FINAL

Site Investigation Report

Smoky Canyon Mine, Caribou County, Idaho

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5.0 DATA QUALITY EVALUATION

All data collected in support of the SI, and reported in Section 6 below, were subject to review to confirm their accuracy, precision, representativeness, and completeness. Reports from the analytical laboratories performing analyses of the COPCs in environmental and biological tissue samples were then subject to more detailed data validation. These review steps were performed in accordance with requirements of the project's Quality Assurance Project Plan (QAPP) (MFG, 2003f). More detailed descriptions of the review methods and findings are provided below.

5.1 Data Review Methods

5.1.1 Field Data Review

Field data records were reviewed for completeness and general accuracy by the project's field supervisor before such data were included in the project file or the project's electronic database. Any errors identified upon such review were either immediately corrected by the field personnel or resolved through confirmation with other field records.

When individual stream flow measurements were used to compute the total stream discharge for a monitoring location, the discharge calculations were also checked before the total stream discharge value was entered into the electronic database.

5.1.2 Laboratory Data Review

Laboratory data generated to support the SI, and reported herein, were reviewed to evaluate the accuracy, precision and completeness of the results and to describe data quality with respect to the project-specific data quality objectives. Two commercial laboratories performed the sample analyses. Environmental samples (e.g., water, soil, etc.) were analyzed by SVL Analytical in Kellogg, Idaho. Biological tissue samples were analyzed by ACZ Laboratories in Steamboat Springs, Colorado.

All data reports prepared by the laboratories were first checked for completeness to confirm that the requested analyses were performed using appropriate analytical methods for each type of sample analysis, required quality control analyses were also performed and the sample and quality control data were reported as specified by the QAPP.

Any deficiencies in the laboratory data reports were immediately communicated to the laboratory. Reporting errors or omissions were corrected by requesting that the laboratory re-issue the data report or electronic data file. In some cases, reanalysis was requested and

performed to address errors in the data report. Corrective actions were completed to address all deficiencies or errors identified in the laboratory data reports.

5.1.3 Laboratory Data Validation

Results for analyses of the COPCs in environmental and biological-tissue samples were reviewed and validated in accordance with MFG SOP No. 20JRS (MFG, 2003b) and EPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review (EPA, 1994).

The data validation process provides confirmation of data quality for individual analysis results and identifies the uncertainties associated with any individual result. Data validation was documented through preparation of a checklist that summarizes the validation findings for each set of sample analyses. The validation checklists were subject to review by the project chemist before validation results were considered final. The validation checklists remain on file with the laboratory data reports. Records that have been subject to data validation are identified in the project's electronic database, and the validation qualifiers assigned to individual results are also incorporated into the electronic database. The qualifiers assigned through data validation are defined below. The qualifiers assigned to validated laboratory data are also shown on the data tables included with this report.

The qualifiers that can be assigned to individual result records during data validation are defined as follows:

Flag	Definition
J	Analyte confirmed, but the reported value is an estimated quantity. The associated numerical value is the approximate concentration of the analyte in the sample.
J+	The reported value is an estimated quantity, and the result may be biased high.
J-	The reported value is an estimated quantity, and the result may be biased low.
U	Analyte not confirmed present at or above the sample detection limit.
UJ	Analyte not confirmed present at or above the sample detection limit. The associated value is an approximate concentration that may be inaccurate or imprecise.
R	The data are not usable due to serious deficiencies in meeting quality control criteria. The analyte may or may not be present in the sample.

Note: The J data qualifier is also assigned to laboratory data reported between the laboratory's method detection limit (MDL) and the reporting limit. Both SVL and ACZ labs use a 'B' qualifier to identify results reported between the MDL and the reporting limit.

Values that are assigned J flags (J, J+, or J-) are considered estimated results. QC data supplied with those values indicate that they may not be accurate or precise within the limits specified in the QAPP but that the magnitude of the potential imprecision or inaccuracy is not great enough to reject the value for the project's intended data uses. These data are usable with the associated qualification as an estimated result.

Values are assigned U flags when the value is less than the method detection limit (MDL) or to indicate that a low concentration of the analyte cannot be confirmed due to the presence of an interferant or the presence of the analyte in associated blanks. UJ flags may be applied to indicate that values reported less than the MDL may not be accurate or precise. Records flagged with U or UJ are fully usable but should be considered "not detected." The reported numerical result may be used for the project objectives only when the value is identified as "not detected."

Values assigned an R flag do not meet the requirements for accuracy, precision, or representativeness specified to provide quantitative data for the project's intended data uses. The R flag indicates that serious deficiencies were encountered preventing the generation of usable data for the project objectives. Data flagged with R are not usable.

