Final NPS Preliminary Assessment and Site Inspection Report

Kenai Fjords National Park

Glass Heifner Gold Mine
5AKR2659

Prepared by

Ahtna Solutions, LLC

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List of Abbreviations and Acronyms

µg/kg	micrograms per kilogram
AAC	Alaska Administrative Code
ADEC	Alaska Department of Environmental Conservation
Ahtna	Ahtna Solutions, LLC
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CSM	conceptual site model
DQO	data quality objective
EPA	United States Environmental Protection Agency
KEFJ	Kenai Fjords National Park
LCL	lower confidence limit
mg/kg	milligrams per kilogram
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NPS	National Park Service
PA	preliminary assessment
SAP	Sampling and Analysis Plan
SI	site inspection
SW	United States Environmental Protection Agency Solid Waste Method
USGS	United States Geological Survey
XRF	X-ray fluorescence

1. Introduction

The site is a former gold mine in Kenai Fjords National Park (KEFJ) that has been under the management authority of KEFJ since the mining claims lapsed in 2002. KEFJ staff members have conducted several environmental response activities at this site since 1998, including a tailing stabilization project, a hazardous waste inventory, and a drum removal. At the end of the 2008 drum removal effort, five soil samples were collected from a ruined rock crusher/ball mill. Results indicated approximately one-third of a cubic yard of soil containing mercury above Alaska Department of Environmental Conservation (ADEC) cleanup levels (Title 18 Alaska Administrative Code ([ACC] 75.341, Table B1, over 40-inch rainfall zone, 2021) exists at the area of the ball mill. One sample result also contained arsenic that exceeded ADEC cleanup levels, as well as background levels. The ADEC File No. for the site is 2332.38.053 and the Hazard Identification No. 27212. The Department of Interior (DOI) Environmental and Disposal Liability Reporting (EDL) Site ID for the site is 5AKR2659.

On June 5, 2021, Ahtna Solutions, LLC, (Ahtna) and a National Park Service (NPS) representative returned to the ball mill at the site and collected five additional samples to determine the extent of mercury contamination in the area.

Ten background samples were also collected from areas around the ball mill to determine existing levels of arsenic and mercury at the site.

This Preliminary Assessment (PA) and Site Inspection (SI) report details the findings of these samples and provides recommendations for the future determination of the site.

1.1. Comprehensive Environmental Response, Compensation, and Liability Act and National Park Service Authority

The NPS is authorized under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 United States Code Section 9601 et seq., to respond as the lead agency to a release or a threatened release of hazardous substances, and/or a release or threatened release of any pollutant or contaminant that may present an imminent and substantial danger to public health or the environment on NPS land.

CERCLA's implementing regulations, codified in the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 Code of Federal Regulations Part 300, establish the framework for responding to such releases and threatened releases. The NCP prescribes two similar processes for responding to releases; removal actions and remedial actions (See NCP Sections 300.400 through 300.440). Under either process, the initial step is to perform a PA. If the PA does not 1) conclude that a release or threat of release exists, 2) confirm whether the contaminants releases include "hazardous substances," or 3) determine whether these contaminants pose a threat to public health or the environment, then environmental sampling is warranted under a SI. See NCP Sections 300.410 and 300.420.

At sites that clearly warrant a SI or at sites that are remote and/or have high mobilization costs, the PA and SI may be combined into one continuous site investigation in order to reduce costs and prevent repetitive tasks.

The purpose of this PA/SI is to determine the lateral and vertical extent and the concentration of mercury and arsenic impacts present in the soil underneath the ball mill area and to assess background levels of arsenic at the site. This data will help determine whether a release or potential release of hazardous substances, pollutants, or contaminants has occurred or could occur and provide the basis for the NPS to determine whether conditions at the site warrant further investigation or a no further action determination (i.e., poses no risk to human health or the environment). See NCP Sections 300.410 and 300.420. Evaluations are focused on past and present practices and processes related to the storage, use, and disposal of hazardous substances at the site. Emphasis is placed on activities that routinely or non-routinely may have led or may lead to releases of hazardous substances into the environment.

2. Sampling and Analysis Plan and Data Quality Objectives Summary

This section provides a summary of the Sampling and Analysis Plan (SAP) and data quality objectives (DQOs) that were used to guide the collection of data under this PA/SI.

2.1. Sampling and Analysis Plan

The purpose of the SAP was to define the following:

- The level and extent of mercury and arsenic impacts in the soil at the ball mill area
- Background levels of arsenic in the area
- Regulatory status of metal contaminants in the soil to assess potential disposal options
- DQOs that would ensure the amount of data collected is sufficient and that the quality of data meets the project needs
- The methods that would be used to collect site and analytical data

The SAP is included in Appendix E.

2.2. Data Quality Objectives

The DQOs for this PA/SI are to provide analytical data showing the concentration, as well as the vertical and horizontal extent of mercury and arsenic impacts in soils at the ball mill, and to answer the question of whether the contaminants in the impacted soils will migrate to groundwater or surface water in the future.

3. Field Activities and Deviations from the Sampling and Analysis Plan

This section provides a summary of the field activities that were conducted along with deviations from the SAP that occurred. Field Notes are provided in Appendix A; Appendix B presents selected site photographs.

3.1. Mobilization

On June 4, 2021, a field team consisting of Baley Lenhart (Ahtna) and Sarah Venator (NPS) departed Lake Hood Airport in Anchorage, Alaska, via float plane to Beauty Bay in Kenai Fjords National Park. Upon arrival in Beauty Bay, they hiked to the site from the beach landing with all camping and sampling equipment. It should be noted that the access is overgrown and any access other than foot traffic was not possible. Upon arrival at the site, the field team determined the best available camping spot and erected

camp before sunset. Precautions were taken with consumables, storing them away from camp in bear-resistant food containers in the event of resident bears traveling through the site.

3.2. Ball Mill Field Screening and Sampling

On June 5, 2021, the field team prepared the sampling and field screening equipment and located the ball mill. With the agreement of the NPS representative, it was determined that the source location would be directly below the opening in the exterior of the ball mill (shown in the Photographic Log).

3.2.1. Source Field Screening and Sampling

Upon determination of the source location, field screenings were then collected in 6-inch intervals with a 4-inch-diameter hand-auger and read with an X-ray fluorescence (XRF) Gold+ analyzer calibrated for mercury. The field screenings were repeated until the XRF analyzer did not detect the contaminant of concern. Mercury was detected in the source boring at the intervals from 0 to 6 inches below ground surface (bgs) and 6–12 inches bgs at levels of 12 parts per million and 8 parts per million respectively. The field screening from 12 inches bgs to 18 inches bgs did not detect mercury in the soil. Per the SAP, sample 21GH-SO-001 was collected at the source from the interval of 12–18 inches bgs.

3.2.2. Step-Out Field Screenings and Sampling

After source sampling, step-out field screenings were performed per the SAP. Step-outs were placed 3–5 feet away from the source to the northwest, northeast, southwest, and southeast as the site conditions allowed. Upon screening from 0 to 6 inches bgs at all locations, no mercury was detected on the XRF. Soil samples 21GH-SO-002, 21GH-SO-003, 21GH-SO-004, and 21GH-SO-005 were collected from the field screening locations at 0–6 inches bgs. Figure 5 shows all analytical soil sampling locations. Ball mill sampling results are further detailed in Section 5.3.4.

3.3. Background Sampling

Upon the completion of sampling at the ball mill, a total of 10 background samples were collected around the site and were analyzed for both arsenic and mercury to provide existing levels of the contaminants of concern at the site. Locations were determined by the field team and were taken as far away from the mercury-impacted area as practicable while still being representative of the site. Samples were collected from approximately 6–12 inches bgs to sample below the upper organic layer and from the same material that is impacted near the ball mill. Figure 6 shows all approximate background sampling locations in respect to the ball mill. Background sampling results are further detailed in Section 5.3.3.

3.4. Demobilization

Upon completion of all sampling activities on June 5, 2021, the field team decided to mobilize to the beach to camp for the float plane pickup the next day. Prior to leaving the site, the NPS representative documented potential blasting equipment still present and inspected erosion around the capped tailings mitigated in past mobilizations. The field team then hiked back to the beach area and determined a camping location. Because of multiple bears seen in the area, care was taken to avoid major travel corridors.

On June 6, 2021, the crew departed KEFJ via float plane with Regal Air and arrived at Lake Hood in Anchorage.

3.5. Deviations From the Sampling and Analysis Plan

The following deviations from the SAP were encountered in this field effort:

- Ahtna performed the location survey rather than the NPS as stated in the SAP. A survey-grade Global Positioning System Arrow® 100 unit was used to collect data, however data quality measurements were not stored. All locations shown are approximate.
- Step-out samples were not collected in the cardinal directions as stated in the SAP. Step-outs were instead performed to the northwest, northeast, southwest, and southeast. The field team decided that this was beneficial due to the site conditions.
- Before mobilization, it was decided that background samples would be analyzed for mercury, which was not stated in the SAP.

3.6. Data Quality Objectives Evaluation

Based on the data review completed, there were no data qualified based on hold time exceedances, surrogate and laboratory control sample recoveries, and duplicate precision. Some data were qualified based on matrix spike/matrix spike duplicate accuracy and precision, but data are considered usable. All analytical data are considered usable for the purpose of evaluating the presence or absence and magnitude of the suspected site contaminants.

4. Site Description, Operational History, and Waste Characteristics

4.1. Site Description

The former Glass-Heifner mine is one of many small gold mines in the Nuka Bay area. The site comprises approximately 40 acres of lapsed unpatented mining claims, which are located on the west side of Ferrum Creek at the head of Beauty Bay, at an elevation of about 200 feet above sea level. The area surrounding the site is densely vegetated with conifers and alder. The site is located approximately 200 feet to the southwest of Ferrum Creek.

The site is developed with a collapsed mill building, several storage sheds, a bunkhouse, and the remains of another bunkhouse, which are located on a level pad approximately 200 feet by 225 feet in size (Figure 4). The milling equipment included two jaw crushers, a ball mill, a Wilfley concentrating table and a second concentrating table. The mine workings consist of surface trenches, an adit which was closed by NPS in 2010, and a collapsed raise.

Access to the mine is very limited because the site is extremely remote. The site is not shown on any major maps of KEFJ. The nearest residential structure to the site is a seasonal recreational cabin approximately 6 miles away.

4.2. Operational History

Gold ore was mined from at least three east-west trending, near-vertical quartz veins, ranging from 1 foot to 5 feet in width. The principal sulfide within the vein system was arsenopyrite, which occurred in lenses, sheets, and irregular masses. The gold was apparently free-milling and was liberated by crushing (Shannon & Wilson, 1996).

There are a series of tailings ponds that have been the focus of previous studies and led to the solidification and stabilization mitigations project after concentrations of near 25% arsenic by weight in the ponds was encountered (Shannon & Wilson, 2006).

The ball mill, the focus of this PA/SI, was believed to have been in use for a limited period between 1965 and 1967 by the Glass and Heifner claimants (as opposed to other claimants at this site). The area sampled by the NPS measured approximately 3 feet wide by 4 feet long and was visually distinct from the surrounding soil (NPS, 2008).

4.3. Previous Investigations and Response Actions

Various investigations have been performed by the NPS in attempts to characterize the site. Previous studies have shown that arsenic is found at elevated concentrations in background soil samples from this area. These investigations are summarized as follows:

- June 1994 – Discovery of arsenic-bearing mine tailings at the Beauty Bay Mine
- July and August 1994 – NPS site visit and sampling
- May 1995 – NPS site visit and sampling
- August 1995 – NPS and Shannon & Wilson site visit and sampling
- January 1996 – Beauty Bay Mine Evaluation/Cost Analysis released
- July 1998 – Removal action completed
- August 1999 – NPS site visit to observe condition of stabilized tailings
- July 2000 – NPS site visit to observe condition of stabilized tailings
- August 2006 – Site visit to observe condition of stabilized tailings
- September 2006 – Removal Action Summary released
- July 2008 – Hazardous barrel and container removal, with sampling conducted under ball mill/rock crusher and amalgamator.

4.4. Waste Characteristics

Sample results collected by NPS in 2008 indicated that approximately one-third of a cubic yard of mercury-contaminated soil is still in place at the ball mill area. However, based on this sampling event, it is likely that several cubic yards of mercury-impacted soil above migration-to-groundwater cleanup levels may require removal. Sample results also indicated the presence of arsenic at the site at concentrations above ADEC cleanup levels. Due to the elevated levels of arsenic present in background soils, setting arsenic cleanup thresholds to ADEC cleanup levels would not be an achievable goal for the site. For the purpose of this investigation, mercury and arsenic are the contaminants of concern.

5. Exposure Pathway and Environmental Hazard Assessment

5.1. Graphical Conceptual Site Model

Figure 5 presents the conceptual site model (CSM) for the site. The CSM provides visual representations of the potentially impacted receptors (humans, birds, mammals, fish, and plants) and soil layers, and the

potential transport of contaminants from the site through precipitation/leaching to the groundwater and into Ferrum Creek.

5.1.1. Key Conceptual Site Model Assumptions

The following assumptions were made in preparation of the graphical CSM:

- Approximately one-third of a cubic yard of soil contains mercury above ADEC cleanup levels.
- Arsenic exists naturally at the site above ADEC cleanup levels.
- Plant roots extend into the impacted zone.
- Invertebrates and insects preyed upon by small mammals are living in the impacted soils.

5.2. Groundwater and Surface Water

The investigation of the groundwater and surface water was not scoped in the SAP, because mercury was not believed to be mobile in the site (NPS, 2008). This study has shown mercury should be considered potentially mobile.

5.2.1. Local Geologic and Hydrogeologic Setting

KEFJ has been shaped by glaciers, with active glacial processes and past glaciations being largely responsible for the fundamental morphology of the landscape. The area is characterized by steep mountain side slopes and cirque walls, formed during glaciation that shed the source rocks for surficial deposits. The deposits consist of primarily graywacke, schist, and phyllite, which cover the majority of KEFJ, and include alluvium on river floodplains (NPS, 2018).

The former Glass-Heifner mine presumably rests on a veneer of glacio-alluvial deposits. An impermeable layer of bedrock or glacial till is expected at a relatively shallow depth. Subsurface water has not been encountered regularly in previous investigations, however there is a possibility of a perched aquifer on the impermeable layer with the only vertical migration being limited to cracks and faults in the bedrock or till (Shannon & Wilson, 2006).

Groundwater flow direction is assumed to be between northwest and north in the direction of Ferrum Creek (Figure 3). This assumption is further supported by the site topography which slopes from the ball mill area to the north-northwest.

5.2.2. Groundwater and Surface Water Use

According to previous investigations by Shannon & Wilson, the depth to the regional aquifer is unknown. Assumptions have been made with regional geology that the subsurface hydrology is controlled by the presence of bedrock or impermeable glacial till. It is also likely there is a colluvial/alluvial gravel aquifer along the base of the hillslope along Ferrum Creek (Shannon & Wilson, 2006).

There is a small creek approximately 4 feet in width directly to the west of the source area. The creek then flows into Ferrum Creek to the north of the site. The creek is approximately 20–25 feet from the source and is not likely impacted by the contaminated materials because they are not assumed to be abundantly mobile in the contaminated media.

5.2.3. Drinking Water Intakes

There are no drinking water intakes or wells in the region of the site.

5.3. Soil

The following activities were performed during the soil investigation at Glass Heifner Mine Site:

- Five primary samples and one duplicate sample were collected and analyzed for the following:
  - Mercury
  - Arsenic
- Ten total background samples were collected to evaluate the naturally occurring levels of arsenic and mercury.

5.3.1. Potential Receptors

The site is currently used by visitors of KEFJ for recreation purposes. Potential human receptors are visitors to KEFJ and the NPS personnel who work there and maintain the area.

Potential ecological receptors include birds nesting in the area, fish living in or traveling through potentially impacted waters of Ferrum Creek, mammals crossing the site or consuming plants, and animals living within the impacted area that may be exposed to contaminants.

The primary potential human exposure route is direct contact with the contaminated soil.

For wildlife, the primary exposure route would also be direct contact of animals burrowing or digging into the impacted soils. Exposure through ingestion could also occur through consumption of plants and animals living within the impacted zone, such as wild plants, fish, birds, or mammals that are gathered or hunted for subsistence.

5.3.2. Sensitive Environments

The site is located within a national park; therefore, the entire area is considered a sensitive environment. It is home to many species of birds including bald eagles and small and large mammals. Black bears and moose have been observed on the site. Four species of anadromous fish (salmon) reside in Ferrum creek, along with resident fish (e.g. dolly varden). Because the surface water from the site drains to Ferrum Creek, which terminates into Beauty Bay, saltwater species of fish and marine mammals may also be affected.

5.3.3. Background Sampling Results

Ten analytical background soil samples (21GH-BKG-001 through 21GH-BKG-010) were collected outside of the zone of contamination for determining background levels of arsenic and mercury present in the soil. All samples were collected from approximately the interval of 6–12 inches bgs to sample from below the surface organic layer and from the representative media for the site. Table 1 presents the background sample results.

