover elements and stormwater BMPs.
Minor Repairs	1	LS	$ 8,000	$ 8,000	Replace erosion control fabric or other BMPs
SUBTOTAL				**$12,000**	
Contingency	25%			$ 3,000	10% scope + 15% bid
SUBTOTAL				**$15,000**	
Project Management	10%			$1,200	
Contractor Overhead	7%			$840	
Profit	10%			$1,200	
		TOTAL ANNUAL O&M COSTS:		**$18,240**	per year
		TOTAL ANNUAL O&M COSTS:		**$547,200**	Years 1-30

PERIODIC COSTS	Year					
Five-Year Review Report	5	1	LS	$19,000	$19,000.00	Preparation of one report at the end of Year 5
Significant Repairs	5	1	LS	$20,000	$20,000.00	Costs for significant repairs and encapsulation BMPs
SUBTOTAL (YEAR 5)					**$39,000.00**	
Five-Year Review Report	10	1	LS	$19,000	$19,000.00	Preparation of one report at the end of Year 10
Major Repairs	10	1	LS	$35,000	$35,000.00	Costs for major repairs to encapsulations
SUBTOTAL (YEAR 10)					**$54,000.00**	
Five-Year Review Report	15	1	LS	$19,000	$19,000.00	Preparation of one report at the end of Year 15
Significant Repairs	15	1	LS	$20,000	$20,000.00	Costs for significant repairs and encapsulation BMPs
SUBTOTAL (YEAR 15)					**$39,000.00**	
Five-Year Review Report	20	1	LS	$19,000	$19,000.00	Preparation of one report at the end of Year 20
Major Repairs	20	1	LS	$35,000	$35,000.00	Costs for major repairs to encapsulations
SUBTOTAL (YEAR 20)					**$54,000.00**	
Five-Year Review Report	15	1	LS	$19,000	$19,000.00	Preparation of one report at the end of Year 25
Significant Repairs	15	1	LS	$20,000	$20,000.00	Costs for significant repairs and encapsulation BMPs
SUBTOTAL (YEAR 25)					**$39,000.00**	
Five-Year Review Report	20	1	LS	$19,000	$19,000.00	Preparation of one report at the end of Year 30
Major Repairs	20	1	LS	$35,000	$35,000.00	Costs for major repairs to encapsulations
SUBTOTAL (YEAR 30)					**$54,000.00**	

Table D-6. Alternative 3B - Cost Summary

CAPITAL COSTS:

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL	SOURCE/NOTES

PRESENT VALUE ANALYSIS:

COST TYPE	YEAR	TOTAL COST	TOTAL COST PER YEAR	DISCOUNT FACTOR (2.0%)	PRESENT VALUE
Capital Cost	0	$ 1,210,465	$ 1,210,465	1.000	$ 1,210,465
Annual O&M Cost	1-30	$ 547,200	$18,240	0.747	$408,511.35
Periodic Cost	5	$39,000.00	$ 39,000	0.906	$ 35,324
Periodic Cost	10	$54,000.00	$ 54,000	0.820	$ 44,299
Periodic Cost	15	$39,000.00	$ 39,000	0.743	$ 28,978
Periodic Cost	20	$54,000.00	$ 54,000	0.673	$ 36,340
Periodic Cost	25	$39,000.00	$ 39,000	0.610	$ 23,772
Periodic Cost	30	$54,000.00	$ 54,000	0.552	$ 29,812
		$2,036,665			$1,817,501

TOTAL PRESENT VALUE OF SELECTED REMEDY **$1,817,501**

Notes:

1. Source: Office of Management and Budget, 2008. OMB Circular No. A-94. January. Online at: <http://www.whitehouse.gov/omb/circulars/a094/a94_appx-c.html>.
2. Source: RS Means Heavy Construction Cost Data 2012
3. RS Means Costs were multiplied by a factor of .887 to account for a Flagstaff, AZ localization factor. (p. 588)
4. Based on a 2.0 percent discount factor for projects with a 30-year (or greater) duration, as specified for federal facility sites in Appendix C of Office of Management and Budget Circular A-94 (effective December 2012)