Values without flags assigned have met all of the project data quality objectives and are suitable for all project data uses.

5.2 Environmental Data Quality

Between September 2003 and November 2004 groundwater, surface water, sediment, soil, overburden and road-material samples were submitted to SVL Analytical for analyses of the parameters specified for each sample type in the project Sampling and Analysis Plan (SAP) (MFG, 2003e). Selected groundwater samples were split, and the splits were submitted to ACZ Laboratories for analyses of selenium and selenium oxidation states (Se^{+4}, Se^{+6} and organic-complexed selenium). Data reports prepared by the laboratories were subject to the review described above, and the analysis results for cadmium, chromium, copper, nickel, selenium, vanadium and zinc were also subject to data validation.

Findings of the data quality review for environmental sample analyses are summarized below.

5.2.1 Sampling and Sample Handling

Field quality control (QC) samples were collected along with environmental samples, as specified by the QAPP. Results from field QC samples were used to evaluate accuracy and representativeness of the COPC data. The samples collected and submitted for laboratory analyses are described below for each environmental medium.

Groundwater and Surface Water

A total of 48 groundwater samples, 8 field duplicates, and 6 equipment rinsate blanks were submitted to SVL Analytical in Kellogg, Idaho. The field QC samples were collected at the frequencies specified by the QAPP for groundwater samples.

A total of 190 surface water samples, 29 field duplicates, and 2 field blanks were submitted to SVL Analytical in Kellogg, Idaho. Surface water samples were collected in October 2002 and May 2003 in accordance with procedures specified in two separate SAPs. The surface water samples collected after May 2003 were collected in accordance with the QC procedures specified by the QAPP for the SI. For this reason, there are some differences between the field QC and laboratory-analysis procedures used before and after finalization of the QAPP. Differences in laboratory methods are described below in Section 5.2.2.

Surface water field duplicates were collected at the frequency specified by the QAPP. Field blanks were not required by the QAPP but two were collected to confirm sample representativeness. Equipment rinsate blanks were also not required because surface water sampling equipment was not re-used between sampling locations or events.

Groundwater and surface water samples were shipped to the laboratory on ice to maintain the preservation temperatures at or around 4 degrees C. A number of water sample shipments were received by the laboratory at temperatures above 6 degrees C. Although the preservation-temperature specifications were not met for certain water-quality analyses of these sample sets, the potential effects on the quality of analyses for the COPCs (non-volatile inorganic constituents) are minimal, especially since the samples were also preserved by acidification to a pH less than 2.

Holding times for nitrate, nitrite, and ortho-phosphate analyses were routinely exceeded for water samples due to difficulties in shipping samples from the remote mine area on the same day they were collected. The local pickup for overnight shipping was located in Afton, WY, and its hours of operation did not allow for samples to be shipped the same day that they were collected. Holding time exceedances have the potential to reduce the representativeness of analyses for parameters that can undergo chemical transformation after sample collection. Results for nitrate/nitrate and orthophosphate in groundwater and surface water should be considered as estimated values potentially biased due to analysis past the recommended holding times. However, because these data will not be used to directly evaluate nature and extent of contamination or resultant risks to human health or the environment, they can be used as intended for general characterization of Site conditions and remedy development and evaluation. Holding times were met for analyses of all water samples for the COPCs.

Sediment and Soil

A total of 45 sediment samples, 3 sediment field duplicates, and 2 equipment rinsate blanks were submitted to SVL Analytical in Kellogg, Idaho. The field duplicates and rinsate blanks associated with the sediment sampling task were collected at the frequencies specified by the QAPP.

A total of 221 soil samples (including overburden and road material samples), 11 field duplicates, and 2 rinsate blanks were submitted to SVL Analytical in Kellogg, Idaho. Field duplicates were collected at the frequency specified in the QAPP. Equipment rinsate blanks were generally not collected; therefore, evaluation of possible cross contamination of soil samples by sampling equipment could not be completed for most of the soil samples, and the representativeness of soil COPC data could not be confirmed in the same manner as for the other sample types collected. Given that the COPC concentrations in soils were always well above detection limits, the potential effect of equipment contamination on sample concentrations would be minimal.

Sediment and soil samples were also shipped to the laboratory on ice, even though sample preservation is not required for the COPC analyses. Sample temperatures were typically maintained at less than 6 degrees C; however, some shipments were received at higher temperatures. For these sample sets, the analysis results for soil nutrients (e.g., nitrate) may be less representative than for the samples sets for which preservation temperatures were maintained. However, because the soil-nutrient data will not be used to evaluate nature and extent of contamination or resultant risks to human health or the environment, the nutrient data can be used as intended for general characterization of Site conditions and remedy development and evaluation. The effects of higher sample temperatures on the quality of COPC data from the sediment and soil samples are negligible.