Arsenic Background Samples

Arsenic sample results ranged from 42 milligrams per kilogram (mg/kg) at 21GH-BKG-002 and 21GH-BKG-003 to 130 mg/kg at 21GH-BKG-001. A 95% upper tolerance limit with 95% coverage (95% UTL)

was calculated for arsenic using the ten background sample results. The 95% UTL was calculated using EPA ProUCL software (version 5.1) (Figure E-5). Inputs for the calculation were sample size (10), sample mean (51.48 mg/kg), and sample standard deviation (41.93 mg/kg). Using the 10 results, the 95% UTL for arsenic was calculated as 173.5 mg/kg (Table 2).

Next, the data set of arsenic background results was evaluated for outliers by performing Dixon's Outlier Test using ProUCL. The ProUCL output indicated that none of the arsenic samples collected were an outlier at the 5% significance level (Appendix E, Figure E-1). Therefore, the site-specific arsenic background level is 173.5 mg/kg.

Appendix E, Figure E-2 shows the quantile plot of the 10 arsenic results used for the analysis as well as the resulting site-specific arsenic back ground level of 173.5 mg/kg. The quantile plot confirms the normal distribution of the background data and subsequently the statistical analysis process used to determine the 95% UTL .

This analysis to determine a site-specific arsenic background level is based on the requirements and methodology in ADEC's Guidance for Evaluating Metals at Contaminated Sites (ADEC, 2018). In particular, the analysis was based on the following:

- The recommended minimum number of soil samples (10) to derive a 95% UTL of the mean arsenic background levels concentration was collected.
- Soil types for background arsenic sampling were similar to soil types where contamination is present.
- Background arsenic samples were collected from locations removed from the zone of contamination (shown on Figure 6).
- Analyses of arsenic samples were by recommended methods (EPA Solid Waste Method [SW]6020B).

Mercury Background Samples

Mercury sample results ranged from 0.075 mg/kg at 21GH-BKG-007 to 0.18 mg/kg at 21GH-BKG-004. A 95% UTL was calculated for arsenic using the 10 background sample results. The 95% UTL was calculated using ProUCL (Figure E-5). Inputs for the calculation were sample size (10), sample mean (0.121 mg/kg), and sample standard deviation (0.033 mg/kg). Using the 10 results, the 95% UTL for mercury was calculated as 0.217 mg/kg (Table 2).

Next, the data set of mercury background results was evaluated for outliers by performing Dixon's Outlier Test using EPA ProUCL software (version 5.1). The ProUCL output indicated that none of the mercury samples collected were an outlier at the 5% significance level (Appendix E, Figure E-3). Therefore, the site-specific mercury background level is 0.217 mg/kg.

Appendix E, Figure E-4 shows the quantile plot of the 10 mercury results used for the analysis as well as the resulting site-specific mercury background level of 0.217 mg/kg. The quantile plot confirms the normal distribution of the background data and subsequently the statistical analysis process used to determine the 95% UTL .

This analysis to determine a site-specific mercury background level is based on the requirements and methodology in ADEC's Guidance for Evaluating Metals at Contaminated Sites (ADEC, 2018). In particular, the analysis was based on the following:

- The recommended minimum number of soil samples (10) to derive a 95% UTL of the mean mercury background levels concentration was collected.
- Soil types for background mercury sampling were similar to soil types where contamination is present.
- Background arsenic samples were collected from locations removed from the zone of contamination (shown on Figure 6).
- Analyses of mercury samples were by recommended methods (SW7471A).

5.3.4. Analytical Source Area Soil Sampling Results

Analytical results from five primary soil samples and one duplicate sample are shown in Table 3. The samples were tested for arsenic using method SW6020B and mercury using method SW7471A. Results are compared to both the 18 AAC 75.341 Table B1 Method Two migration-to-groundwater soil cleanup levels and 18 AAC 75 Table B1 Method two human health soil cleanup levels over 40-inch zone for arsenic and mercury. Sample locations are shown on Figure 5.

All sampling locations in this area had arsenic concentrations exceeding ADEC migration-to-groundwater level of 0.2 mg/kg, and human health criteria of 7.2 mg/kg as well as the calculated background level of 21.5 mg/kg.

Mercury exceeded the ADEC migration-to-groundwater cleanup level of 0.36 mg/kg in samples 21GH-SO-002, 21GH-SO-003, 21GH-SO-004, and 21GH-SO-005. The mercury level in samples 21GH-SO-003 and 21GH-SO-004 also exceeded the human health cleanup level of 3.1 mg/kg.

In sample 21GH-SO-001(and field duplicate sample 21GH-SO-901) collected from 12 to 18 inches bgs beneath the former ball mill were below migration-to-groundwater cleanup levels suggesting mercury impacts are confined to the upper 12 inches of the soil column.

6. Conclusions and Recommendations

Background sampling for the site shows arsenic to be widespread in the area at a 95% UTL concentration of 173.5 mg/kg. This is in excess of the arsenic ADEC migration-to-groundwater concentration. A complete cleanup of arsenic to migration-to-groundwater levels in this area is not feasible. The 95% UTL background mercury concentration is of 0.217 mg/kg is below the ADEC migration-to-groundwater cleanup concentration.

In the source area, both arsenic and mercury are present at concentrations above both ADEC migration-to-groundwater and human health levels. Field screening suggested that clean edges of the impacted area had been reached but analytical results suggest a larger area of impacted soil than previously expected. The concentrations present could impact groundwater. Human receptors are unlikely due to the remoteness of the site, but the potential of exposure exists. Exposure to wildlife also exist. This is represented in the graphical CSM (Figure 7). It should be noted that the XRF field screening

underestimated metals concentrations and does not appear to be an adequate tool for metals determination at this site.

As stated previously, several more cubic yards of mercury-impacted soil is likely present at the site, and the volume of arsenic soil impacted above background levels is likely higher. Due to the remoteness of the site and challenging access to the area, it appears that hand excavation of soil to cleanup levels and transportation out of the site is not a feasible alternative.

As a first step, further delineation of the area of impacted soil should be conducted. Because the XRF analyzer does not seem to be an appropriate instrument, Ahtna recommends setting out a 5-foot grid around the ball mill spacing to 15 feet in each direction and sampling grid points for arsenic and mercury. After this is accomplished, alternative remedial scenarios should be considered such as capping the area with a low-permeability material, excavating and encapsulating the material on site, and/or mixing soils with stabilization chemicals that prevent leaching of the metals.

Groundwater transport of mercury and arsenic contaminants into Ferrum Creek is of concern. It is recommended that surface water/sediment couplets be taken from Ferrum Creek upgradient from the site, at the site, and downgradient from the site to assess potential impacts to the creek.

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Figures

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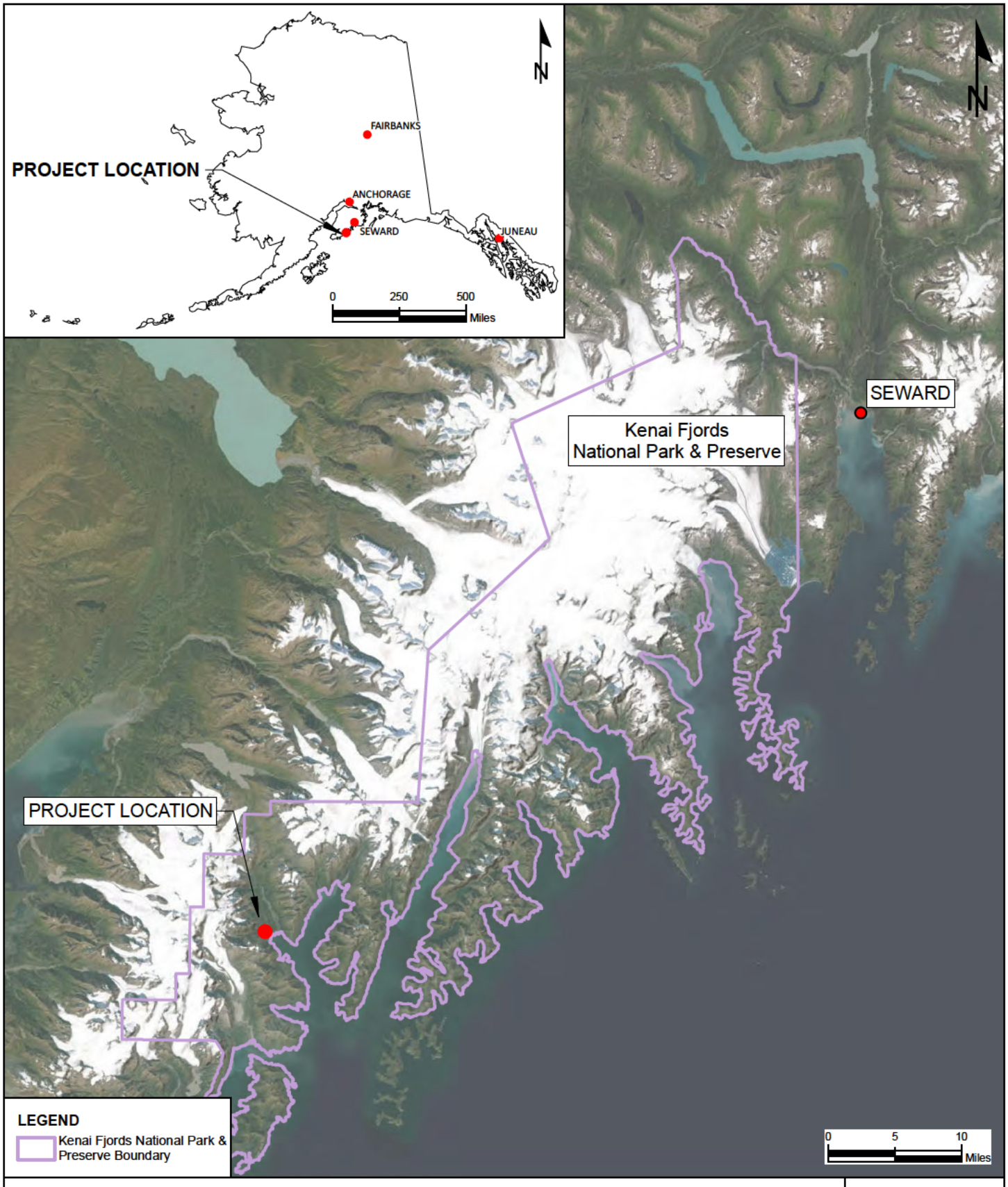

Glass-Heifner Mine, Preliminary Assessment and Site Inspection
Kenai Fjords National Park & Preserve, Alaska

Ahtna Solutions, LLC

STATE AND SITE VICINITY

Project Number: 23010	Figure Number: 1
Date: 8/6/2021	
Drafted By: RH	

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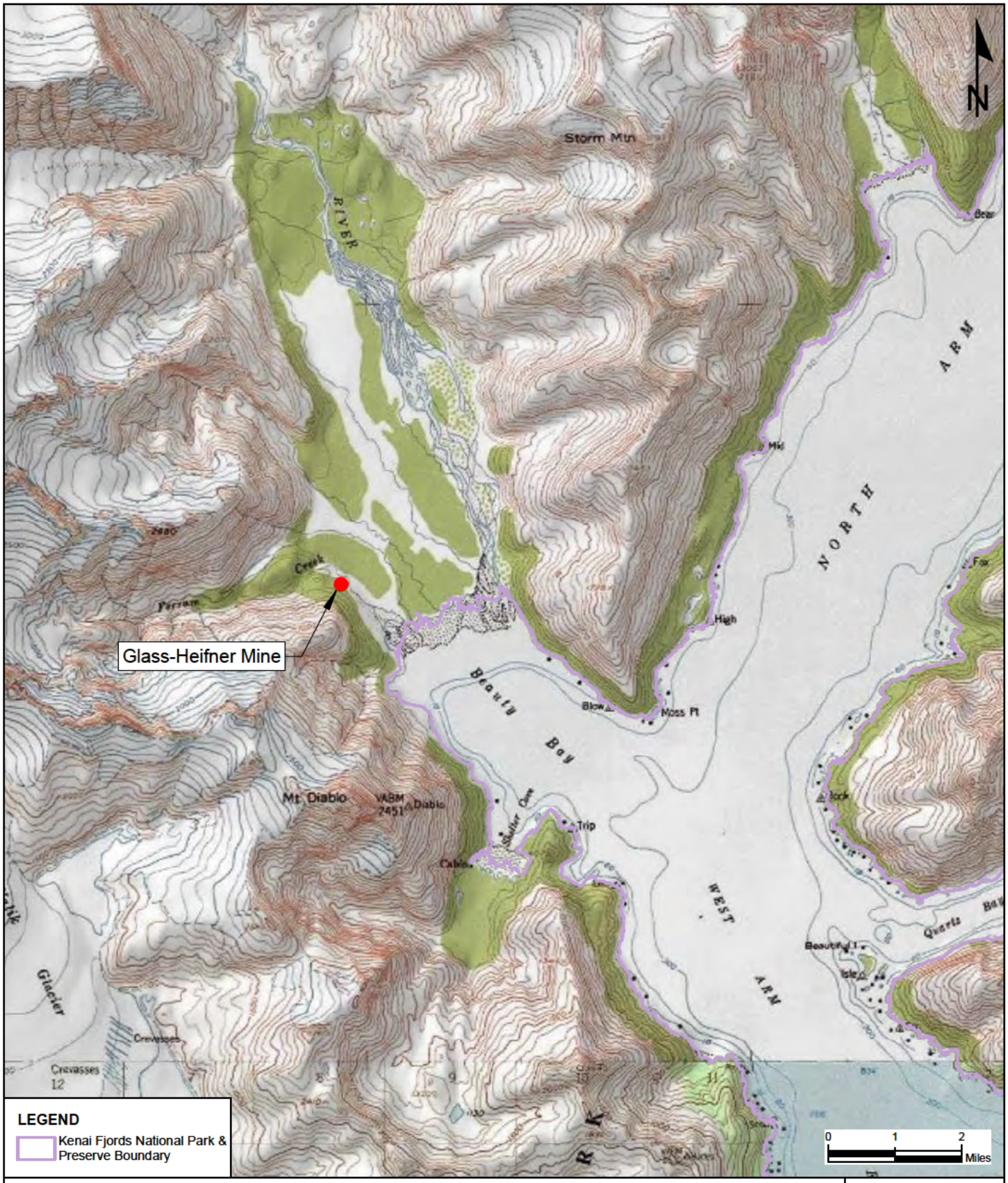

LEGEND

Kenai Fjords National Park & Preserve Boundary

Glass-Heifner Mine, Preliminary Assessment and Site Inspection
Kenai Fjords National Park & Preserve, Alaska

Ahtna Solutions, LLC

SITE LOCATION

Project Number: 23010	Figure Number: 2
Date: 8/6/2021	
Drafted By: RH	

Prepared by rhuetson, 8/6/2021; C:\Users\rhuetson\OneDrive - Ahtna, Inc\Desktop\GIS\GlassHeifnerMine\GIS\MXD\REPORT\F2_SiteLocation.mxd

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Glass-Heifner Mine, Preliminary Assessment and Site Inspection
Kenai Fjords National Park & Preserve, Alaska

Ahtna Solutions, LLC

SITE PLAN

Project Number: 23010	Figure Number: 3
Date: 12/6/2021	
Drafted By: RH	

Prepared by rhudson, 12/6/2021: C:\Users\rhudson\OneDrive - Ahtna, Inc\Desktop\GIS\GlassHeifnerMine\GIS\MXD\REPORT\F3_SitePlan.mxd