AC= Acre
BCY= Bank Cubic Yard
CY = cubic yards
ea = each
LCY= Loose Cubic Yard
LF = linear feet
LS = lump sum
LUC = land use control
O&M = operation and maintenance
SF = square feet
SY = square yard
TN= Ton

Table D-7. Alternative 3B - Cash Flow Analysis

Year	Periodic Cost	Annual Cost	Discount Factor	Actual Periodic Cost	Actual Annual Cost
1		$18,240	0.980392157		$17,882.35
2		$18,240	0.961168781		$17,531.72
3		$18,240	0.942322335		$17,187.96
4		$18,240	0.923845426		$16,850.94
5	$39,000	$18,240	0.90573081	$35,323.50	$16,520.53
6		$18,240	0.887971382		$16,196.60
7		$18,240	0.870560179		$15,879.02
8		$18,240	0.853490371		$15,567.66
9		$18,240	0.836755266		$15,262.42
10	$54,000	$18,240	0.8203483	$44,298.81	$14,963.15
11		$18,240	0.804263039		$14,669.76
12		$18,240	0.788493176		$14,382.12
13		$18,240	0.773032525		$14,100.11
14		$18,240	0.757875025		$13,823.64
15	$39,000	$18,240	0.74301473	$28,977.57	$13,552.59
16		$18,240	0.728445814		$13,286.85
17		$18,240	0.714162562		$13,026.33
18		$18,240	0.700159375		$12,770.91
19		$18,240	0.68643076		$12,520.50
20	$54,000	$18,240	0.672971333	$36,340.45	$12,275.00
21		$18,240	0.659775817		$12,034.31
22		$18,240	0.646839036		$11,798.34
23		$18,240	0.634155918		$11,567.00
24		$18,240	0.621721488		$11,340.20
25	$39,000	$18,240	0.609530871	$23,771.70	$11,117.84
26		$18,240	0.597579285		$10,899.85
27		$18,240	0.585862044		$10,686.12
28		$18,240	0.574374553		$10,476.59
29		$18,240	0.563112307		$10,271.17
30	$54,000	$18,240	0.552070889	$29,811.83	$10,069.77

Table D-8. Alternative 4 - Cost Summary

CAPITAL COSTS:

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL	SOURCE/NOTES
Implementation Plans/Setup	1	LS	$75,000	$75,000.00	Includes pre-mobilization archeological survey, to be conducted prior to other planning documents. Includes 10 days for Technical Staff to complete pre-mobilization plans (including Work Plan and HASP with graphics, review, and production).
Design	1	LS	$37,500	$37,500.00	Includes 15 days for Technical Staff to complete the design of road grades and restored grades. Includes surveys.
Mobilization and demobilization	1	LS	$160,000	$160,000.00	Mobilization and demobilization of crew, materials, and equipment. Craft trade crew of nine plus one technical person for 4 days. Includes airfare and hotel costs for the duration of work.
Site Work					
Road grading	1	LS	$105,000.00	$105,000.00	8 days of work, includes use of an excavator, dozer, and backhoe.
Load and haul waste to stockpile area	11,500	BCY	$8.08	$92,875.55	RS Means Heavy Construction Cost Data 2012, G1030 140 3400 Load and haul common earth, 3.5 cy track loader, four 20 cy dump trailers, 1 mi round trip. Multiply by 1.5 for grade at Upper Workings Area.
Load waste into end dumps	18,400	Ton	$320.00	$5,888,000.00	Estimated rate of 10 loads per day. Includes crew and material costs for wrapping waste in plastic and glueing shut for transport as asbestos-containing material.
Waste disposal	18,400	Ton	$46.00	$846,400.00	Apache Junction Landfill in Apache Junction, AZ.
Waste transport	840	Load	$1,950.00	$1,638,000.00	Written quote from MP Environmental, Phoenix, AZ.
Grading disturbed waste removal areas	8,000	SY	$0.51	$4,044.72	RS Means Heavy Construction Cost Data 2012, 31 22 16.10 3300 Finish Grading slopes, gentle. Multiply by 3 for grade.
Erosion control fabric	8,000	SY	$1.17	$9,366.72	RS Means Heavy Construction Cost Data 2012, 31 25 14.16 0020 Rolled erosion control mats and blankets, jute mesh, 100 sy per roll, 4' wide, stapled.
Hydroseeding with native plants	72	MSF	$71.40	$5,141.05	RS Means Heavy Construction Cost Data 2012, 32 92 19.14 4600 Seeding, slope mix, 6#/MSF, hydro or air seeding, with mulch and fertilizer.
Adit Closure	1	LS	$280,000.00	$280,000.00	Bat survey of 16 adits, bat gates at 8 adits, safety closures at 8 adits. Backfill safety closures with native soil.
4,000 gallon water truck	31	WK	$1,605.00	$49,755.00	Water truck use for dust suppression during all construction activities.
After Action Report	1	LS	$20,000	$20,000.00	Includes 10 days for Technical Staff to write a completion report, including graphics, review, and production.
SUBTOTAL				**$9,211,083**	
Contingency	25%			$2,302,771	15% scope + 10% bid
SUBTOTAL				**$11,513,854**	
Project Management	10%			$921,108.30	Includes project management during all phases of construction, regulatory interface, permitting, and crew per diems.
Construction Management	12%			$1,105,329.97	Includes construction management, quality control, geotechnical testing, and quality control testing.
SUBTOTAL					
Institutional Controls	1	LS	$40,500	$40,500	Forest Plan amendment, legal description for ARIC, and legal fees. Includes reproduction.
	TOTAL CAPITAL CONSTRUCTION COSTS:			**$13,580,792**	