5.2.2 Analysis Methods and Detection Limits

Groundwater samples were analyzed as specified by the SAP and QAPP, except that some parameters were analyzed using alternative methods available from the contracted laboratory, SVL Analytical, as described by letter to the USFS before field investigations began (September 15, 2003 letter from S. Werner/MFG to J. Jones/USFS). When alternative methods were used, SVL demonstrated that the alternative would meet the project's detectability, precision and accuracy specifications. COPCs in groundwater were analyzed using a combination of atomic absorption (AA) and inductively-coupled plasma (ICP) spectrometry instead of the ICP-mass spectrometry (ICP-MS) method because ICP-MS was not available from SVL. Methods used for COPCs include: cadmium by 213.2, chromium by 200.7, copper by 200.7, nickel by 200.7, selenium by Standard Method 3114B and 3114C, vanadium by 200.7 and zinc by 200.7. Additional analyses, not specified in the SAP or QAPP, were also performed to describe

selenium species in groundwater samples and evaluate selenium fate and transport in the environment. The selenium speciation data were not validated and therefore should be used qualitatively to evaluate selenium oxidation states in the groundwater samples.

Table 5-1 includes a summary of the parameters for which non-detected results were reported in groundwater samples. The analytical methods, the highest non-detect result, and the MDL goal established in the FSP for groundwater analyses are listed. Although calcium, magnesium, sodium, potassium, and sulfate were assigned preliminary MDL goals in the FSP, they were not included in Table 5-1 because there were no groundwater samples with non-detected results for these analytes. For groundwater samples, the majority of the MDL goals were met with the exceptions being some chromium (0.0003 mg/L vs. 0.00005 mg/L), copper (0.0026 mg/L vs. 0.0005 mg/L), nickel (0.0017 mg/L vs. 0.0002 mg/L), TDS (10 mg/L vs. 5 mg/L), and ortho-phosphate (0.01mg/L vs. 0.005mg/L) measurements. In these cases one or more of the non-detected results were reported above the preliminary MDL goal. These deviations from the MDL goals do not affect data usability for the project's objectives.

Surface water samples were analyzed as specified in the relevant SAP and QAPP, except that some parameters were analyzed using alternative methods available from the contracted laboratory, SVL Analytical, as described by letter to the USFS before field investigations began (September 15, 2003 letter from S. Werner/MFG to J. Jones/USFS). When alternative methods were used, SVL demonstrated that the alternative would meet the project's detectability, precision and accuracy specifications. Further, surface water samples collected in October 2002 and May 2003 were submitted to ACZ Laboratories for analyses, and the methods used for those sample analyses were specified in individual SAPs that preceded finalization of the FSP and QAPP. As a result, COPCs in surface water were analyzed using a combination of AA, ICP and ICP-MS methods (cadmium by 200.8 or 213.2, chromium by 200.8 or 200.7, copper by 200.8 or 200.7, nickel by 200.8 or 200.7, selenium by Standard Methods 3114C, vanadium by 200.7 and zinc by 200.7).

Table 5-2 includes a summary of the parameters for which non-detected results were reported in surface water samples. The analytical methods, the highest non-detect result, and the MDL goal established in the FSP for surface water analyses are listed. Although barium, calcium, magnesium, sodium, and TDS were assigned preliminary MDL goals in the FSP, they were not included in Table 5-2 because there were no surface water samples with non-detected results for these parameters. For surface water samples, the MDL goals specified in the QAPP were not met by one or more of the non-detected results for total selenium (0.002 mg/L vs. 0.001 mg/L), dissolved cadmium (0.0005 mg/L vs. 0.0002 mg/L), dissolved chromium (0.0003 mg/L vs. 0.00005 mg/L), dissolved copper (0.0026 mg/L vs. 0.0005 mg/L), dissolved nickel (0.0017 mg/L vs. 0.0002 mg/L), dissolved zinc (0.02 mg/L vs. 0.01 mg/L), dissolved potassium (0.6 mg/L vs. 0.3 mg/L), sulfate (10 mg/L vs. 4 mg/L), ammonia (0.1 mg/L vs. 0.02 mg/L), ortho-phosphate (0.01 mg/L vs. 0.005 mg/L), dissolved arsenic (0.005 mg/L vs. 0.0005 mg/L), dissolved iron (0.02 mg/L vs. 0.01 mg/L), dissolved lead (0.01 mg/L vs. 0.0001 mg/L), and dissolved silver

(0.0001 mg/L vs. 0.00005 mg/L). These deviations from the MDL goals do not affect data usability for the project's objectives.