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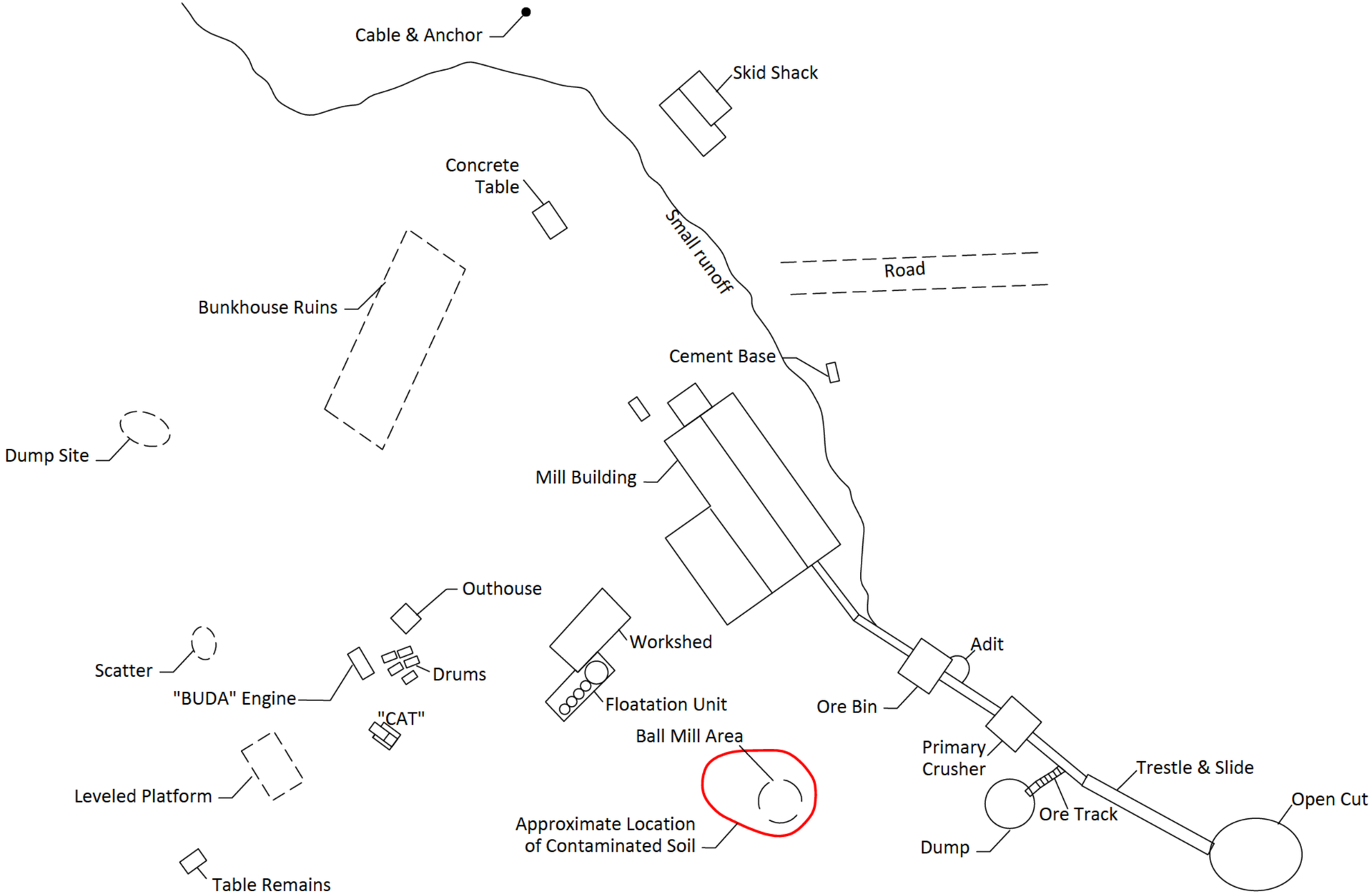

NOT TO SCALE

Notes:

1. All locations are approximate.
2. Drawing based on KEFJ89-004 Glass-Heifner Beauty Bay 12 Aug 89, by J. Creech.

Glass-Heifner Mine, Preliminary Assessment and Site Inspection
Kenai Fjords National Park & Preserve, Alaska

HISTORICAL SITE LAYOUT

Ahtna Solutions, LLC

Project Number:	Figure Number:
23010	4
Date: 08.06.2021	
Drawn By: R.H.	

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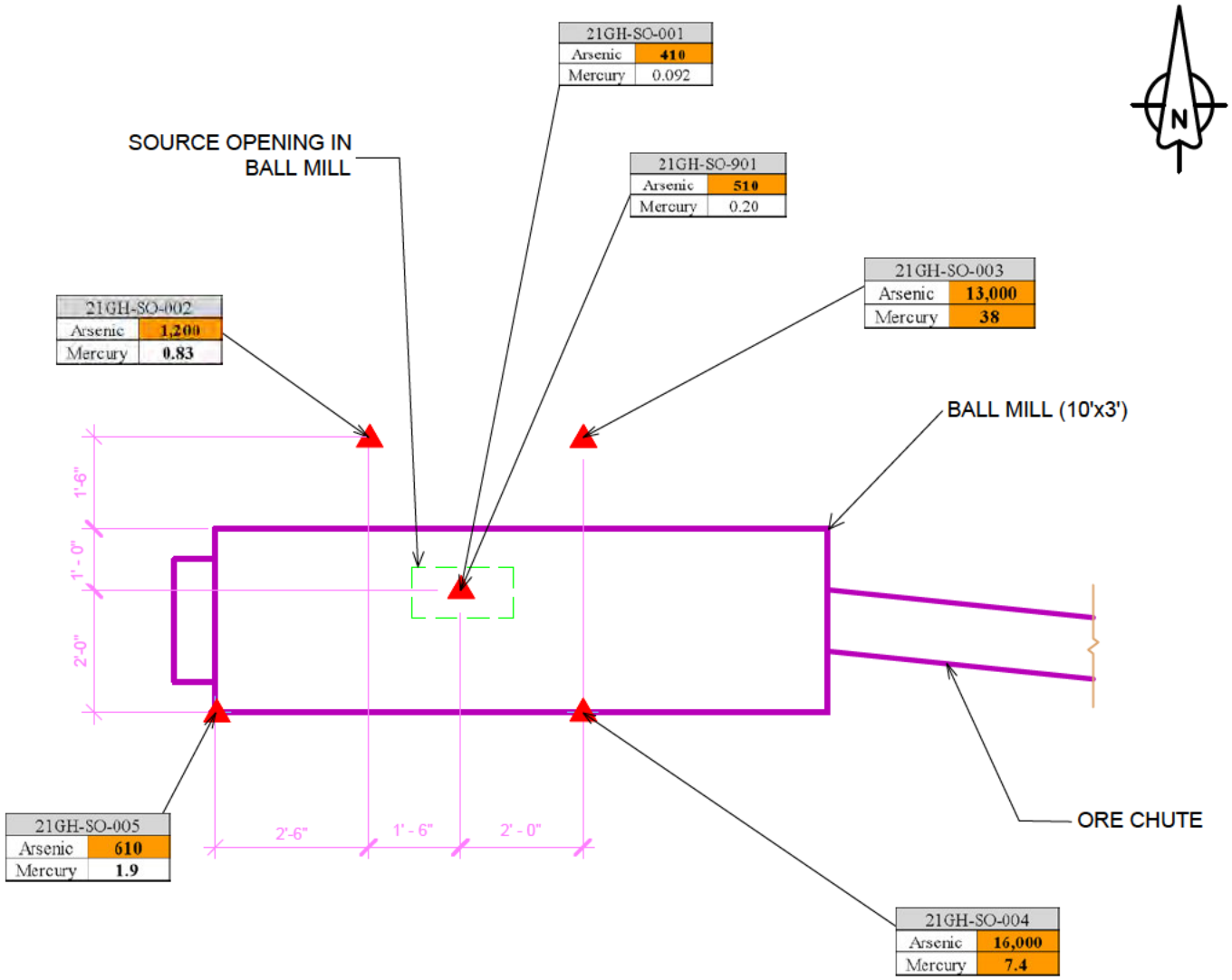
Analyte	MTG Limit	O40 HH Limit	Units
Arsenic	0.2	7.2	mg/kg
Mercury	0.36	3.1	mg/kg



Glass-Heifner Mine, Preliminary Assessment and Site Inspection
Kenai Fjords National Park & Preserve, Alaska

Ahtna Solutions, LLC

BALL MILL SAMPLING LOCATIONS

Project Number: 23010
Date: 09.15.2021
Drawn By: RH
Figure Number: 5

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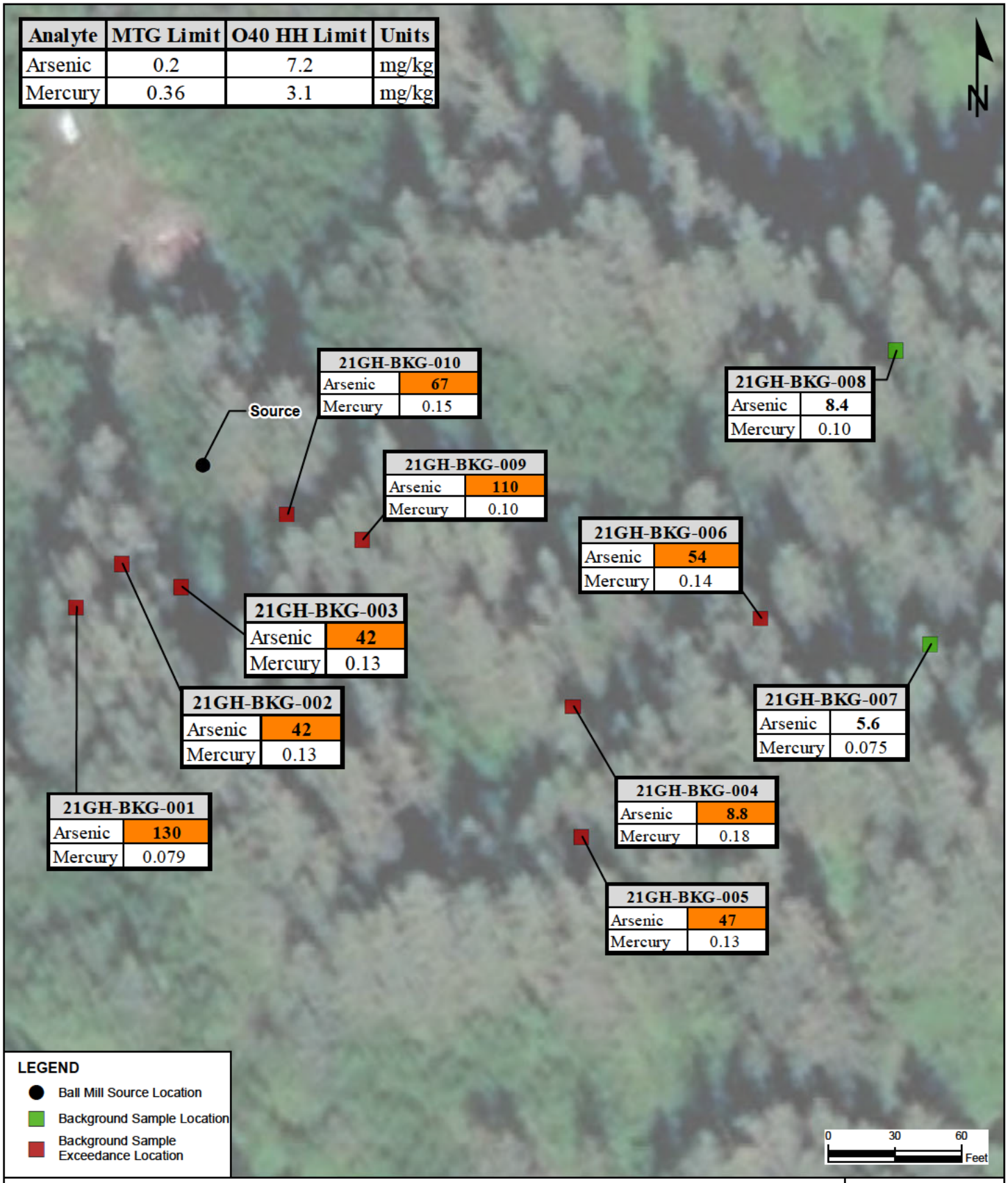

Glass-Heifner Mine, Preliminary Assessment and Site Inspection
Kenai Fjords National Park & Preserve, Alaska

Ahtna Solutions, LLC

BACKGROUND SAMPLE LOCATIONS

Project Number: 23010	Figure Number: 6
Date: 9/16/2021	
Drafted By: RH	

Prepared by rhudson, 9/16/2021; C:\Users\rhudson\OneDrive - Ahtna, Inc\Desktop\GIS\GlassHeifnerMine\GIS\MXD\REPORT\F6_Background.mxd

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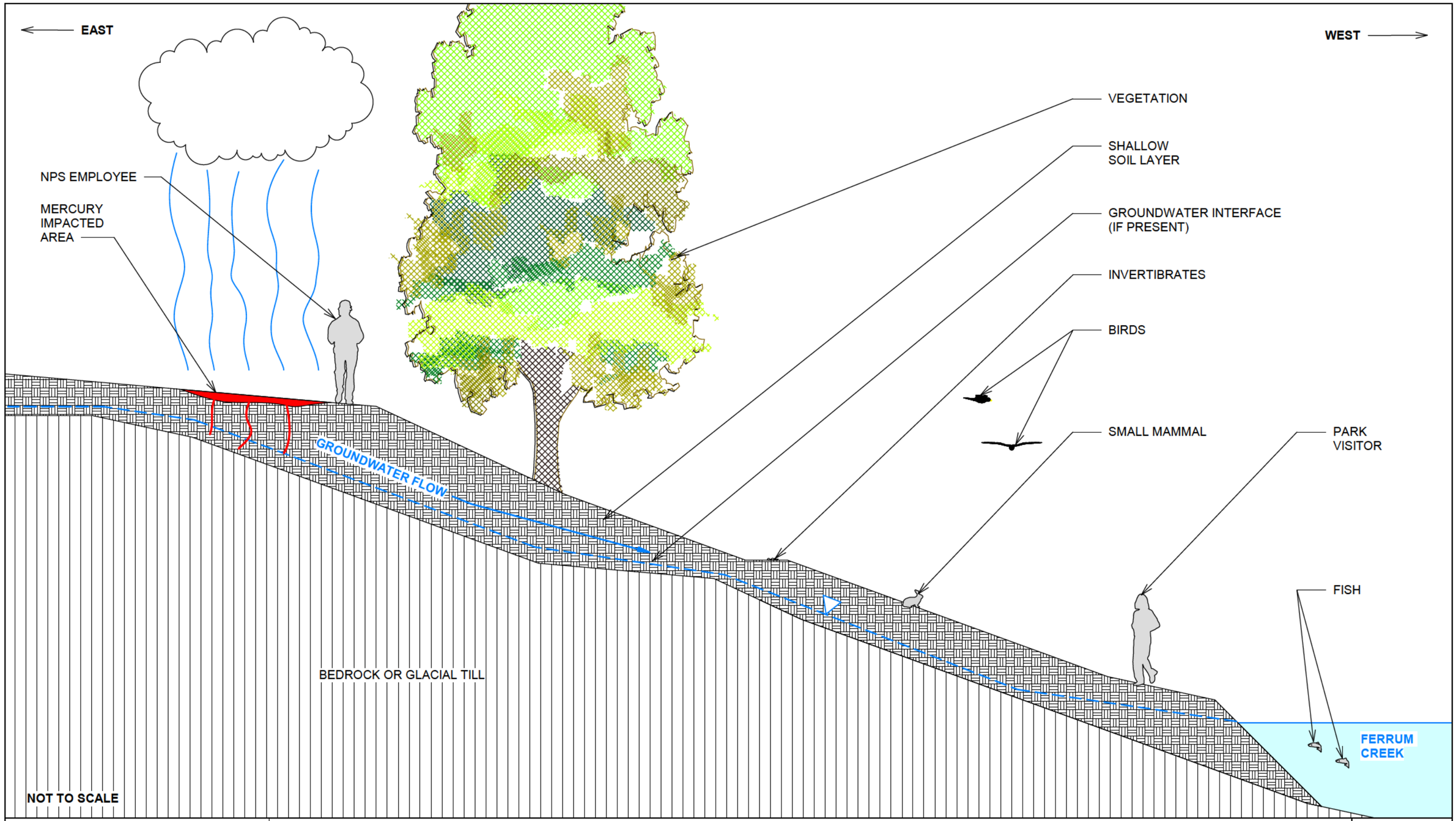

Note: Ferrum Creek terminates into Beauty Bay. Saltwater species of fish and marine mammals may also be affected.