Table D-8. Alternative 4 - Cost Summary

CAPITAL COSTS:

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL	SOURCE/NOTES
Inspections and Maintenance					
Biannual Inspections	2	LS	$ 2,000	$ 4,000	Biannual inspections to evaluate the integrity of all graded areas and stormwater BMPs.
Minor Repairs	1	LS	$ 6,500	$ 6,500	Replace erosion control fabric or other BMPs
SUBTOTAL				**$10,500**	
Contingency	25%			$ 2,625	10% scope + 15% bid
SUBTOTAL				**$13,125**	
Project Management	10%			$1,050	
Contractor Overhead	7%			$735	
Profit	10%			$1,050	
		TOTAL ANNUAL O&M COSTS:		**$15,960**	per year
		TOTAL ANNUAL O&M COSTS:		**$478,800**	Years 1-30

PERIODIC COSTS	Year					
Five-Year Review Report	5	1	LS	$19,000	$19,000.00	Preparation of one report at the end of Year 5
Significant Repairs	5	1	LS	$12,000	$12,000.00	Costs for significant repairs to graded areas and gabions
SUBTOTAL (YEAR 5)					**$31,000.00**	
Five-Year Review Report	10	1	LS	$19,000	$19,000.00	Preparation of one report at the end of Year 10
Major Repairs	10	1	LS	$20,000	$20,000.00	Costs for major repairs to graded areas and gabions
SUBTOTAL (YEAR 10)					**$39,000.00**	
Five-Year Review Report	15	1	LS	$19,000	$19,000.00	Preparation of one report at the end of Year 15
Significant Repairs	15	1	LS	$12,000	$12,000.00	Costs for significant repairs to graded areas and gabions
SUBTOTAL (YEAR 15)					**$31,000.00**	
Five-Year Review Report	20	1	LS	$19,000	$19,000.00	Preparation of one report at the end of Year 20
Major Repairs	20	1	LS	$20,000	$20,000.00	Costs for major repairs to graded areas and gabions
SUBTOTAL (YEAR 20)					**$39,000.00**	
Five-Year Review Report	15	1	LS	$19,000	$19,000.00	Preparation of one report at the end of Year 25
Significant Repairs	15	1	LS	$12,000	$12,000.00	Costs for significant repairs to graded areas and gabions
SUBTOTAL (YEAR 25)					**$31,000.00**	
Five-Year Review Report	20	1	LS	$19,000	$19,000.00	Preparation of one report at the end of Year 30
Major Repairs	20	1	LS	$20,000	$20,000.00	Costs for major repairs to graded areas and gabions
SUBTOTAL (YEAR 30)					**$39,000.00**	