Soil samples were analyzed using the methods specified in the SAP and QAPP, and all results except two were reported at concentrations above the laboratory MDLs. The two non-detect results were for nitrate+nitrite (MDL = 0.02 mg/Kg) analyzed using EPA method 353.2. There was no preliminary MDL goal set for nitrate+nitrite. For sediments, all samples were analyzed using the methods specified in the SAP and QAPP (except for cadmium by 6010B vs. 6020, selenium by 311C vs. 7742, and phosphorous by 6010B vs. 365.4), and all results were reported at concentrations above the laboratory MDLs.

5.2.3 Laboratory Data Validation

Data validation was performed using the project's SOP for data quality evaluation and referencing the QAPP-specified control limits for each analysis type. Tables 5-3, 5-4 and 5-5 provide a summary of the validation qualifiers assigned for COPC analyses of groundwater, surface water, and sediment and soil samples, respectively, as well as the reasons that the validation qualifiers were applied in each case.

For groundwater samples, the main reasons for applying validation qualifiers to the COPC results were as follows (Table 5-3):

- results less than five times the result in a blank sample (U flag);
- inadequate sample preservation (J- or UJ);
- poor post-digestion spike recovery (J-, cadmium only);
- poor field or laboratory duplicate precision (J or UJ); and
- poor serial dilution precision (J or UJ).

None of the groundwater results (0%) were rejected (R); 1 of 48 (2%) total selenium results was qualified J, and 7 of 48 (15%) total selenium results were qualified U. The other qualified data are reported on Table 5-3.

For surface water samples, the main reasons for applying validation qualifiers to the COPCs were as follows (Table 5-4):

- poor matrix spike recoveries (J-, selenium only);

- poor post-digestion spike recoveries (J or UJ, cadmium only);
- poor contract-required detection limit (CRDL) standard recoveries (J or UJ) (note: CRDL standards were considered in the same manner as a laboratory control standard [LCS]); and
- poor field or laboratory duplicate precision (J or UJ).

Twenty-one out of 188 samples (11%) of the dissolved copper results were rejected (R) due to CRDL standard recoveries less than 50 percent; 41 of 217 (19%) dissolved selenium results were qualified J or UJ and 21 of 188 (11%) dissolved copper results were qualified UJ. The other qualified data are reported on Table 5-4.

For sediment samples, the reasons for applying validation qualifiers were as follows (Table 5-5):

- poor matrix spike recoveries (J+, chromium only),
- poor CRDL standard recoveries (J+, copper only), and
- poor serial dilution precision (J, zinc only).

None of the cadmium, nickel, selenium or vanadium data were qualified. None of the sediment results were rejected (R).

For soil samples, the reasons for applying validation qualifiers were as follows (Table 5-5):

- poor matrix spike recoveries,
- poor CRDL standard recoveries (copper only), and
- poor serial dilution precision.

Twenty of the 221 total copper results (9%) were rejected (R) due to CRDL standard recoveries greater than 180 percent; 77 of 221 selenium results (35%) were J- qualified due to poor matrix spike recoveries. Some nickel (9%) and zinc (19%) results were J qualified due to poor ICP serial dilution results.

5.2.4 Environmental Data Quality Summary

The analytical results received from SVL Analytical for groundwater, surface water, sediment and soil samples were evaluated for data quality. Sample collection and transfer were verified,

and quality control parameters for accuracy, precision and completeness were reviewed. Nitrate/nitrite and orthophosphorus results for water samples are considered estimated values. Nutrient data for soil samples are also estimated results.

The COPC data for groundwater, surface water, sediment and soil analyses were validated to further verify data quality and usability for the SI. Validated results are considered either fully usable without qualification (U or no qualifer assigned), usable with qualification (UJ, J-, J, J+) or not usable (R) with respect to the project's intended data uses, which include use in ecological and human health risk assessment.

For groundwater, approximately 60 percent of the results for any of the individual COPCs are considered fully usable, and the remaining are usable with qualification.

For surface water, approximately 75 percent of the results for any of the individual COPCs are considered fully usable, 11 percent of the dissolved copper results are not usable, and the remaining COPC results are usable with qualification.

For sediment, approximately 70 percent of the results for any of the individual COPCs, including all of the cadmium, nickel, selenium, and vanadium results, are fully usable. None of the sediment COPC results were rejected (R).