Glass-Heifner Mine, Preliminary Assessment and Site Inspection
Kenai Fjords National Park & Preserve, Alaska

Ahtna Solutions, LLC

Conceptual Site Model Graphic

Project Number: 23010	Figure Number: 7
Date: 4/29/2020	
Drawn By: BKL	

AR000155

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Tables

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Table 1: Background Soil Sampling Analytical Results
Glass-Heifner Mine Site
Kenai Fjords National Park and Preserve, Alaska

				Sample ID	21GH-BKG-001	21GH-BKG-002	21GH-BKG-003	21GH-BKG-004	21GH-BKG-005
				Sample Date	6/5/2021	6/5/2021	6/5/2021	6/5/2021	6/5/2021
				Sample Time	13:15	13:20	13:30	14:50	15:00
				Matrix	Soil	Soil	Soil	Soil	Soil
				Sample Type	Primary	Primary	Primary	Primary	Primary
				Parent Sample					
Method	Analyte	MTG Limit	O40 HH Limit	Units					
SW6020B	Arsenic	0.2	7.2	mg/kg	**130**	**42**	**42**	**8.8**	**47**
SW7471A	Mercury	0.36	3.1	mg/kg	0.079	0.13	0.13	0.18	0.13
				Sample ID	21GH-BKG-006	21GH-BKG-007	21GH-BKG-008	21GH-BKG-009	21GH-BKG-010
				Sample Date	6/5/2021	6/5/2021	6/5/2021	6/5/2021	6/5/2021
				Sample Time	15:10	15:20	15:30	15:45	15:55
				Matrix	Soil	Soil	Soil	Soil	Soil
				Sample Type	Primary	Primary	Primary	Primary	Primary
				Parent Sample					
Method	Analyte	MTG Limit	O40 HH Limit	Units					
SW6020B	Arsenic	0.2	7.2	mg/kg	**54**	**5.6**	**8.4**	**110**	**67**
SW7471A	Mercury	0.36	3.1	mg/kg	0.14	0.075	0.10	0.10	0.15

Notes:

bold	concentration exceeds MTG criteria
	concentration exceeds U40 HH criteria
mg/kg	milligrams per kilogram
MTG	18AAC75 Tables B1/B2 Method 2 Soil Cleanup Levels Migration to Groundwater, amended 6/2021
O40 HH	18AAC75 Tables B1/B2 Method 2 Soil Cleanup Levels Human Health Over 40 Inch Zone, amended 6/2021

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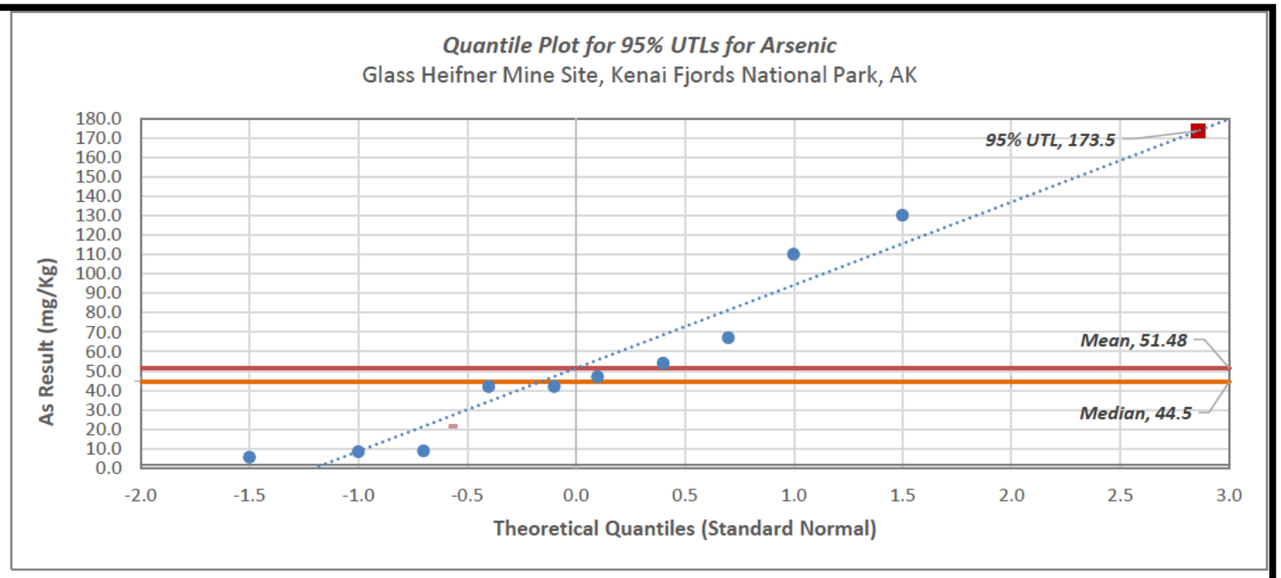
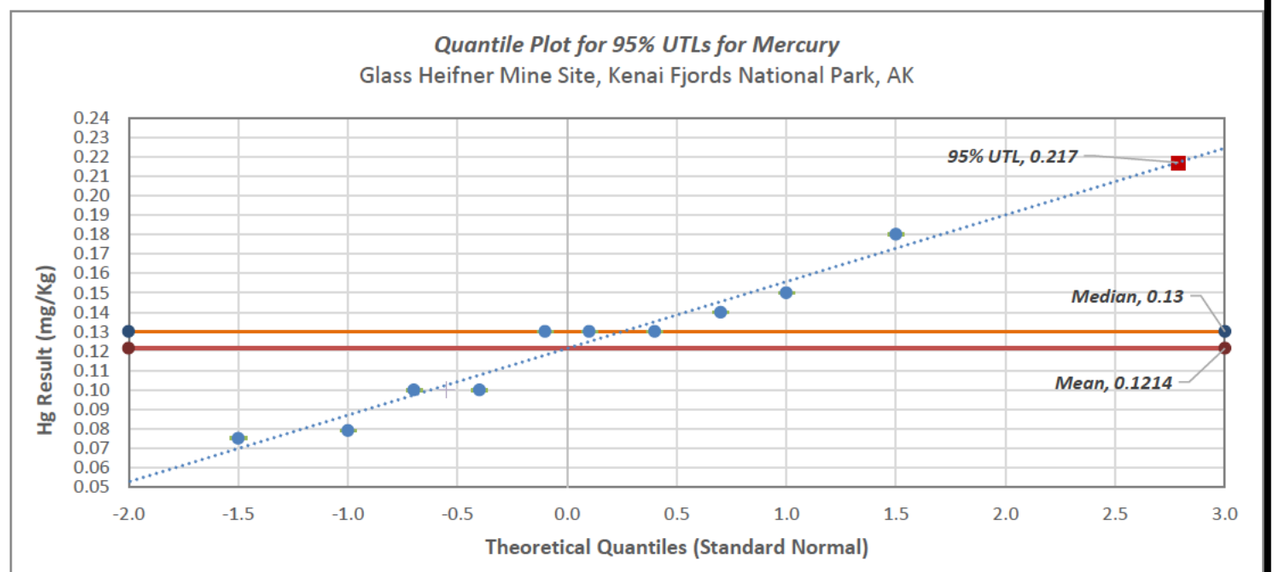
Table 2: Background Soil Statistical Analysis
Glass-Heifner Mine Site
Kenai Fjords National Park and Preserve, Alaska

	Statistics	
As in mg/kg	**Mean**	51.48
	Median	44.50
	95% UTL	173.50
	Std Dev	41.93
	CI	16.424136



	Statistics	
Hg in mg/kg	**Mean**	0.1214
	Median	0.1300
	95% UTL	0.2170
	Std Dev	0.0328
	CI	0.0939687



Notes:
As arsenic
CI confidence interval
Hg mercury
UTL upper tolerance limit
mg/kg milligrams per kilogram
Std Dev standard deviation

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Table 3: Ball Mill Area Soil Sampling Analytical Results
Glass-Heifner Mine Site
Kenai Fjords National Park and Preserve, Alaska

				Sample ID	21GH-SO-001	21GH-SO-901	21GH-SO-002	21GH-SO-003	21GH-SO-004	21GH-SO-005
				Sample Date	6/5/2021	6/5/2021	6/5/2021	6/5/2021	6/5/2021	6/5/2021
				Sample Time	10:30	10:35	10:50	11:10	11:30	11:50
				Matrix	Soil	Soil	Soil	Soil	Soil	Soil
				Sample Type	Primary	Duplicate	Primary	Primary	Primary	Primary
				Parent Sample		21GH-SO-001				
Method	Analyte	MTG Limit	O40 HH Limit	Units						
SW6020B	Arsenic	0.2	7.2	mg/kg	**410**	**510**	**1,200**	**13,000**	**16,000**	**610**
SW7471A	Mercury	0.36	3.1	mg/kg	0.092	0.20	**0.83**	**38**	**7.4**	**1.9**

Notes:

bold	concentration exceeds migration to groundwater (MTG) criteria
	concentration exceeds U40 Human Health (HH) criteria
mg/kg	milligrams per kilogram
MTG	18AAC75 Tables B1/B2 Method 2 Soil Cleanup Levels Migration to Groundwater, amended 6/2021
O40 HH	18AAC75 Tables B1/B2 Method 2 Soil Cleanup Levels Human Health Over 40 Inch Zone, amended 6/2021

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Appendix A
Field Notes

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NPS - GLASS
HEIFNER MINE

Rite in the Rain
ALL-WEATHER
UNIVERSAL
№ 371FX

B. LENHART

2310.000
JUNE 4, 2021 -

MADE IN TACOMA
— SINCE 1916 —

Rite in the Rain®

— DEFYING MOTHER NATURE —

Name _____

_____

Address _____

_____

Phone _____

Project _____

_____

_____

_____

RiteintheRain.com

CONTENTS

PAGE	REFERENCE	DATE

2 6/4/21 GLASS HELFNER B LENHART

1845 BL ARRIVES AT REGAL AIR

1730 SU ARRIVES AT REGAL AIR

1745 DEPART LAKE HOOD VIA CESSNA 206 FOR BEAUTY BAY.

1915 ARRIVE IN BEAUTY BAY. BL AND SARAH VENATOR (SU) BEGIN HIKE TO CAMPSITE AT GLASS-HELFNER MINE.

2130 ARRIVE AT SITE AND SET UP CAMP. IT SHOULD BE NOTED THAT THE ROAD ACCESS IS OVERGROWN AND ACCESS IS DIFFICULT. EOD.

Scale: 1 square = _____

GLASS HELFNER

6/5/21 B LENHART 3

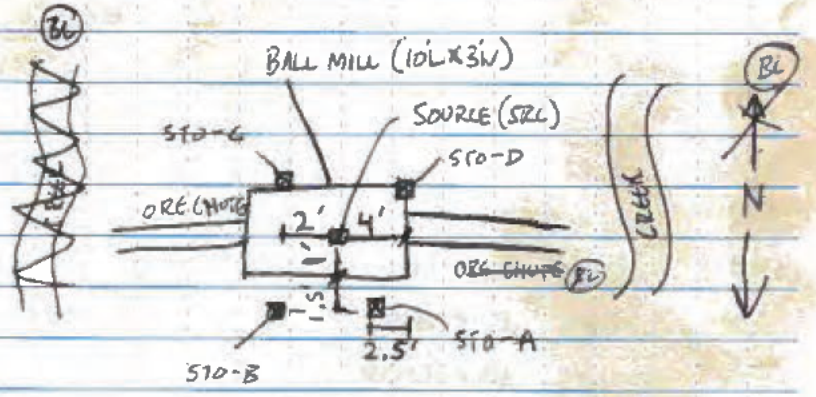
0700 FIELD TEAM BEGINS DAY, BEGINS PREPARING FIELD EQUIPMENT.

0850 YOUNG BLACK BEAR SEEN IN CAMP/SITE. FIELD TEAM MADE NOISE PASSED THROUGH

0940 FIELD TEAM MOVES TO BALL MILL TO BEGIN DELINEATION

1000 BEGIN COLLECTING XRF SCREENINGS AT BALL MILL BEGIN AT SOURCE

LOCATION	DETECT? Hg	LOD Hg	As LEVEL	NOTES
SRC-0-6	Y (12)	8	—	
SRC-6-12	Y (8)	7.4	—	
SRC-12-18	N	6.9	—	
STO-A-0-6	N		1100	
STO-B-0-6	N		10.1K	Pb≈200
STO-C-0-6	N		10.4K	Pb≈52
STO-D-0-6	N		990	Pb≈340



1030 COLLECT SAMPLE 21GH-SO-001 AT SRC-12-18

1035 COLLECT DUPLICATE SAMPLE 21GH-SO-901 AT SRC-12-18

Scale: 1 square = _____

Rite in the Rain

6/5/21 GLASS HEFENER B LENHART

1050 COLLECT SAMPLE 21GH-SO-002 AT STO-A-0-6

1110 COLLECT SAMPLE 21GH-SO-003 AT STO-B-0-6

1130 COLLECT SAMPLE 21GH-SO-004 AT STO-C-0-6

1150 COLLECT SAMPLE 21GH-SO-005 AT STO-D-0-6

1200 SAMPLE LOCATION WERE MEASURED W/ HAND TAPE AND RECORDED W/ ARROW 100 UNIT ON AVENZA MAPS. LOCATIONS (GPS) ARE APPROXIMATE. A PIECE OF ORE PULLED FROM THE SOURCE SAMPLE HOLE WAS READ W/ THE XRF TO A READING OF 25 PPM

1315 COLLECT ARSENIC BKG SAMPLE 21GH-BKG-001

1320 COLLECT BACKGROUND SAMPLE 21GH-BKG-002

1330 COLLECT BACKGROUND SAMPLE 21GH-BKG-003

1340 BREAK FOR LUNCH, REMAINING BACKGROUND SAMPLES WILL COME FROM UPGRADIENT OF SITE AWAY FROM ASSUMED DISTURBED AREAS. BL AND SV WORKING TOGETHER W/ GEOREFERCED USGS MAP (HISTORICAL), LOCATIONS BEING RECORDED IN AVENZA MAPS.

1450 COLLECT BACKGROUND SAMPLE 21GH-BKG-004

1500 COLLECT BACKGROUND SAMPLE 21GH-BKG-005

1510 COLLECT BACKGROUND SAMPLE 21GH-BKG-006

1520 COLLECT BACKGROUND SAMPLE 21GH-BKG-007

1530 COLLECT BACKGROUND SAMPLE 21GH-BKG-008

1545 COLLECT BACKGROUND SAMPLE 21GH-BKG-009 DIRECTLY UPGRADIENT OF BALL MILL

Scale: 1 square = _____

1555 COLLECT BACKGROUND SAMPLE 21GH-BKG-010 UPGRADIENT OF BALL MILL. IT SHOULD BE NOTED THAT ALL BKG SAMPLES WERE COLLECTED IN THE ~~1'-2'~~ (B) 0-1' DEPTH USING DISPOSABLE SAMPLING GEAR.

1600 SV DOCUMENTS POTENTIAL BLASTING EQUIPMENT.

1640 BREAK DOWN CAMP, PLAN IS TO CAMP NEAR BEACH FOR AM FLIGHT PICKUP

1645 INSPECT EROSION AT CAPPED TAILINGS. SV DOCUMENTS W/ PHOTOS.

1745 DEPART SITE FOR BEACH

1930 ARRIVE AT BEACH AREA. BROWN/BLACK BEARS SEEN IN AREA SO SELECT CAMP AWAY FROM VISIBLE BEAR TRAILS AT END OF FORMER RUNWAY.

Scale: 1 square = _____

Rite in the Rain

AR000170

6 6/6/21 GLASS HELFNER BLENHART

0700 CREW WAKES UP, BEGINS CAMP BREAKDOWN

0720 NPS REP CONTACTS REGAL AIR, BEAVER HAS JUST TAKEN OFF FROM ANC ETA 0830

0830 REGAL AIR ARRIVES AT BEAUTY BAY

0845 DEPART BEAUTY BAY W/ SAMPLES AND GEAR

1030 LAND AT LAKE HOOD IN ANC. EGD, BL WILL SHIP SAMPLES TOMORROW AFTER FINAL LABELING AND PACKAGING.

Scale: 1 square = _____

7

Scale: 1 square = _____

Rite in the Rain

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Appendix B
Photographs

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1: Camp set up at the site. View southwest.

2. Mine debris. View to southeast.

3: Hand auger at Ball Mill prior to sampling. View to south.

4: Mine Debris. View southeast.

5: View of Ball Mill from above. View northwest.

6: View of Ball Mill from above. View north.

7: View of Ball Mill from adjacent creek. View southeast.

8: View of Ball Mill from below. View southeast.

9: View of Ball Mill from below. View southeast.

10: Source sample location. View down.

11: Surveying sample location 21GH-SO-002. View down.

12: Source sample location (21GH-SO-001) and step out (21GH-SO-002). View down.

13: Step out sample locations 21GH-SO-003. View east.

14: Surveying step out sample location 21GH-SO-005. View down.

15: Location of background sample 21GH-BKG-001. View down.

16: Location of background sample 21GH-BKG-002. View south.

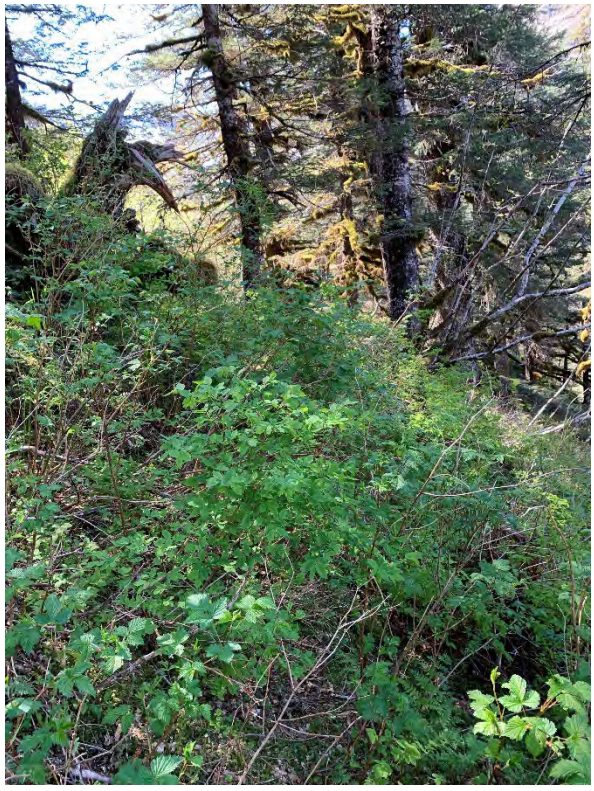
17: Location of background sample 21GH-BKG-003. View southeast.

18: Mine debris. View southwest.

19: Location of background sample 21GH-BKG-005. View northwest.

20: Location of background sample 21GH-BKG-006. View north.

21: Location of background sample 21GH-BKG-007 and NPS Personnel, view east.