Table D-8. Alternative 4 - Cost Summary

CAPITAL COSTS:

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL	SOURCE/NOTES

PRESENT VALUE ANALYSIS:

COST TYPE	YEAR	TOTAL COST	TOTAL COST PER YEAR	DISCOUNT FACTOR (2.0%)	PRESENT VALUE
Capital Cost	0	$ 13,580,792	$ 13,580,792	1.000	$ 13,580,792
Annual O&M Cost	1-30	$ 478,800	$15,960	0.747	$357,447.43
Periodic Cost	5	$31,000.00	$ 31,000	0.906	$ 28,078
Periodic Cost	10	$39,000.00	$ 39,000	0.820	$ 31,994
Periodic Cost	15	$31,000.00	$ 31,000	0.743	$ 23,033
Periodic Cost	20	$39,000.00	$ 39,000	0.673	$ 26,246
Periodic Cost	25	$31,000.00	$ 31,000	0.610	$ 18,895
Periodic Cost	30	$39,000.00	$ 39,000	0.552	$ 21,531
		$14,269,592			$14,088,016

TOTAL PRESENT VALUE OF SELECTED REMEDY **$14,088,016**

Notes:

1. Source: Office of Management and Budget, 2008. OMB Circular No. A-94. January. Online at: <http://www.whitehouse.gov/omb/circulars/a094/a94_appx-c.html>.
2. Source: RS Means Heavy Construction Cost Data 2012
3. RS Means Costs were multiplied by a factor of .897 to account for a Flagstaff, AZ localization factor. (p. 588)
4. Based on a 2.0 percent discount factor for projects with a 30-year (or greater) duration, as specified for federal facility sites in Appendix C of Office of Management and Budget Circular A-94 (effective December 2012)

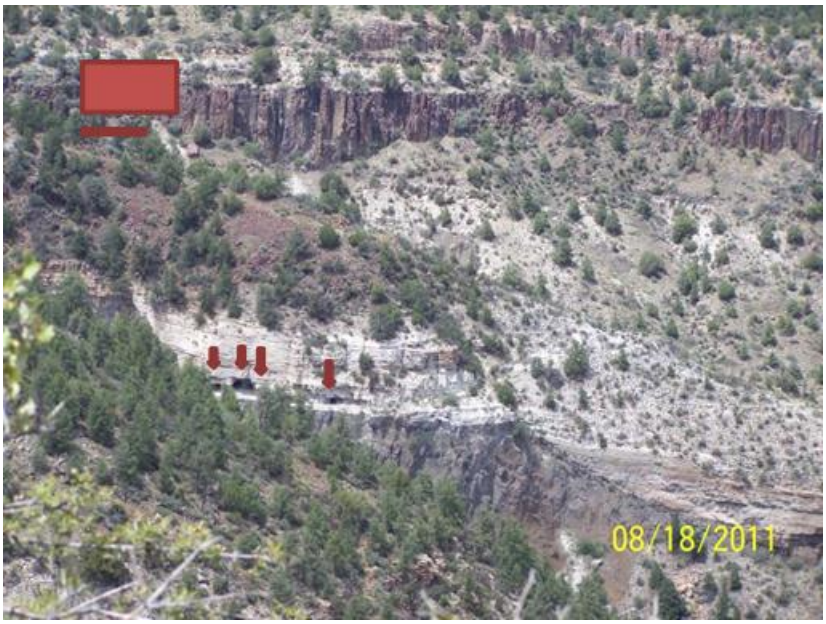
AC= Acre
BCY= Bank Cubic Yard
CY = cubic yards
ea = each
LCY= Loose Cubic Yard
LF = linear feet
LS = lump sum
LUC = land use control
O&M = operation and maintenance
SF = square feet
SY = square yard
TN= Ton