For soil, approximately 65 percent of the results for any of the individual COPCs are considered fully usable, 9 percent of the copper results are not usable, and the remaining COPC results are usable with qualification.

5.3 Biological Tissue Data Quality

Biological tissue samples were submitted to ACZ Analytical Laboratories in Steamboat Springs, Colorado for analyses of COPCs. The findings of the data quality review for these sample types are presented below.

5.3.1 Sample Handling

A total of 27 fish tissue samples, 31 invertebrate (benthic and terrestrial) tissue samples, and 49 small mammal tissue samples were submitted for analyses of COPCs. In addition, a total of 422 vegetation (periphyton, macrophytes, terrestrial vegetation and riparian vegetation) tissue samples and 16 field duplicates were submitted for analyses of COPCs.

Biological tissue samples were analyzed for cadmium and selenium by ICP-MS Method 6020; chromium, copper, nickel, vanadium, and zinc were analyzed by ICP Method 6010B. Sample types, number of samples and number of quality control reports per sample type were as

follows: 14 benthic tissue samples (one report), 13 periphyton plant tissue samples (one report), 32 aquatic macrophyte plant tissue samples (two reports), 27 fish tissue samples (two reports), 66 mammal tissue samples (4 reports), and 466 terrestrial plant tissue samples (35 reports).

All samples were properly preserved and received at the laboratory at the recommended preservation temperatures. All samples listed on the chain of custody forms were analyzed for the requested analyses, with the exception of percent moisture for some of the benthic and mammal tissue samples, which was due to insufficient sample size. All samples were analyzed within the recommended holding time for each method.

5.3.2 Analysis Methods and Detection Limits

Table 5-6 includes a summary, by tissue type, of the parameters for which non-detected results were reported, the analytical methods, the highest non-detect result, and the target MDLs reported in the QAPP.

For aquatic and terrestrial invertebrate tissue samples, the MDL goals specified in the QAPP were not met by one or more of the non-detected results for chromium (7 mg/Kg vs. 1 mg/Kg), nickel (7 mg/Kg vs. 1 mg/Kg), and vanadium (4 mg/Kg vs. 0.5 mg/Kg). These exceedances were unavoidable due to the small sample mass available for analysis. All other COPC results met the MDL goals established in the QAPP.

For aquatic and terrestrial vegetation tissue samples, the MDL goals specified in the QAPP were not met by one or more of the non-detected results for cadmium (0.05 mg/Kg vs. 0.02 mg/Kg) and nickel (6 mg/Kg vs. 1 mg/Kg). These exceedances were unavoidable due to the small sample mass available for some of the macrophyte and periphyton samples. All other COPC results met the MDL goals established in the QAPP.

COPC concentrations in biological tissue are either reported on a dry weight basis (DW) or wet weight basis (WW). The concentrations in fish, benthic macroinvertebrate, terrestrial invertebrate and mammal tissue samples are reported on a wet weight basis. The concentrations in terrestrial vegetation, riparian vegetation, macrophyte and periphyton samples are reported on a DW basis. When the percent moisture is available for the tissue sample, either DW or WW concentrations can be computed for any sample type.

5.3.3 Laboratory Data Validation

All of the QC data associated with the tissue sample analyses were within the project's control limits for precision and accuracy. No validation qualifiers were applied to these results. An explanation of the data validation findings for biological tissue analyses is provided below. QC results are described by data set, and each data set typically includes 10 to 20 tissue samples.

Accuracy

The LCS recoveries were within project control limits for all analyses. Either the LCS or LCSD results for cadmium exceeded laboratory control limits for 8 of the 45 data sets; however, these recoveries still met the project control limits.

Out of 45 data reports, MS/MS duplicate (MSD) recoveries exceeded laboratory control limits for either the MS or MSD for zinc in 7 data sets and for selenium in 8 data sets. None of the corresponding results were qualified, however, for one of the following reasons: (1) the spike amount was disproportionately low for the spiked sample concentration, (2) either the corresponding MS or MSD recovery was within limits, or (3) the spike recovery exceeded laboratory control limits but was within project control limits.

Zinc was detected at or slightly above the MDL in method blanks for five of the data sets, and selenium in method blanks for two of the reports, but corresponding sample amounts were greater than 10 times the amounts found in the method blanks. No data qualification was necessary.

Precision

Laboratory precision was evaluated based on the relative percent difference (RPD) of the MS and MSD recoveries. MS/MSD RPDs exceeded laboratory limits (<20%) for cadmium (39.7%), selenium (25.4%) and zinc (22.1%) in one of the fish tissue reports and for cadmium (26.1%) and zinc (22.4%) in one of the mammal tissue reports, but were all within project control limits (<50%).