22: Location of background sample 21GH-BKG-008. View northwest.

23: Location of background sample 21GH-BKG-009. View north.

24: Location of background sample 21GH-BKG-010. View north.

25: Mine debris. View south.

26: Field equipment packed to be demobilized from the site. View down.

27: View of Beauty Bay from the trailhead to the site. View southeast.

28: Demobilization via DeHavilland Beaver. View west.

Appendix C
Laboratory Report

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eurofins | Environment Testing America

ANALYTICAL REPORT

Eurofins FGS, Seattle
5755 8th Street East
Tacoma, WA 98424
Tel: (253)922-2310

Laboratory Job ID: 580-103655-1
Client Project/Site: 2021 NPS -Glass Heifner Mine Site

For:
Ahtna Solutions LLC
110 W 38th Ave
Suite 200L
Anchorage, Alaska 99503

Attn: Nino Muniz

M. Elaine Walker

Authorized for release by:
6/23/2021 12:56:25 PM

Elaine Walker, Project Manager II
(253)248-4972
m.elaine.walker@eurofinset.com

This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Results relate only to the items tested and the sample(s) as received by the laboratory.

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QC Sample Results 11
QC Association Summary 13
Lab Chronicle 16
Certification Summary 22
Method Summary 23
Sample Summary 24
Chain of Custody 25
Receipt Checklists 29
Prep Data 30

Qualifiers

Metals

Qualifier	Qualifier Description
4	MS, MSD: The analyte present in the original sample is greater than 4 times the matrix spike concentration; therefore, control limits are not applicable.
F2	MS/MSD RPD exceeds control limits
F3	Duplicate RPD exceeds the control limit

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CFU	Colony Forming Unit
CNF	Contains No Free Liquid
DER	Duplicate Error Ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL	Detection Limit (DoD/DOE)
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision Level Concentration (Radiochemistry)
EDL	Estimated Detection Limit (Dioxin)
LOD	Limit of Detection (DoD/DOE)
LOQ	Limit of Quantitation (DoD/DOE)
MCL	EPA recommended "Maximum Contaminant Level"
MDA	Minimum Detectable Activity (Radiochemistry)
MDC	Minimum Detectable Concentration (Radiochemistry)
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
MPN	Most Probable Number
MQL	Method Quantitation Limit
NC	Not Calculated
ND	Not Detected at the reporting limit (or MDL or EDL if shown)
NEG	Negative / Absent
POS	Positive / Present
PQL	Practical Quantitation Limit
PRES	Presumptive
QC	Quality Control
RER	Relative Error Ratio (Radiochemistry)
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)
TNTC	Too Numerous To Count

Job ID: 580-103655-1

Laboratory: Eurofins FGS, Seattle

Narrative

Job Narrative
580-103655-1

Receipt
Sixteen samples were received on 6/8/2021 2:26 PM. Unless otherwise noted below, the samples arrived in good condition, and where required, properly preserved and on ice. The temperature of the cooler at receipt was 1.4º C.

Receipt Exceptions

The following samples were activated for 7471A analysis by the client on 06/09/2021: 21GH-BKG-001 (580-103655-7), 21GH-BKG-002 (580-103655-8), 21GH-BKG-003 (580-103655-9), 21GH-BKG-004 (580-103655-10), 21GH-BKG-005 (580-103655-11), 21GH-BKG-006 (580-103655-12), 21GH-BKG-007 (580-103655-13), 21GH-BKG-008 (580-103655-14), 21GH-BKG-009 (580-103655-15) and 21GH-BKG-010 (580-103655-16). This analysis was not originally requested on the chain-of-custody (COC). Client provided a revised COC.

Metals
Method 6020B: Due to the high concentration of Arsenic in sample 21GH-SO-001 (580-103655-1), the matrix spike/matrix spike duplicate (MS/MSD) recoveries and precision for preparation batch 580-359455 and analytical batch 580-359769 could not be evaluated for accuracy and precision. The associated laboratory control sample/laboratory control sample duplicate (LCS/LCSD) recoveries and precision met acceptance criteria.

Method 6020B: The sample duplicate precision (%RPD) for sample 21GH-SO-001 (580-103655-1) in preparation batch 359455 and analytical batch 580-359769 was outside control limits. Sample non-homogeneity is suspected.

Method 7471A: Due to the high concentration of Mercury in sample 580-103655-5, the matrix spike/matrix spike duplicate (MS/MSD) recoveries for preparation batch 580-359417 and analytical batch 580-359579 could not be evaluated for accuracy and precision. The associated laboratory control sample/laboratory control sample duplicate (LCS/LCSD) recoveries met acceptance criteria.

Method 7471A: The sample duplicate precision (%RPD) for job 580-103655-5 in preparation batch 580-359417 and analytical batch 580-359579 was outside control limits. Sample non-homogeneity is suspected.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

General Chemistry
No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

Detection Summary

Client: Ahtna Solutions LLC
Project/Site: 2021 NPS -Glass Heifner Mine Site

Job ID: 580-103655-1

Client Sample ID: 21GH-SO-001 — Lab Sample ID: 580-103655-1

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Arsenic	410	F2	0.25	0.049	mg/Kg	5	☼	6020B	Total/NA
Mercury	0.092		0.024	0.0071	mg/Kg	1	☼	7471A	Total/NA

Client Sample ID: 21GH-SO-901 — Lab Sample ID: 580-103655-2

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Arsenic	510		0.22	0.044	mg/Kg	5	☼	6020B	Total/NA
Mercury	0.20		0.033	0.0098	mg/Kg	1	☼	7471A	Total/NA

Client Sample ID: 21GH-SO-002 — Lab Sample ID: 580-103655-3

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Arsenic	1200		0.21	0.043	mg/Kg	5	☼	6020B	Total/NA
Mercury	0.83		0.051	0.015	mg/Kg	2	☼	7471A	Total/NA

Client Sample ID: 21GH-SO-003 — Lab Sample ID: 580-103655-4

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Arsenic	13000		4.1	0.82	mg/Kg	100	☼	6020B	Total/NA
Mercury	38		1.6	0.48	mg/Kg	50	☼	7471A	Total/NA

Client Sample ID: 21GH-SO-004 — Lab Sample ID: 580-103655-5

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Arsenic	16000		4.7	0.94	mg/Kg	100	☼	6020B	Total/NA
Mercury	7.4		0.28	0.084	mg/Kg	10	☼	7471A	Total/NA

Client Sample ID: 21GH-SO-005 — Lab Sample ID: 580-103655-6

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Arsenic	610		0.23	0.046	mg/Kg	5	☼	6020B	Total/NA
Mercury	1.9		0.086	0.026	mg/Kg	2	☼	7471A	Total/NA

Client Sample ID: 21GH-BKG-001 — Lab Sample ID: 580-103655-7

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Arsenic	130		0.36	0.072	mg/Kg	5	☼	6020B	Total/NA
Mercury	0.079		0.036	0.011	mg/Kg	1	☼	7471A	Total/NA

Client Sample ID: 21GH-BKG-002 — Lab Sample ID: 580-103655-8

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Arsenic	42		0.48	0.096	mg/Kg	5	☼	6020B	Total/NA
Mercury	0.13		0.070	0.021	mg/Kg	1	☼	7471A	Total/NA

Client Sample ID: 21GH-BKG-003 — Lab Sample ID: 580-103655-9

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Arsenic	42		0.35	0.069	mg/Kg	5	☼	6020B	Total/NA
Mercury	0.13		0.050	0.015	mg/Kg	1	☼	7471A	Total/NA

Client Sample ID: 21GH-BKG-004 — Lab Sample ID: 580-103655-10

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Arsenic	8.8		0.31	0.062	mg/Kg	5	☼	6020B	Total/NA

This Detection Summary does not include radiochemical test results.

Eurofins FGS, Seattle

Client Sample ID: 21GH-BKG-004 (Continued) — Lab Sample ID: 580-103655-10

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Mercury	0.18		0.043	0.013	mg/Kg	1	☼	7471A	Total/NA

Client Sample ID: 21GH-BKG-005 — Lab Sample ID: 580-103655-11

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Arsenic	47		0.41	0.083	mg/Kg	5	☼	6020B	Total/NA
Mercury	0.13		0.043	0.013	mg/Kg	1	☼	7471A	Total/NA

Client Sample ID: 21GH-BKG-006 — Lab Sample ID: 580-103655-12

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Arsenic	54		0.43	0.086	mg/Kg	5	☼	6020B	Total/NA
Mercury	0.14		0.049	0.015	mg/Kg	1	☼	7471A	Total/NA

Client Sample ID: 21GH-BKG-007 — Lab Sample ID: 580-103655-13

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Arsenic	5.6		0.42	0.084	mg/Kg	5	☼	6020B	Total/NA
Mercury	0.075		0.053	0.016	mg/Kg	1	☼	7471A	Total/NA

Client Sample ID: 21GH-BKG-008 — Lab Sample ID: 580-103655-14

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Arsenic	8.4		0.51	0.10	mg/Kg	5	☼	6020B	Total/NA
Mercury	0.10		0.043	0.013	mg/Kg	1	☼	7471A	Total/NA

Client Sample ID: 21GH-BKG-009 — Lab Sample ID: 580-103655-15

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Arsenic	110		0.46	0.093	mg/Kg	5	☼	6020B	Total/NA
Mercury	0.10		0.038	0.012	mg/Kg	1	☼	7471A	Total/NA

Client Sample ID: 21GH-BKG-010 — Lab Sample ID: 580-103655-16

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Arsenic	67		0.43	0.086	mg/Kg	5	☼	6020B	Total/NA
Mercury	0.15		0.059	0.018	mg/Kg	1	☼	7471A	Total/NA

This Detection Summary does not include radiochemical test results.

Client Sample ID: 21GH-SO-001
Lab Sample ID: 580-103655-1
Date Collected: 06/05/21 10:30
Matrix: Solid
Date Received: 06/08/21 14:26
Percent Solids: 86.5

Method: 6020B - Metals (ICP/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	410	F2	0.25	0.049	mg/Kg	☼	06/16/21 16:11	06/19/21 08:58	5

Method: 7471A - Mercury (CVAA)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	0.092		0.024	0.0071	mg/Kg	☼	06/15/21 11:02	06/15/21 14:34	1

Client Sample ID: 21GH-SO-901
Lab Sample ID: 580-103655-2
Date Collected: 06/05/21 10:35
Matrix: Solid
Date Received: 06/08/21 14:26
Percent Solids: 84.5

Method: 6020B - Metals (ICP/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	510		0.22	0.044	mg/Kg	☼	06/16/21 16:11	06/19/21 10:50	5

Method: 7471A - Mercury (CVAA)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	0.20		0.033	0.0098	mg/Kg	☼	06/15/21 11:02	06/15/21 14:36	1

Client Sample ID: 21GH-SO-002
Lab Sample ID: 580-103655-3
Date Collected: 06/05/21 10:50
Matrix: Solid
Date Received: 06/08/21 14:26
Percent Solids: 72.4

Method: 6020B - Metals (ICP/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	1200		0.21	0.043	mg/Kg	☼	06/16/21 16:11	06/19/21 10:53	5

Method: 7471A - Mercury (CVAA)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	0.83		0.051	0.015	mg/Kg	☼	06/15/21 11:02	06/15/21 15:29	2

Client Sample ID: 21GH-SO-003
Lab Sample ID: 580-103655-4
Date Collected: 06/05/21 11:10
Matrix: Solid
Date Received: 06/08/21 14:26
Percent Solids: 75.3

Method: 6020B - Metals (ICP/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	13000		4.1	0.82	mg/Kg	☼	06/16/21 16:11	06/21/21 16:55	100

Method: 7471A - Mercury (CVAA)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	38		1.6	0.48	mg/Kg	☼	06/15/21 11:02	06/15/21 16:25	50

Client Sample ID: 21GH-SO-004
Lab Sample ID: 580-103655-5
Date Collected: 06/05/21 11:30
Matrix: Solid
Date Received: 06/08/21 14:26
Percent Solids: 77.9

Method: 6020B - Metals (ICP/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	16000		4.7	0.94	mg/Kg	☼	06/16/21 16:11	06/21/21 16:59	100

Method: 7471A - Mercury (CVAA)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	7.4		0.28	0.084	mg/Kg	☼	06/16/21 13:34	06/17/21 13:11	10

Client Sample ID: 21GH-SO-005
Lab Sample ID: 580-103655-6
Date Collected: 06/05/21 11:50
Matrix: Solid
Date Received: 06/08/21 14:26
Percent Solids: 60.4

Method: 6020B - Metals (ICP/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	610		0.23	0.046	mg/Kg	☼	06/16/21 16:11	06/19/21 09:56	5

Method: 7471A - Mercury (CVAA)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	1.9		0.086	0.026	mg/Kg	☼	06/16/21 13:34	06/17/21 13:22	2

Client Sample ID: 21GH-BKG-001
Lab Sample ID: 580-103655-7
Date Collected: 06/05/21 13:15
Matrix: Solid
Date Received: 06/08/21 14:26
Percent Solids: 60.6

Method: 6020B - Metals (ICP/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	130		0.36	0.072	mg/Kg	☼	06/16/21 16:11	06/19/21 10:00	5

Method: 7471A - Mercury (CVAA)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	0.079		0.036	0.011	mg/Kg	☼	06/16/21 13:34	06/17/21 13:25	1

Client Sample ID: 21GH-BKG-002
Lab Sample ID: 580-103655-8
Date Collected: 06/05/21 13:20
Matrix: Solid
Date Received: 06/08/21 14:26
Percent Solids: 41.0

Method: 6020B - Metals (ICP/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	42		0.48	0.096	mg/Kg	☼	06/16/21 16:11	06/19/21 10:04	5

Method: 7471A - Mercury (CVAA)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	0.13		0.070	0.021	mg/Kg	☼	06/16/21 13:34	06/17/21 13:27	1

Client Sample ID: 21GH-BKG-003
Lab Sample ID: 580-103655-9
Date Collected: 06/05/21 13:30
Matrix: Solid
Date Received: 06/08/21 14:26
Percent Solids: 46.4

Method: 6020B - Metals (ICP/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	42		0.35	0.069	mg/Kg	☼	06/16/21 16:11	06/19/21 10:07	5

Method: 7471A - Mercury (CVAA)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	0.13		0.050	0.015	mg/Kg	☼	06/16/21 13:34	06/17/21 13:30	1

Client Sample ID: 21GH-BKG-004
Lab Sample ID: 580-103655-10
Date Collected: 06/05/21 14:50
Matrix: Solid
Date Received: 06/08/21 14:26
Percent Solids: 47.4

Method: 6020B - Metals (ICP/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	8.8		0.31	0.062	mg/Kg	☼	06/16/21 16:11	06/19/21 10:11	5

Method: 7471A - Mercury (CVAA)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	0.18		0.043	0.013	mg/Kg	☼	06/16/21 13:34	06/17/21 13:32	1

Client Sample ID: 21GH-BKG-005
Lab Sample ID: 580-103655-11
Date Collected: 06/05/21 15:00
Matrix: Solid
Date Received: 06/08/21 14:26
Percent Solids: 46.9

Method: 6020B - Metals (ICP/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	47		0.41	0.083	mg/Kg	☼	06/16/21 16:11	06/19/21 10:57	5

Method: 7471A - Mercury (CVAA)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	0.13		0.043	0.013	mg/Kg	☼	06/16/21 13:34	06/17/21 13:34	1

Client Sample ID: 21GH-BKG-006
Lab Sample ID: 580-103655-12
Date Collected: 06/05/21 15:10
Matrix: Solid
Date Received: 06/08/21 14:26
Percent Solids: 50.5

Method: 6020B - Metals (ICP/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	54		0.43	0.086	mg/Kg	☼	06/16/21 16:11	06/19/21 10:30	5

Method: 7471A - Mercury (CVAA)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	0.14		0.049	0.015	mg/Kg	☼	06/16/21 13:34	06/17/21 13:42	1

Client Sample ID: 21GH-BKG-007
Lab Sample ID: 580-103655-13
Date Collected: 06/05/21 15:20
Matrix: Solid
Date Received: 06/08/21 14:26
Percent Solids: 50.1

Method: 6020B - Metals (ICP/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	5.6		0.42	0.084	mg/Kg	☼	06/16/21 16:11	06/19/21 10:34	5

Method: 7471A - Mercury (CVAA)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	0.075		0.053	0.016	mg/Kg	☼	06/16/21 13:34	06/17/21 13:44	1

Client Sample ID: 21GH-BKG-008
Lab Sample ID: 580-103655-14
Date Collected: 06/05/21 15:30
Matrix: Solid
Date Received: 06/08/21 14:26
Percent Solids: 44.3

Method: 6020B - Metals (ICP/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	8.4		0.51	0.10	mg/Kg	☼	06/16/21 16:11	06/19/21 10:38	5

Method: 7471A - Mercury (CVAA)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	0.10		0.043	0.013	mg/Kg	☼	06/16/21 13:34	06/17/21 13:46	1