Table D-9. Alternative 4 - Cash Flow Analysis

Year	Periodic Cost	Annual Cost	Discount Factor	Actual Periodic Cost	Actual Annual Cost
1		$15,960	0.980392157		$15,647.06
2		$15,960	0.961168781		$15,340.25
3		$15,960	0.942322335		$15,039.46
4		$15,960	0.923845426		$14,744.57
5	$31,000	$15,960	0.90573081	$28,077.66	$14,455.46
6		$15,960	0.887971382		$14,172.02
7		$15,960	0.870560179		$13,894.14
8		$15,960	0.853490371		$13,621.71
9		$15,960	0.836755266		$13,354.61
10	$39,000	$15,960	0.8203483	$31,993.58	$13,092.76
11		$15,960	0.804263039		$12,836.04
12		$15,960	0.788493176		$12,584.35
13		$15,960	0.773032525		$12,337.60
14		$15,960	0.757875025		$12,095.69
15	$31,000	$15,960	0.74301473	$23,033.46	$11,858.52
16		$15,960	0.728445814		$11,626.00
17		$15,960	0.714162562		$11,398.03
18		$15,960	0.700159375		$11,174.54
19		$15,960	0.68643076		$10,955.43
20	$39,000	$15,960	0.672971333	$26,245.88	$10,740.62
21		$15,960	0.659775817		$10,530.02
22		$15,960	0.646839036		$10,323.55
23		$15,960	0.634155918		$10,121.13
24		$15,960	0.621721488		$9,922.67
25	$31,000	$15,960	0.609530871	$18,895.46	$9,728.11
26		$15,960	0.597579285		$9,537.37
27		$15,960	0.585862044		$9,350.36
28		$15,960	0.574374553		$9,167.02
29		$15,960	0.563112307		$8,987.27
30	$39,000	$15,960	0.552070889	$21,530.76	$8,811.05

Attachment 1. 2011 Forest Service Photographs of Lower Workings Adits

Attachment 1. 2011 Forest Service Photographs of Lower Workings Adits



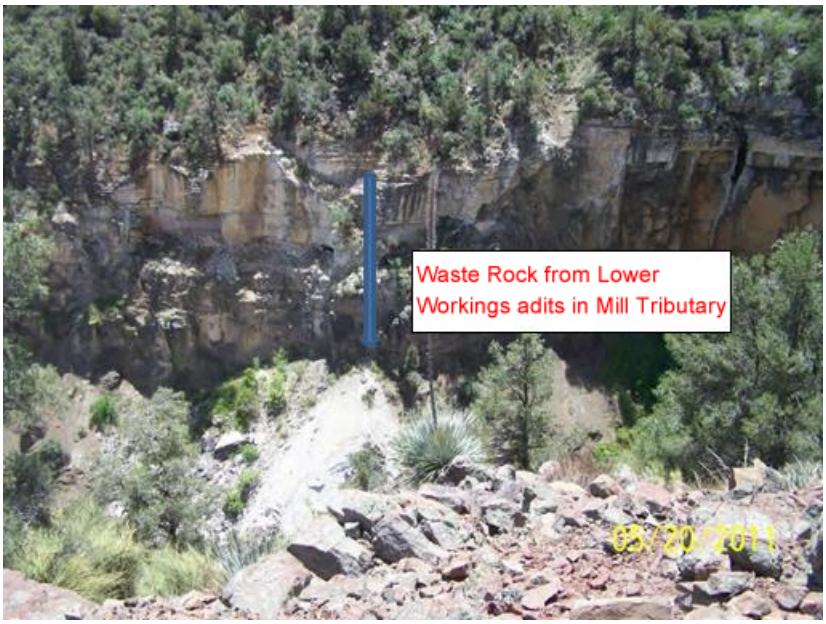
Lower Workings in the Mill Tributary as seen from Phillips Canyon at pulley building

Same as above photo as seen from the Mill site. Ledge was carved out. There is waste rock below this. Metal is visible on ledge.

Attachment 1. 2011 Forest Service Photographs of Lower Workings Adits

Mill Tributary with waste rock in bottom of drainage.

Lower Workings across the Mill Tributary from Mill site

Attachment 1. 2011 Forest Service Photographs of Lower Workings Adits

Some of the Lower Workings adits across from the Mill in the Mill trib. Access is an issue but they are adits that are visible from the Mill.