Sixteen of the 438 total terrestrial plant tissue samples submitted and analyzed were field duplicates (splits). Results from sample splits can be used as measure of sample homogeneity as well as an additional laboratory precision check. RPDs calculated on duplicate-sample results greater than five times the MDL were all less than 50 percent RPD.

Completeness

Analytical results were reported for all samples submitted for all analyses, with the exception of percent moisture for 11 mammal-tissue samples and 11 benthic macro-invertebrate samples. The mammal tissues were not dried for the percent moisture determination because the laboratory was not equipped to dry deer mice with possible hanta virus contamination. Insufficient sample mass was provided for the benthic macro-invertebrate samples that were not dried for percent moisture. The analytical results from the mammal and benthic macro-invertebrate tissues without percent moisture records are usable as reported (WW concentrations).

5.3.4 Biological Tissue Data Quality Summary

The analytical results received from ACZ Laboratories for benthic macro-invertebrate, periphyton, aquatic macrophyte, fish, mammal and terrestrial/riparian plant tissue samples were evaluated for data quality. Sample collection and transfer was verified, and quality control parameters for accuracy, precision and completeness were acceptable for all analyses. All of the tissue sample results are determined to be fully usable as reported with no qualifications.

TABLES

Table 5-1

Groundwater Parameters With Non-Detect Results

Parameter	Analytical Method	Maximum Reported Non-Detect at the MDL shown (mg/L)	Preliminary MDL Goal[1] (mg/L)
COPCs			
Selenium, Total	SM 3114 B, AA-Hydride	0.001	0.001
Selenium, Dissolved			
Selenium, Total	3114C	0.0003	
Selenium, Dissolved			
Cadmium, Total	213.2	0.0001	0.0002
Cadmium, Dissolved			
Chromium, Total	200.7	0.0003	0.00005
Chromium, Dissolved			
Copper, Total	200.7	0.0026	0.0005
Copper, Dissolved			
Nickel, Total	200.7	0.001	
Nickel, Dissolved		0.0017	0.0002
Vanadium, Dissolved	200.7	0.0002	0.005
Zinc, Dissolved	200.7	0.0018	0.01
Major Ions			
TDS	160.1	10	5
TSS	160.2	5	
Carbonate as CaCO3	2320B	1	2
Hydroxide as CaCO3		1	
Fluoride	300	0.5	0.1
Nutrients			
Nitrate + Nitrite (as N)	353.2	0.02	0.02
Orthophosphate (as P)	365.2	0.01	0.005
Phosphorus, Total	365.2	0.01	
Trace Elements			
Aluminum, Dissolved	200.7	0.0097	0.03
Antimony, Total	204.2	0.0006	
Antimony, Dissolved			
Arsenic, Total	206.2	0.0006	
Arsenic, Dissolved			
Beryllium, Total	200.7	0.0002	
Beryllium, Dissolved		0.0001	
Iron, Total	200.7	0.0124	
Iron, Dissolved			0.01
Lead, Total	239.2	0.001	
Lead, Dissolved		0.0004	
Manganese, Dissolved	200.7	0.001	0.005
Mercury, Total	245.1	0.0002	
Mercury, Dissolved		0.0001	
Silver, Total	272.2	0.0001	
Silver, Dissolved			
Thallium, Total	279.2	0.0004	