Client Sample ID: 21GH-BKG-009
Lab Sample ID: 580-103655-15
Date Collected: 06/05/21 15:45
Matrix: Solid
Date Received: 06/08/21 14:26
Percent Solids: 49.4

Method: 6020B - Metals (ICP/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	110		0.46	0.093	mg/Kg	☼	06/16/21 16:11	06/19/21 10:42	5

Method: 7471A - Mercury (CVAA)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	0.10		0.038	0.012	mg/Kg	☼	06/16/21 13:34	06/17/21 13:49	1

Client: Ahtna Solutions LLC
Job ID: 580-103655-1
Project/Site: 2021 NPS -Glass Heifner Mine Site

Client Sample ID: 21GH-BKG-010
Lab Sample ID: 580-103655-16
Date Collected: 06/05/21 15:55
Matrix: Solid
Date Received: 06/08/21 14:26
Percent Solids: 43.1

Method: 6020B - Metals (ICP/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	67		0.43	0.086	mg/Kg	☼	06/16/21 16:11	06/19/21 10:46	5

Method: 7471A - Mercury (CVAA)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	0.15		0.059	0.018	mg/Kg	☼	06/16/21 13:34	06/17/21 13:51	1

Method: 6020B - Metals (ICP/MS)

Lab Sample ID: MB 580-359455/24-A
Matrix: Solid
Analysis Batch: 359769

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 359455

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	ND		0.25	0.050	mg/Kg		06/16/21 16:11	06/19/21 08:50	5

Lab Sample ID: LCS 580-359455/25-A
Matrix: Solid
Analysis Batch: 359769

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 359455

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Arsenic	50.0	50.0		mg/Kg		100	80 - 120

Lab Sample ID: LCSD 580-359455/26-A
Matrix: Solid
Analysis Batch: 359769

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA
Prep Batch: 359455

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Arsenic	50.0	50.2		mg/Kg		100	80 - 120	0	20

Lab Sample ID: 580-103655-1 MS
Matrix: Solid
Analysis Batch: 359769

Client Sample ID: 21GH-SO-001
Prep Type: Total/NA
Prep Batch: 359455

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Arsenic	410	F2	45.5	440	4	mg/Kg	☼	73	80 - 120

Lab Sample ID: 580-103655-1 MSD
Matrix: Solid
Analysis Batch: 359769

Client Sample ID: 21GH-SO-001
Prep Type: Total/NA
Prep Batch: 359455

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Arsenic	410	F2	46.9	737	4 F2	mg/Kg	☼	703	80 - 120	50	20

Lab Sample ID: 580-103655-1 DU
Matrix: Solid
Analysis Batch: 359769

Client Sample ID: 21GH-SO-001
Prep Type: Total/NA
Prep Batch: 359455

Analyte	Sample Result	Sample Qualifier	DU Result	DU Qualifier	Unit	D	RPD	RPD Limit
Arsenic	410	F2	274	F3	mg/Kg	☼	39	20

Method: 7471A - Mercury (CVAA)

Lab Sample ID: MB 580-359280/22-A
Matrix: Solid
Analysis Batch: 359400

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 359280

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND		0.030	0.0090	mg/Kg		06/15/21 11:02	06/15/21 13:55	1

Method: 7471A - Mercury (CVAA) (Continued)

Lab Sample ID: LCS 580-359280/23-A
Matrix: Solid
Analysis Batch: 359400

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 359280

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Mercury	0.167	0.180		mg/Kg		108	80 - 120

Lab Sample ID: LCSD 580-359280/24-A
Matrix: Solid
Analysis Batch: 359400

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA
Prep Batch: 359280

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Mercury	0.167	0.166		mg/Kg		99	80 - 120	8	20

Lab Sample ID: MB 580-359417/22-A
Matrix: Solid
Analysis Batch: 359579

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 359417

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND		0.030	0.0090	mg/Kg		06/16/21 13:34	06/17/21 12:54	1

Lab Sample ID: LCS 580-359417/23-A
Matrix: Solid
Analysis Batch: 359579

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 359417

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Mercury	0.167	0.159		mg/Kg		96	80 - 120

Lab Sample ID: LCSD 580-359417/24-A
Matrix: Solid
Analysis Batch: 359579

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA
Prep Batch: 359417

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Mercury	0.167	0.152		mg/Kg		91	80 - 120	5	20

Lab Sample ID: 580-103655-5 MS
Matrix: Solid
Analysis Batch: 359579

Client Sample ID: 21GH-SO-004
Prep Type: Total/NA
Prep Batch: 359417

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Mercury	7.4		0.158	1.58	4	mg/Kg	☼	-3644	80 - 120

Lab Sample ID: 580-103655-5 MSD
Matrix: Solid
Analysis Batch: 359579

Client Sample ID: 21GH-SO-004
Prep Type: Total/NA
Prep Batch: 359417

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Mercury	7.4		0.147	1.68	4	mg/Kg	☼	-3849	80 - 120	6	20

Lab Sample ID: 580-103655-5 DU
Matrix: Solid
Analysis Batch: 359579

Client Sample ID: 21GH-SO-004
Prep Type: Total/NA
Prep Batch: 359417

Analyte	Sample Result	Sample Qualifier	DU Result	DU Qualifier	Unit	D	RPD	RPD Limit
Mercury	7.4		2.62	F3	mg/Kg	☼	95	20

Metals

Prep Batch: 359280

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
580-103655-1	21GH-SO-001	Total/NA	Solid	7471A	
580-103655-2	21GH-SO-901	Total/NA	Solid	7471A	
580-103655-3	21GH-SO-002	Total/NA	Solid	7471A	
580-103655-4	21GH-SO-003	Total/NA	Solid	7471A	
MB 580-359280/22-A	Method Blank	Total/NA	Solid	7471A	
LCS 580-359280/23-A	Lab Control Sample	Total/NA	Solid	7471A	
LCSD 580-359280/24-A	Lab Control Sample Dup	Total/NA	Solid	7471A	

Analysis Batch: 359400

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
580-103655-1	21GH-SO-001	Total/NA	Solid	7471A	359280
580-103655-2	21GH-SO-901	Total/NA	Solid	7471A	359280
580-103655-3	21GH-SO-002	Total/NA	Solid	7471A	359280
580-103655-4	21GH-SO-003	Total/NA	Solid	7471A	359280
MB 580-359280/22-A	Method Blank	Total/NA	Solid	7471A	359280
LCS 580-359280/23-A	Lab Control Sample	Total/NA	Solid	7471A	359280
LCSD 580-359280/24-A	Lab Control Sample Dup	Total/NA	Solid	7471A	359280

Prep Batch: 359417

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
580-103655-5	21GH-SO-004	Total/NA	Solid	7471A	
580-103655-6	21GH-SO-005	Total/NA	Solid	7471A	
580-103655-7	21GH-BKG-001	Total/NA	Solid	7471A	
580-103655-8	21GH-BKG-002	Total/NA	Solid	7471A	
580-103655-9	21GH-BKG-003	Total/NA	Solid	7471A	
580-103655-10	21GH-BKG-004	Total/NA	Solid	7471A	
580-103655-11	21GH-BKG-005	Total/NA	Solid	7471A	
580-103655-12	21GH-BKG-006	Total/NA	Solid	7471A	
580-103655-13	21GH-BKG-007	Total/NA	Solid	7471A	
580-103655-14	21GH-BKG-008	Total/NA	Solid	7471A	
580-103655-15	21GH-BKG-009	Total/NA	Solid	7471A	
580-103655-16	21GH-BKG-010	Total/NA	Solid	7471A	
MB 580-359417/22-A	Method Blank	Total/NA	Solid	7471A	
LCS 580-359417/23-A	Lab Control Sample	Total/NA	Solid	7471A	
LCSD 580-359417/24-A	Lab Control Sample Dup	Total/NA	Solid	7471A	
580-103655-5 MS	21GH-SO-004	Total/NA	Solid	7471A	
580-103655-5 MSD	21GH-SO-004	Total/NA	Solid	7471A	
580-103655-5 DU	21GH-SO-004	Total/NA	Solid	7471A	

Prep Batch: 359455

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
580-103655-1	21GH-SO-001	Total/NA	Solid	3050B	
580-103655-2	21GH-SO-901	Total/NA	Solid	3050B	
580-103655-3	21GH-SO-002	Total/NA	Solid	3050B	
580-103655-4	21GH-SO-003	Total/NA	Solid	3050B	
580-103655-5	21GH-SO-004	Total/NA	Solid	3050B	
580-103655-6	21GH-SO-005	Total/NA	Solid	3050B	
580-103655-7	21GH-BKG-001	Total/NA	Solid	3050B	
580-103655-8	21GH-BKG-002	Total/NA	Solid	3050B	
580-103655-9	21GH-BKG-003	Total/NA	Solid	3050B	
580-103655-10	21GH-BKG-004	Total/NA	Solid	3050B	

Metals (Continued)

Prep Batch: 359455 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
580-103655-11	21GH-BKG-005	Total/NA	Solid	3050B	
580-103655-12	21GH-BKG-006	Total/NA	Solid	3050B	
580-103655-13	21GH-BKG-007	Total/NA	Solid	3050B	
580-103655-14	21GH-BKG-008	Total/NA	Solid	3050B	
580-103655-15	21GH-BKG-009	Total/NA	Solid	3050B	
580-103655-16	21GH-BKG-010	Total/NA	Solid	3050B	
MB 580-359455/24-A	Method Blank	Total/NA	Solid	3050B	
LCS 580-359455/25-A	Lab Control Sample	Total/NA	Solid	3050B	
LCSD 580-359455/26-A	Lab Control Sample Dup	Total/NA	Solid	3050B	
580-103655-1 MS	21GH-SO-001	Total/NA	Solid	3050B	
580-103655-1 MSD	21GH-SO-001	Total/NA	Solid	3050B	
580-103655-1 DU	21GH-SO-001	Total/NA	Solid	3050B	

Analysis Batch: 359579

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
580-103655-5	21GH-SO-004	Total/NA	Solid	7471A	359417
580-103655-6	21GH-SO-005	Total/NA	Solid	7471A	359417
580-103655-7	21GH-BKG-001	Total/NA	Solid	7471A	359417
580-103655-8	21GH-BKG-002	Total/NA	Solid	7471A	359417
580-103655-9	21GH-BKG-003	Total/NA	Solid	7471A	359417
580-103655-10	21GH-BKG-004	Total/NA	Solid	7471A	359417
580-103655-11	21GH-BKG-005	Total/NA	Solid	7471A	359417
580-103655-12	21GH-BKG-006	Total/NA	Solid	7471A	359417
580-103655-13	21GH-BKG-007	Total/NA	Solid	7471A	359417
580-103655-14	21GH-BKG-008	Total/NA	Solid	7471A	359417
580-103655-15	21GH-BKG-009	Total/NA	Solid	7471A	359417
580-103655-16	21GH-BKG-010	Total/NA	Solid	7471A	359417
MB 580-359417/22-A	Method Blank	Total/NA	Solid	7471A	359417
LCS 580-359417/23-A	Lab Control Sample	Total/NA	Solid	7471A	359417
LCSD 580-359417/24-A	Lab Control Sample Dup	Total/NA	Solid	7471A	359417
580-103655-5 MS	21GH-SO-004	Total/NA	Solid	7471A	359417
580-103655-5 MSD	21GH-SO-004	Total/NA	Solid	7471A	359417
580-103655-5 DU	21GH-SO-004	Total/NA	Solid	7471A	359417

Analysis Batch: 359769

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
580-103655-1	21GH-SO-001	Total/NA	Solid	6020B	359455
580-103655-2	21GH-SO-901	Total/NA	Solid	6020B	359455
580-103655-3	21GH-SO-002	Total/NA	Solid	6020B	359455
580-103655-6	21GH-SO-005	Total/NA	Solid	6020B	359455
580-103655-7	21GH-BKG-001	Total/NA	Solid	6020B	359455
580-103655-8	21GH-BKG-002	Total/NA	Solid	6020B	359455
580-103655-9	21GH-BKG-003	Total/NA	Solid	6020B	359455
580-103655-10	21GH-BKG-004	Total/NA	Solid	6020B	359455
580-103655-11	21GH-BKG-005	Total/NA	Solid	6020B	359455
580-103655-12	21GH-BKG-006	Total/NA	Solid	6020B	359455
580-103655-13	21GH-BKG-007	Total/NA	Solid	6020B	359455
580-103655-14	21GH-BKG-008	Total/NA	Solid	6020B	359455
580-103655-15	21GH-BKG-009	Total/NA	Solid	6020B	359455
580-103655-16	21GH-BKG-010	Total/NA	Solid	6020B	359455
MB 580-359455/24-A	Method Blank	Total/NA	Solid	6020B	359455

Metals (Continued)

Analysis Batch: 359769 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
LCS 580-359455/25-A	Lab Control Sample	Total/NA	Solid	6020B	359455
LCSD 580-359455/26-A	Lab Control Sample Dup	Total/NA	Solid	6020B	359455
580-103655-1 MS	21GH-SO-001	Total/NA	Solid	6020B	359455
580-103655-1 MSD	21GH-SO-001	Total/NA	Solid	6020B	359455
580-103655-1 DU	21GH-SO-001	Total/NA	Solid	6020B	359455

Analysis Batch: 359918

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
580-103655-4	21GH-SO-003	Total/NA	Solid	6020B	359455
580-103655-5	21GH-SO-004	Total/NA	Solid	6020B	359455

General Chemistry

Analysis Batch: 358719

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
580-103655-1	21GH-SO-001	Total/NA	Solid	2540G	
580-103655-2	21GH-SO-901	Total/NA	Solid	2540G	
580-103655-3	21GH-SO-002	Total/NA	Solid	2540G	
580-103655-4	21GH-SO-003	Total/NA	Solid	2540G	
580-103655-5	21GH-SO-004	Total/NA	Solid	2540G	
580-103655-6	21GH-SO-005	Total/NA	Solid	2540G	
580-103655-7	21GH-BKG-001	Total/NA	Solid	2540G	
580-103655-8	21GH-BKG-002	Total/NA	Solid	2540G	
580-103655-9	21GH-BKG-003	Total/NA	Solid	2540G	
580-103655-10	21GH-BKG-004	Total/NA	Solid	2540G	
580-103655-11	21GH-BKG-005	Total/NA	Solid	2540G	
580-103655-12	21GH-BKG-006	Total/NA	Solid	2540G	
580-103655-13	21GH-BKG-007	Total/NA	Solid	2540G	
580-103655-14	21GH-BKG-008	Total/NA	Solid	2540G	
580-103655-15	21GH-BKG-009	Total/NA	Solid	2540G	
580-103655-16	21GH-BKG-010	Total/NA	Solid	2540G	
580-103655-3 DU	21GH-SO-002	Total/NA	Solid	2540G	

Lab Chronicle

Client: Ahtna Solutions LLC
Job ID: 580-103655-1
Project/Site: 2021 NPS -Glass Heifner Mine Site

Client Sample ID: 21GH-SO-001
Lab Sample ID: 580-103655-1
Date Collected: 06/05/21 10:30
Matrix: Solid
Date Received: 06/08/21 14:26

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	2540G		1	358719	06/09/21 11:09	JHR	FGS SEA

Client Sample ID: 21GH-SO-001
Lab Sample ID: 580-103655-1
Date Collected: 06/05/21 10:30
Matrix: Solid
Date Received: 06/08/21 14:26
Percent Solids: 86.5

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3050B			359455	06/16/21 16:11	TMH	FGS SEA
Total/NA	Analysis	6020B		5	359769	06/19/21 08:58	FCW	FGS SEA
Total/NA	Prep	7471A			359280	06/15/21 11:02	C1K	FGS SEA
Total/NA	Analysis	7471A		1	359400	06/15/21 14:34	C1K	FGS SEA

Client Sample ID: 21GH-SO-901
Lab Sample ID: 580-103655-2
Date Collected: 06/05/21 10:35
Matrix: Solid
Date Received: 06/08/21 14:26

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	2540G		1	358719	06/09/21 11:09	JHR	FGS SEA

Client Sample ID: 21GH-SO-901
Lab Sample ID: 580-103655-2
Date Collected: 06/05/21 10:35
Matrix: Solid
Date Received: 06/08/21 14:26
Percent Solids: 84.5

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3050B			359455	06/16/21 16:11	TMH	FGS SEA
Total/NA	Analysis	6020B		5	359769	06/19/21 10:50	FCW	FGS SEA
Total/NA	Prep	7471A			359280	06/15/21 11:02	C1K	FGS SEA
Total/NA	Analysis	7471A		1	359400	06/15/21 14:36	C1K	FGS SEA

Client Sample ID: 21GH-SO-002
Lab Sample ID: 580-103655-3
Date Collected: 06/05/21 10:50
Matrix: Solid
Date Received: 06/08/21 14:26

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	2540G		1	358719	06/09/21 11:09	JHR	FGS SEA

Client Sample ID: 21GH-SO-002
Lab Sample ID: 580-103655-3
Date Collected: 06/05/21 10:50
Matrix: Solid
Date Received: 06/08/21 14:26
Percent Solids: 72.4