[1]From Field Sampling Plan Table 2-2

Table 5-2

Surface Water Parameters With Non-Detect Results

Parameter	Analytical Method(s)	Maximum Reported Non-Detect at the MDL shown (mg/L)	Preliminary MDL Goal[1] (mg/L)
COPCs			
Selenium, Total	SM 3114 C	0.002	0.001
Selenium, Dissolved		0.001	0.001
Cadmium, Total	213.2 and 200.8	0.0001	
Cadmium, Dissolved		0.0005	0.0002
Chromium, Total	200.7 and 200.8	0.0005	
Chromium, Dissolved	200.7	0.0003	0.00005
Copper, Total	200.7 and 200.8	0.0014	
Copper, Dissolved		0.0026	0.0005
Nickel, Total	200.8	0.0004	
Nickel, Dissolved	200.7	0.0017	0.0002
Vanadium, Total	200.7	0.005	
Vanadium, Dissolved		0.005	0.005
Zinc, Total	200.7	0.01	
Zinc, Dissolved		0.02	0.01
Major Ions			
TSS	160.2	5	5
Potassium, Dissolved	200.7	0.6	0.3
Carbonate as CaCO3	SM 2320 B	2	2
Hydroxide as CaCO3		2	2
Fluoride	SM 4500 F and 300	0.1	0.1
Chloride	325.2	1	1
Sulfate	375.3	10	4
Nutrients			
Ammonia (as N)	350.1	0.1	0.02
Nitrate + Nitrite (as N)	353.2	0.02	0.02
Orthophosphate (as P)	365.2 and 365.1	0.01	0.005
Phosphorus, Total	365.1	0.01	
TOC	415.1	1	1
Trace Elements			
Aluminum, Total	200.7	0.06	
Aluminum, Dissolved		0.03	0.03
Antimony, Total	204.2	0.0003	
Arsenic, Total	200.8	0.0005	
Arsenic, Dissolved	206.2 and 200.8	0.005	0.0005
Beryllium, Total	200.7	0.00007	
Boron, Dissolved	200.7	0.01	
Cobalt, Total	200.7	0.01	
Iron, Total	200.7	0.01	
Iron, Dissolved		0.02	0.01
Lead, Total	239.2 and 200.8	0.0004	
Lead, Dissolved		0.01	0.0001
Manganese, Total	200.7	0.005	
Manganese, Dissolved		0.005	0.005
Mercury, Total	245.1	0.0002	
Mercury, Dissolved		0.0002	
Silver, Total	200.8	0.0001	
Silver, Dissolved	272.2 and 200.8	0.0001	0.00005
Thallium, Total	279.2	0.0004	

[1]From Field Sampling Plan Table 2-2

Table 5-3

Validation Qualifiers for Groundwater COPCs

COPC	Sample Count	Total Percentage of Results Assigned Qualifiers	U	UJ	J	J-	J+	R	Reasons for assigning qualfiers
Selenium, Total	48	17%	15%		2%				Field duplicate RPD >30% (J)
									Result <5x equipment rinsate blank (U)
									Result <5x field blank (U)
									Result <5x preservation blank (U)
Selenium, Dissolved	48	8%	4%		2%	2%			Field duplicate RPD >30% (J)
									Inadequate sample preservation (J-)
									Result <5x field blank (U)
Cadmium, Total	39	31%	13%	8%	10%				Duplicate injection precision outside control limits (J)
									Field duplicate RPD >30% (J)
									MSA std curve correlation <0.995 (J)
									PDS recovery outside control limits (J)
									PDS recovery < 75% (UJ)
									PDS recovery <85% (UJ)
									PDS recovery outside 85-115% (UJ)
Cadmium, Dissolved	39	49%	15%	26%	8%				Lab duplicate RPD >20% (J or UJ)
									Inadequate sample preservation (J-)
									PDS recovery < 75% (UJ)
									PDS recovery <85% (UJ)
									PDS recovery outside 85-115% (UJ)
Chromium, Total	39	31%	15%		15%				Poor precision of analytical duplicate (J)
									Result <5x field blank (U)
									Result <5x equipment rinsate blank (U)
Chromium, Dissolved	39	26%	10%	5%	10%				Poor precision of analytical duplicate (UJ or J)
									Result <5x field blank (U)
									Inadequate sample preservation (J-)
Copper, Total	39	10%	10%						Result < 5x lab method blank (U)
Copper, Dissolved	39	10%	8%	3%					Inadequate sample preservation (UJ)
Nickel, Dissolved	39	51%	49%			3%			Inadequate sample preservation (J-)
									Result < 5x field blank (U)
									Result <5x lab blank (U)
									CRDL recovery >130% (J+)
									Result <5x method blank (U)
Vanadium, Dissolved	39	15%	13%			3%			Inadequate sample preservation (J-)
									Result <5x lab blank (U)
Zinc, Total	1	100%			100%				Lab duplicate RPD >20% (J)
Zinc, Dissolved	39	56%	44%	8%	5%				Serial Dilution % difference >10% (UJ or J)
									Inadequate sample preservation (J-)
									Result <5x field blank (U)
									Field duplicate difference > 2x IDL (UJ or J)
									Result <5x lab blank (U)
									Result <5x method blank (U)

CRDL = contract required detection limit
IDL = instrument detection limit
MSA = matrix spike addition
PDS = post digestion spike
RPD = relative percent difference

Table 5-4

Validation Qualifiers for Surface Water COPCs

COPCs	Sample Count	Total Percentage of Results Assigned Qualifiers	U	UJ	J	J-	J+	R	Reasons for assigning qualifiers
Selenium, Total	171	35%	16%	3%	6%	10%			Field duplicate RPD > 2x IDL (J)
									Field duplicate RPD > 30% (J)
									MS and MSD recoveries <75% (J-)
									MS recovery < 75% (UJ or J-)
									poor recovery of matrix spike
									Result <5x Preservation Blank (U)
Selenium, Dissolved	217	31%	6%	7%	4%	10%	5%		Field duplicate RPD > 2x IDL (J)
									MS and MSD recoveries <75% (J-)
									MS recovery < 75% (UJ or J-)
									poor recovery of matrix spike
									MS recovery > 125% (J+)
Cadmium, Total	32	88%	66%		22%				PDS recovery < 75% (UJ)
Cadmium, Dissolved	188	9%	1%	5%	3%				Field duplicate RPD > 30% (J)
									PDS recovery < 85% (J)
									PDS recovery outside 85-115% (UJ or J)
									PDS recovery < 75% (UJ)
									PDS recovery < 85% (UJ)
Chromium, Total	32	91%	84%	3%	3%				poor precision of analytical duplicate
Chromium, Dissolved	188	9%	8%	1%					Result < 5x blank concentration (U)
									Result < 5x prep blank (U)
									Result <5x lab blank result (U)
									Result <5x method blank (U)
									poor precision of analytical duplicate
Copper, Total	32	88%	88%						CRDL recovery <70% (UJ)
Copper, Dissolved	188	27%	3%	11%	1%	3%		11%	CRDL recovery <70% (UJ or J-)
									CRDL recovery < 50% (J or R)
									Result <5x method blank (U)
									Lab duplicate RPD > 2x IDL (UJ)
Nickel, Dissolved	188	14%	14%						Field duplicate difference > 2x IDL (J)
									Result < 5x field blank (U)
									Result <5x blank (U)
									Result <5x equipment blank (U)
									Result <5x lab blank (U)
Vanadium, Dissolved	180	9%	9%						Field duplicate difference > 2x IDL (J)
									Result < 5x prep blank (U)
									Result <5x blank (U)
									Field duplicate difference > 2x IDL (UJ)
Zinc, Dissolved	188	7%	7%	1%					Field duplicate difference > 2x IDL (UJ or J)
									Result < 5x lab blank (U)
									Result <5x equipment blank (U)
									Field duplicate RPD >30% (J)
									Result <5x Prep Blank (U)
									Results <5x blank concentration (U)

RPD = relative percent difference
MS = matrix spike
MSD = matrix spike duplicate
IDL = instrument detection limit
PDS = post digestion spike
CRDL = contract required detection limit

Table 5-5

Validation Qualifiers for Soil and Sediment COPCs

Parameter	Sample Count	Total Percentage of Results Assigned Qualifiers	U	UJ	J	J-	J+	R	Reasons for assigning qualifiers
Soil									
Chromium, Total	221	1%					1%		MS recovery >125% (J+)
Copper, Total	221	13%					4%	9%	MS recovery >125% (J+) CRDL recovery >180% (R)
Nickel, Total	221	9%			9%				Serial dilution difference >10% (J)
Selenium, Total	221	35%				35%			MS recovery <75% (J-)
Zinc, Total	221	19%			19%				MS recovery <75% (J-) Serial dilution difference >10% (J)
Sediment									
Chromium, Total	45	29%					29%		MS recovery >125% (J+)
Copper, Total	45	4%					4%		CRDL recovery >125% (J+)
Zinc, Total	45	29%			29%				Serial dilution difference >10% (J)

CRDL = contract required detection limit
MS = matrix spike

Table 5-6

Tissue Parameters With Non-Detect Results (mg/kg)

Parameter	Analytical Method	Maximum Reported Non-Detect at the MDL Shown	Target MDLs
Fish Tissue			
Cadmium, Total	M6020 ICP-MS	0.02	0.02
Chromium, Total	M6010B ICP	0.5	1
Nickel, Total	M6010B ICP	0.5	1
Vanadium, Total	M6010B ICP	0.2	0.5
Small Mammal Tissue			
Cadmium, Total	M6020 ICP-MS	0.01	0.02
Chromium, Total	M6010B ICP	0.4	1
Nickel, Total	M6010B ICP	0.4	1
Vanadium, Total	M6010B ICP	0.2	0.5
Aquatic and Terrestrial Invertebrate Tissue			
Chromium, Total	M6010B ICP	7	1
Nickel, Total	M6010B ICP	7	1
Vanadium, Total	M6010B ICP	4	0.5
Aquatic and Terrestrial Vegetation Tissue			
Cadmium, Total	M6020 ICP-MS	0.05	0.02
Chromium, Total	M6010B ICP	1	1
Nickel, Total	M6010B ICP	6	1
Selenium, Total	M6020 ICP-MS	0.05	0.1
Vanadium, Total	M6010B ICP	0.5	0.5