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3050B			359455	06/16/21 16:11	TMH	FGS SEA
Total/NA	Analysis	6020B		5	359769	06/19/21 10:53	FCW	FGS SEA
Total/NA	Prep	7471A			359280	06/15/21 11:02	C1K	FGS SEA
Total/NA	Analysis	7471A		2	359400	06/15/21 15:29	C1K	FGS SEA

Lab Chronicle

Client: Ahtna Solutions LLC
Job ID: 580-103655-1
Project/Site: 2021 NPS -Glass Heifner Mine Site

Client Sample ID: 21GH-SO-003
Lab Sample ID: 580-103655-4
Date Collected: 06/05/21 11:10
Matrix: Solid
Date Received: 06/08/21 14:26

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	2540G		1	358719	06/09/21 11:09	JHR	FGS SEA

Client Sample ID: 21GH-SO-003
Lab Sample ID: 580-103655-4
Date Collected: 06/05/21 11:10
Matrix: Solid
Date Received: 06/08/21 14:26
Percent Solids: 75.3

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3050B			359455	06/16/21 16:11	TMH	FGS SEA
Total/NA	Analysis	6020B		100	359918	06/21/21 16:55	FCW	FGS SEA
Total/NA	Prep	7471A			359280	06/15/21 11:02	C1K	FGS SEA
Total/NA	Analysis	7471A		50	359400	06/15/21 16:25	C1K	FGS SEA

Client Sample ID: 21GH-SO-004
Lab Sample ID: 580-103655-5
Date Collected: 06/05/21 11:30
Matrix: Solid
Date Received: 06/08/21 14:26

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	2540G		1	358719	06/09/21 11:09	JHR	FGS SEA

Client Sample ID: 21GH-SO-004
Lab Sample ID: 580-103655-5
Date Collected: 06/05/21 11:30
Matrix: Solid
Date Received: 06/08/21 14:26
Percent Solids: 77.9

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3050B			359455	06/16/21 16:11	TMH	FGS SEA
Total/NA	Analysis	6020B		100	359918	06/21/21 16:59	FCW	FGS SEA
Total/NA	Prep	7471A			359417	06/16/21 13:34	TMH	FGS SEA
Total/NA	Analysis	7471A		10	359579	06/17/21 13:11	C1K	FGS SEA

Client Sample ID: 21GH-SO-005
Lab Sample ID: 580-103655-6
Date Collected: 06/05/21 11:50
Matrix: Solid
Date Received: 06/08/21 14:26

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	2540G		1	358719	06/09/21 11:09	JHR	FGS SEA

Client Sample ID: 21GH-SO-005
Lab Sample ID: 580-103655-6
Date Collected: 06/05/21 11:50
Matrix: Solid
Date Received: 06/08/21 14:26
Percent Solids: 60.4

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3050B			359455	06/16/21 16:11	TMH	FGS SEA
Total/NA	Analysis	6020B		5	359769	06/19/21 09:56	FCW	FGS SEA
Total/NA	Prep	7471A			359417	06/16/21 13:34	TMH	FGS SEA
Total/NA	Analysis	7471A		2	359579	06/17/21 13:22	C1K	FGS SEA

Lab Chronicle

Client: Ahtna Solutions LLC
Job ID: 580-103655-1
Project/Site: 2021 NPS -Glass Heifner Mine Site

Client Sample ID: 21GH-BKG-001
Lab Sample ID: 580-103655-7
Date Collected: 06/05/21 13:15
Matrix: Solid
Date Received: 06/08/21 14:26

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	2540G		1	358719	06/09/21 11:09	JHR	FGS SEA

Client Sample ID: 21GH-BKG-001
Lab Sample ID: 580-103655-7
Date Collected: 06/05/21 13:15
Matrix: Solid
Date Received: 06/08/21 14:26
Percent Solids: 60.6

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3050B			359455	06/16/21 16:11	TMH	FGS SEA
Total/NA	Analysis	6020B		5	359769	06/19/21 10:00	FCW	FGS SEA
Total/NA	Prep	7471A			359417	06/16/21 13:34	TMH	FGS SEA
Total/NA	Analysis	7471A		1	359579	06/17/21 13:25	C1K	FGS SEA

Client Sample ID: 21GH-BKG-002
Lab Sample ID: 580-103655-8
Date Collected: 06/05/21 13:20
Matrix: Solid
Date Received: 06/08/21 14:26

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	2540G		1	358719	06/09/21 11:09	JHR	FGS SEA

Client Sample ID: 21GH-BKG-002
Lab Sample ID: 580-103655-8
Date Collected: 06/05/21 13:20
Matrix: Solid
Date Received: 06/08/21 14:26
Percent Solids: 41.0

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3050B			359455	06/16/21 16:11	TMH	FGS SEA
Total/NA	Analysis	6020B		5	359769	06/19/21 10:04	FCW	FGS SEA
Total/NA	Prep	7471A			359417	06/16/21 13:34	TMH	FGS SEA
Total/NA	Analysis	7471A		1	359579	06/17/21 13:27	C1K	FGS SEA

Client Sample ID: 21GH-BKG-003
Lab Sample ID: 580-103655-9
Date Collected: 06/05/21 13:30
Matrix: Solid
Date Received: 06/08/21 14:26

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	2540G		1	358719	06/09/21 11:09	JHR	FGS SEA

Client Sample ID: 21GH-BKG-003
Lab Sample ID: 580-103655-9
Date Collected: 06/05/21 13:30
Matrix: Solid
Date Received: 06/08/21 14:26
Percent Solids: 46.4

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3050B			359455	06/16/21 16:11	TMH	FGS SEA
Total/NA	Analysis	6020B		5	359769	06/19/21 10:07	FCW	FGS SEA
Total/NA	Prep	7471A			359417	06/16/21 13:34	TMH	FGS SEA
Total/NA	Analysis	7471A		1	359579	06/17/21 13:30	C1K	FGS SEA

Lab Chronicle

Client: Ahtna Solutions LLC
Job ID: 580-103655-1
Project/Site: 2021 NPS -Glass Heifner Mine Site

Client Sample ID: 21GH-BKG-004
Lab Sample ID: 580-103655-10
Date Collected: 06/05/21 14:50
Matrix: Solid
Date Received: 06/08/21 14:26

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	2540G		1	358719	06/09/21 11:09	JHR	FGS SEA

Client Sample ID: 21GH-BKG-004
Lab Sample ID: 580-103655-10
Date Collected: 06/05/21 14:50
Matrix: Solid
Date Received: 06/08/21 14:26
Percent Solids: 47.4

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3050B			359455	06/16/21 16:11	TMH	FGS SEA
Total/NA	Analysis	6020B		5	359769	06/19/21 10:11	FCW	FGS SEA
Total/NA	Prep	7471A			359417	06/16/21 13:34	TMH	FGS SEA
Total/NA	Analysis	7471A		1	359579	06/17/21 13:32	C1K	FGS SEA

Client Sample ID: 21GH-BKG-005
Lab Sample ID: 580-103655-11
Date Collected: 06/05/21 15:00
Matrix: Solid
Date Received: 06/08/21 14:26

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	2540G		1	358719	06/09/21 11:09	JHR	FGS SEA

Client Sample ID: 21GH-BKG-005
Lab Sample ID: 580-103655-11
Date Collected: 06/05/21 15:00
Matrix: Solid
Date Received: 06/08/21 14:26
Percent Solids: 46.9

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3050B			359455	06/16/21 16:11	TMH	FGS SEA
Total/NA	Analysis	6020B		5	359769	06/19/21 10:57	FCW	FGS SEA
Total/NA	Prep	7471A			359417	06/16/21 13:34	TMH	FGS SEA
Total/NA	Analysis	7471A		1	359579	06/17/21 13:34	C1K	FGS SEA

Client Sample ID: 21GH-BKG-006
Lab Sample ID: 580-103655-12
Date Collected: 06/05/21 15:10
Matrix: Solid
Date Received: 06/08/21 14:26

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	2540G		1	358719	06/09/21 11:09	JHR	FGS SEA

Client Sample ID: 21GH-BKG-006
Lab Sample ID: 580-103655-12
Date Collected: 06/05/21 15:10
Matrix: Solid
Date Received: 06/08/21 14:26
Percent Solids: 50.5

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3050B			359455	06/16/21 16:11	TMH	FGS SEA
Total/NA	Analysis	6020B		5	359769	06/19/21 10:30	FCW	FGS SEA
Total/NA	Prep	7471A			359417	06/16/21 13:34	TMH	FGS SEA
Total/NA	Analysis	7471A		1	359579	06/17/21 13:42	C1K	FGS SEA

Lab Chronicle

Client: Ahtna Solutions LLC
Job ID: 580-103655-1
Project/Site: 2021 NPS -Glass Heifner Mine Site

Client Sample ID: 21GH-BKG-007
Lab Sample ID: 580-103655-13
Date Collected: 06/05/21 15:20
Matrix: Solid
Date Received: 06/08/21 14:26

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	2540G		1	358719	06/09/21 11:09	JHR	FGS SEA

Client Sample ID: 21GH-BKG-007
Lab Sample ID: 580-103655-13
Date Collected: 06/05/21 15:20
Matrix: Solid
Date Received: 06/08/21 14:26
Percent Solids: 50.1

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3050B			359455	06/16/21 16:11	TMH	FGS SEA
Total/NA	Analysis	6020B		5	359769	06/19/21 10:34	FCW	FGS SEA
Total/NA	Prep	7471A			359417	06/16/21 13:34	TMH	FGS SEA
Total/NA	Analysis	7471A		1	359579	06/17/21 13:44	C1K	FGS SEA

Client Sample ID: 21GH-BKG-008
Lab Sample ID: 580-103655-14
Date Collected: 06/05/21 15:30
Matrix: Solid
Date Received: 06/08/21 14:26

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	2540G		1	358719	06/09/21 11:09	JHR	FGS SEA

Client Sample ID: 21GH-BKG-008
Lab Sample ID: 580-103655-14
Date Collected: 06/05/21 15:30
Matrix: Solid
Date Received: 06/08/21 14:26
Percent Solids: 44.3

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3050B			359455	06/16/21 16:11	TMH	FGS SEA
Total/NA	Analysis	6020B		5	359769	06/19/21 10:38	FCW	FGS SEA
Total/NA	Prep	7471A			359417	06/16/21 13:34	TMH	FGS SEA
Total/NA	Analysis	7471A		1	359579	06/17/21 13:46	C1K	FGS SEA

Client Sample ID: 21GH-BKG-009
Lab Sample ID: 580-103655-15
Date Collected: 06/05/21 15:45
Matrix: Solid
Date Received: 06/08/21 14:26

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	2540G		1	358719	06/09/21 11:09	JHR	FGS SEA

Client Sample ID: 21GH-BKG-009
Lab Sample ID: 580-103655-15
Date Collected: 06/05/21 15:45
Matrix: Solid
Date Received: 06/08/21 14:26
Percent Solids: 49.4

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3050B			359455	06/16/21 16:11	TMH	FGS SEA
Total/NA	Analysis	6020B		5	359769	06/19/21 10:42	FCW	FGS SEA
Total/NA	Prep	7471A			359417	06/16/21 13:34	TMH	FGS SEA
Total/NA	Analysis	7471A		1	359579	06/17/21 13:49	C1K	FGS SEA

Lab Chronicle

Client: Ahtna Solutions LLC
Job ID: 580-103655-1
Project/Site: 2021 NPS -Glass Heifner Mine Site

Client Sample ID: 21GH-BKG-010
Lab Sample ID: 580-103655-16
Date Collected: 06/05/21 15:55
Matrix: Solid
Date Received: 06/08/21 14:26

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	2540G		1	358719	06/09/21 11:09	JHR	FGS SEA

Client Sample ID: 21GH-BKG-010
Lab Sample ID: 580-103655-16
Date Collected: 06/05/21 15:55
Matrix: Solid
Date Received: 06/08/21 14:26
Percent Solids: 43.1

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3050B			359455	06/16/21 16:11	TMH	FGS SEA
Total/NA	Analysis	6020B		5	359769	06/19/21 10:46	FCW	FGS SEA
Total/NA	Prep	7471A			359417	06/16/21 13:34	TMH	FGS SEA
Total/NA	Analysis	7471A		1	359579	06/17/21 13:51	C1K	FGS SEA

Laboratory References:

FGS SEA = Eurofins FGS, Seattle, 5755 8th Street East, Tacoma, WA 98424, TEL (253)922-2310

Accreditation/Certification Summary

Client: Ahtna Solutions LLC
Job ID: 580-103655-1
Project/Site: 2021 NPS -Glass Heifner Mine Site

Laboratory: Eurofins FGS, Seattle

Unless otherwise noted, all analytes for this laboratory were covered under each accreditation/certification below.

Authority	Program	Identification Number	Expiration Date
Alaska (UST)	State	20-004	02-19-22

The following analytes are included in this report, but the laboratory is not certified by the governing authority. This list may include analytes for which the agency does not offer certification.

Analysis Method	Prep Method	Matrix	Analyte
2540G		Solid	Percent Moisture
2540G		Solid	Percent Solids

Method Summary

Client: Ahtna Solutions LLC
Job ID: 580-103655-1
Project/Site: 2021 NPS -Glass Heifner Mine Site

Method	Method Description	Protocol	Laboratory
6020B	Metals (ICP/MS)	SW846	FGS SEA
7471A	Mercury (CVAA)	SW846	FGS SEA
2540G	SM 2540G	SM22	FGS SEA
3050B	Preparation, Metals	SW846	FGS SEA
7471A	Preparation, Mercury	SW846	FGS SEA

Protocol References:

SM22 = Standard Methods For The Examination Of Water And Wastewater, 22nd Edition

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

Laboratory References:

FGS SEA = Eurofins FGS, Seattle, 5755 8th Street East, Tacoma, WA 98424, TEL (253)922-2310

Sample Summary

Client: Ahtna Solutions LLC
Project/Site: 2021 NPS -Glass Heifner Mine Site

Job ID: 580-103655-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received	Asset ID
580-103655-1	21GH-SO-001	Solid	06/05/21 10:30	06/08/21 14:26	
580-103655-2	21GH-SO-901	Solid	06/05/21 10:35	06/08/21 14:26	
580-103655-3	21GH-SO-002	Solid	06/05/21 10:50	06/08/21 14:26	
580-103655-4	21GH-SO-003	Solid	06/05/21 11:10	06/08/21 14:26	
580-103655-5	21GH-SO-004	Solid	06/05/21 11:30	06/08/21 14:26	
580-103655-6	21GH-SO-005	Solid	06/05/21 11:50	06/08/21 14:26	
580-103655-7	21GH-BKG-001	Solid	06/05/21 13:15	06/08/21 14:26	
580-103655-8	21GH-BKG-002	Solid	06/05/21 13:20	06/08/21 14:26	
580-103655-9	21GH-BKG-003	Solid	06/05/21 13:30	06/08/21 14:26	
580-103655-10	21GH-BKG-004	Solid	06/05/21 14:50	06/08/21 14:26	
580-103655-11	21GH-BKG-005	Solid	06/05/21 15:00	06/08/21 14:26	
580-103655-12	21GH-BKG-006	Solid	06/05/21 15:10	06/08/21 14:26	
580-103655-13	21GH-BKG-007	Solid	06/05/21 15:20	06/08/21 14:26	
580-103655-14	21GH-BKG-008	Solid	06/05/21 15:30	06/08/21 14:26	
580-103655-15	21GH-BKG-009	Solid	06/05/21 15:45	06/08/21 14:26	
580-103655-16	21GH-BKG-010	Solid	06/05/21 15:55	06/08/21 14:26	

Eurofins TestAmerica, Seattle
5755 8th Street East

Tacoma, WA 98424-1317
phone 253.922.2310 fax 253.922.5047

Chain of Custody Record

eurofins | Environment Testing America

Regulatory Program: ☐ DW ☐ NPDES ☐ RCRA ☐ Other:

TestAmerica Laboratories, Inc. d/b/a Eurofins TestAmerica

Client Contact	**Project Manager: Nino Muniz**		COC No: 1
Ahtna Solutions, LLC	Email: nmuniz@ahtna.net	Site Contact: Baley Lenhart	Date: 6/7/2021
110 West 38th Avenue, Suite 200J	Tel/Fax: 907-375-4750	Lab Contact: Elaine Walker	Carrier: AK Air Cargo
Anchorage, AK 99503	**Analysis Turnaround Time**		TALS Project #:
(907) 569-8250 Phone	☐ CALENDAR DAYS ☐ WORKING DAYS		Sampler: BL
(907) 561-5475 FAX	TAT if different from Below _____		**For Lab Use Only:**
Project Name: Glass Heifner Mine Site	☐ 2 weeks		Walk-in Client:
Site:	☐ 1 week		Lab Sampling:
P O # 23010.000	☐ 2 days		Job / SDG No.:
	☐ 1 day		

Sample Identification	Sample Date	Sample Time	Sample Type (C=Comp, G=Grab)	Matrix	# of Cont.	Filtered Sample (Y / N)	Perform MS / MSD (Y / N)	6020B - Low Level Arsenic	7471A- Hg	Sample Specific Notes:
21GH-SO-001	6/5/2021	10:30	G	S	1	N	N	X	X	
21GH-SO-901	6/5/2021	10:35	G	S	1	N	N	X	X	
21GH-SO-002	6/5/2021	10:50	G	S	1	N	N	X	X	
21GH-SO-003	6/5/2021	11:10	G	S	1	N	N	X	X	
21GH-SO-004	6/5/2021	11:30	G	S	1	N	N	X	X	
21GH-SO-005	6/5/2021	11:50	G	S	1	N	N	X	X	
21GH-BKG-001	6/5/2021	13:15	G	S	1	N	N	X	X	
21GH-BKG-002	6/5/2021	13:20	G	S	1	N	N	X	X	
21GH-BKG-003	6/5/2021	13:30	G	S	1	N	N	X	X	
21GH-BKG-004	6/5/2021	14:50	G	S	1	N	N	X	X	
21GH-BKG-005	6/5/2021	15:00	G	S	1	N	N	X	X	
21GH-BKG-006	6/5/2021	1510	G	S	1	N	N	X	X	
Preservation Used: 1= Ice, 2= HCl; 3= H2SO4; 4=HNO3; 5=NaOH; 6= Other MeOH								1	1	

Possible Hazard Identification:
Are any samples from a listed EPA Hazardous Waste? Please List any EPA Waste Codes for the sample in the Comments Section if the lab is to dispose of the sample.

☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)

☐ Return to Client ☑ Disposal by Lab ☐ Archive for_____ Months

Special Instructions/QC Requirements & Comments:

Custody Seals Intact: ☐ Yes ☐ No | Custody Seal No.: | Cooler Temp. (°C): Obs'd:_____ Corr'd:_____ Therm ID No.:_____

Relinquished by: Baley Lenhart	Company: ASL	Date/Time: 6/7/2021 12:45	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received in Laboratory by:	Company:	Date/Time:

Form No. CA-C-WI-002, Rev. 4.35, dated 10/6/2020

Eurofins TestAmerica, Seattle
5755 8th Street East

Tacoma, WA 98424-1317
phone 253.922.2310 fax 253.922.5047

Chain of Custody Record

eurofins | Environment Testing America

Regulatory Program: ☐ DW ☐ NPDES ☐ RCRA ☐ Other:

TestAmerica Laboratories, Inc. d/b/a Eurofins TestAmerica

Client Contact	**Project Manager: Nino Muniz**		COC No: 1
Ahtna Solutions, LLC	**Email: nmuniz@ahtna.net**	**Site Contact: Baley Lenhart**	**Date: 6/7/2021**	__1__ of __2__ COCs
110 West 38th Avenue, Suite 200J	**Tel/Fax: 907-375-4750**	**Lab Contact: Elaine Walker**	**Carrier: AK Air Cargo**	TALS Project #:
Anchorage, AK 99503	**Analysis Turnaround Time**			Sampler: BL
(907) 569-8250 Phone	☐ CALENDAR DAYS ☐ WORKING DAYS			**For Lab Use Only:**
(907) 561-5475 FAX	TAT if different from Below _____			Walk-in Client:
Project Name: Glass Heifner Mine Site	☐ 2 weeks			Lab Sampling:
Site:	☐ 1 week			Job / SDG No.:
P O # 23010.000	☐ 2 days			
	☐ 1 day			

Sample Identification	Sample Date	Sample Time	Sample Type (C=Comp, G=Grab)	Matrix	# of Cont.	Filtered Sample (Y / N)	Perform MS / MSD (Y / N)	6020B - Low Level Arsenic	7471A- Hg	Sample Specific Notes:
21GH-BKG-007	6/5/2021	15:20	G	S	1	N	N	X	X	
21GH-BKG-008	6/5/2021	15:30	G	S	1	N	N	X	X	
21GH-BKG-009	6/5/2021	15:45	G	S	1	N	N	X	X	
21GH-BKG-010	6/5/2021	15:55	G	S	1	N	N	X	X	
Preservation Used: 1= Ice, 2= HCl; 3= H_2SO_4; 4=HNO_3; 5=NaOH; 6= Other __MeOH__								**1**	**1**	

Possible Hazard Identification:
Are any samples from a listed EPA Hazardous Waste? Please List any EPA Waste Codes for the sample in the Comments Section if the lab is to dispose of the sample.

☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)

☐ Return to Client ☑ Disposal by Lab ☐ Archive for_____ Months

Special Instructions/QC Requirements & Comments:

Custody Seals Intact: ☐ Yes ☐ No | Custody Seal No.: | Cooler Temp. (°C): Obs'd:_____ Corr'd:_____ Therm ID No.:_____

Relinquished by: Baley Lenhart	Company: ASL	Date/Time: 6/7/2021 12:45	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received in Laboratory by:	Company:	Date/Time:

Form No. CA-C-WI-002, Rev. 4.35, dated 10/6/2020

Eurofins TestAmerica, Seattle
5755 8th Street East

Tacoma, WA 98424-1317
phone 253.922.2310 fax 253.922.5047

Chain of Custody Record

eurofins Environment Testing America

Regulatory Program: ☐ DW ☐ NPDES ☐ RCRA ☐ Other:

TestAmerica Laboratories, Inc. d/b/a Eurofins TestAmerica

Client Contact	Project Manager: Nino Muniz	Site Contact: Baley Lenhart	Date: 6/7/21	COC No: 1
Ahtna Solutions LLC	Email: nmuniz@ahtna.net	Lab Contact: Sheri Cruz	Carrier: Ak Air Cargo	1 of 2 COCs
110 West 38th Avenue, Suite 200L	Tel/Fax: 907-433-0731			TALS Project #:
Anchorage, AK 99503	Analysis Turnaround Time			Sampler: BL
(907) 569-8250 Phone	☐ CALENDAR DAYS ☐ WORKING DAYS			For Lab Use Only:
(907) 561-5475 FAX	TAT if different from Below ___STD_____			Walk-in Client:
Project Name: Glass Heifner Mine Site	☐ 2 weeks			Lab Sampling:
Site:	☐ 1 week			Job / SDG No.:
P O #	☐ 2 days ☐ 1 day			

Sample Identification	Sample Date	Sample Time	Sample Type (C=Comp, G=Grab)	Matrix	# of Cont.	Filtered Sample (Y / N)	Perform MS / MSD (Y / N)	GRO - AK101	DRO/ RRO - AK102/103	6020B - Low Level Arsenic	7471A - Mercury	Sample Specific Notes:
21GH-SO-001	6/5/2021	1030	G	S	1	N	N			X	X	
21GH-SO-901	6/5/2021	1035	G	S	1	N	N			X	X	
21GH-SO-002	6/5/2021	1050	G	S	1	N	N			X	X	
21GH-SO-003	6/5/2021	1110	G	S	1	N	N			X	X	
21GH-SO-004	6/5/2021	1130	G	S	1	N	N			X	X	
21GH-SO-005	6/5/2021	1150	G	S	1	N	N			X	X	
21GH-BKG-001	6/5/2021	1315	G	S	1	N	N			X		
21GH-BKG-002	6/5/2021	1320	G	S	1	N	N			X		
21GH-BKG-003	6/5/2021	1330	G	S	1	N	N			X		
21GH-BKG-004	6/5/2021	1450	G	S	1	N	N			X		
21GH-BKG-005	6/5/2021	1500	G	S	1	N	N			X		
21GH-BKG-006	6/5/2021	1510	G	S	1	N	N			X		
										1	1	

580-103655 Chain of Custody

Therm. ID: A2 Cor: 1.4 ° Unc: 1.5 °
Cooler Dsc: MID Bx1
Packing: Bub
Cust. Seal: Yes X No ___
Blue Ice, Wet, Dry, None
FedEx: ___
UPS: ___
Lab Cour: X
Other: ___

Preservation Used: 1= Ice, 2= HCl; 3= H2SO4; 4=HNO3; 5=NaOH; 6= Other MeOH

Possible Hazard Identification:
Are any samples from a listed EPA Hazardous Waste? Please List any EPA Waste Codes for the sample in the Comments Section if the lab is to dispose of the sample.
☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☑ Unknown

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ Return to Client ☑ Disposal by Lab ☐ Archive for ___ Months

Special Instructions/QC Requirements & Comments:

Custody Seals Intact: ☐ Yes ☐ No	Custody Seal No.:		Cooler Temp. (°C): Obs'd:	Corr'd:	Therm ID No.:
Relinquished by: BALEY LENHART	Company: ASL	Date/Time: 6/7/21 1245	Received by:	Company: EFGS	Date/Time: 6/8/21 14:26
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received in Laboratory by:	Company:	Date/Time:

Form No. CA-C-WI-002, Rev. 4.35, dated 10/8/2020

AR000217

6/23/2021

Eurofins TestAmerica, Seattle
5755 8th Street East

Tacoma, WA 98424-1317
phone 253.922.2310 fax 253.922.5047

Chain of Custody Record

eurofins Environment Testing America

Regulatory Program: ☐ DW ☐ NPDES ☐ RCRA ☐ Other:

TestAmerica Laboratories, Inc. d/b/a Eurofins TestAmerica

Client Contact	**Project Manager: Nino Muniz**			COC No: 1
Ahtna Solutions LLC	Email: nmuniz@ahtna.net	**Site Contact: Baley Lenhart**	**Date: 6/7/21**	2 of 2 COCs
110 West 38th Avenue, Suite 200L	**Tel/Fax: 907-433-0731**	Lab Contact: Sheri Cruz	**Carrier: Ak Air Cargo**	TALS Project #:
Anchorage, AK 99503	**Analysis Turnaround Time**			Sampler: BL
(907) 569-8250 Phone	☐ CALENDAR DAYS ☐ WORKING DAYS			**For Lab Use Only:**
(907) 561-5475 FAX	TAT if different from Below ___STD_____			Walk-in Client:
Project Name: Glass Heifner Mine Site	☐ 2 weeks			Lab Sampling:
Site:	☐ 1 week			Job / SDG No.:
P O #	☐ 2 days ☐ 1 day			

Sample Identification	Sample Date	Sample Time	Sample Type (C=Comp, G=Grab)	Matrix	# of Cont.	Filtered Sample (Y / N)	Perform MS / MSD (Y / N)	GRO- AK101	DRO/ RRO - AK102/103	6020B - Low Level Arsenic	Sample Specific Notes:
21GH-BKG-007	6/5/2021	1520	G	S	1	N	N			X	
21GH-BKG-008	6/5/2021	1530	G	S	1	N	N			X	
21GH-BKG-009	6/5/2021	1545	G	S	1	N	N			X	
21GH-BKG-010	6/5/2021	1555	G	S	1	N	N			X	
Preservation Used: 1= Ice, 2= HCl; 3= H2SO4; 4=HNO3; 5=NaOH; 6= Other MeOH										1	

Possible Hazard Identification:
Are any samples from a listed EPA Hazardous Waste? Please List any EPA Waste Codes for the sample in the Comments Section if the lab is to dispose of the sample.
☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☑ Unknown

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ Return to Client ☑ Disposal by Lab ☐ Archive for_____ Months

Special Instructions/QC Requirements & Comments:

Custody Seals Intact: ☐ Yes ☐ No	Custody Seal No.:		Cooler Temp. (°C): Obs'd:_____ Corr'd:_____		Therm ID No.:_____
Relinquished by: BALEY LENHART	Company: ASL	Date/Time: 6/7/21 1245	Received by:	Company: EFGS	Date/Time: 6/8/21 14:26
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received in Laboratory by:	Company:	Date/Time:

Form No. CA-C-WI-002, Rev. 4.35, dated 10/6/2020

AR000218

6/23/2021

Login Sample Receipt Checklist

Client: Ahtna Solutions LLC

Job Number: 580-103655-1

Login Number: 103655
List Number: 1
Creator: Vallelunga, Diana L

List Source: Eurofins FGS, Seattle

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	N/A	
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	N/A	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time (excluding tests with immediate HTs)	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	N/A	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

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METALS BATCH WORKSHEET

Lab Name: Eurofins FGS, Seattle Job No.: 580-103655-1

SDG No.:

Batch Number: 359455 Batch Start Date: 06/16/21 16:11 Batch Analyst: Hua, Tammy M

Batch Method: 3050B Batch End Date: 06/17/21 09:56

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	FinalAmount	ICP CAL 1 00011	ICP CAL 2 00011	MET Spike 3C 00029	
580-103655-A-1	21GH-SO-001	3050B, 6020B	T	1.1708 g	50 mL				
580-103655-A-1 DU	21GH-SO-001	3050B, 6020B	T	1.2345 g	50 mL				
580-103655-A-1 MS	21GH-SO-001	3050B, 6020B	T	1.2717 g	50 mL	0.5 mL	0.5 mL	0.5 mL	
580-103655-A-1 MSD	21GH-SO-001	3050B, 6020B	T	1.2332 g	50 mL	0.5 mL	0.5 mL	0.5 mL	
580-103655-A-2	21GH-SO-901	3050B, 6020B	T	1.3464 g	50 mL				
580-103655-A-3	21GH-SO-002	3050B, 6020B	T	1.6064 g	50 mL				
580-103655-A-4	21GH-SO-003	3050B, 6020B	T	1.6171 g	50 mL				
580-103655-A-5	21GH-SO-004	3050B, 6020B	T	1.3616 g	50 mL				
580-103655-A-6	21GH-SO-005	3050B, 6020B	T	1.8091 g	50 mL				
580-103655-A-7	21GH-BKG-001	3050B, 6020B	T	1.1498 g	50 mL				
580-103655-A-8	21GH-BKG-002	3050B, 6020B	T	1.2747 g	50 mL				
580-103655-A-9	21GH-BKG-003	3050B, 6020B	T	1.5564 g	50 mL				
580-103655-A-10	21GH-BKG-004	3050B, 6020B	T	1.6888 g	50 mL				
580-103655-A-11	21GH-BKG-005	3050B, 6020B	T	1.2847 g	50 mL				
580-103655-A-12	21GH-BKG-006	3050B, 6020B	T	1.1544 g	50 mL				
580-103655-A-13	21GH-BKG-007	3050B, 6020B	T	1.1884 g	50 mL				
580-103655-A-14	21GH-BKG-008	3050B, 6020B	T	1.1138 g	50 mL				
580-103655-A-15	21GH-BKG-009	3050B, 6020B	T	1.0877 g	50 mL				
580-103655-A-16	21GH-BKG-010	3050B, 6020B	T	1.3535 g	50 mL				
MB 580-359455/24		3050B, 6020B		1.0 g	50 mL				
LCS 580-359455/25		3050B, 6020B		1.0 g	50 mL	0.5 mL	0.5 mL	0.5 mL	
LCSD 580-359455/26		3050B, 6020B		1.0 g	50 mL	0.5 mL	0.5 mL	0.5 mL	

The pound sign (#) in the amount added field denotes that the reagent was used undiluted. All calculations are performed using the stated concentration for this reagent.

METALS BATCH WORKSHEET

Lab Name: Eurofins FGS, Seattle Job No.: 580-103655-1

SDG No.:

Batch Number: 359455 Batch Start Date: 06/16/21 16:11 Batch Analyst: Hua, Tammy M

Batch Method: 3050B Batch End Date: 06/17/21 09:56

Batch Notes	
Balance ID	sea241
Blank Soil Lot Number	2062632
Temperature - Corrected - End	92.5 Degrees C
Temperature - Corrected - Start	91.5 Degrees C
Digestion End Time	06/17/2021 09:56
Digestion Start Time	06/17/2021 08:56
Digestion Unit ID	Block A
Digestion Tube/Cup ID	2839283
Hydrogen Peroxide ID	2867314
Hydrochloric Acid ID	2880259
Nitric Acid ID	2849053
Nominal Amount Used	1.0 g g
Pipette/Syringe/Dispenser ID	Metals Prep 2
Analyst ID - Spike Analyst	see above
Sufficient Volume for Batch QC	yes
Thermometer Location ID	A8
Thermometer ID	1108438
Temperature - Uncorrected - End	93 Degrees C
Temperature - Uncorrected - Start	92 Degrees C

Basis	Basis Description
T	Total/NA

The pound sign (#) in the amount added field denotes that the reagent was used undiluted. All calculations are performed using the stated concentration for this reagent.

METALS BATCH WORKSHEET

Lab Name: Eurofins FGS, Seattle Job No.: 580-103655-1

SDG No.:

Batch Number: 359280 Batch Start Date: 06/15/21 11:02 Batch Analyst: Knight, Christine 1

Batch Method: 7471A Batch End Date: 06/15/21 12:20

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	FinalAmount	Hg_SPK_WORK 00054			
580-103655-A-1	21GH-SO-001	7471A, 7471A	T	0.8779 g	50 mL				
580-103655-A-2	21GH-SO-901	7471A, 7471A	T	0.6509 g	50 mL				
580-103655-A-3	21GH-SO-002	7471A, 7471A	T	0.9836 g	50 mL				
580-103655-A-4	21GH-SO-003	7471A, 7471A	T	0.7456 g	50 mL				
MB 580-359280/22		7471A, 7471A		0.6 g	50 mL				
LCS 580-359280/23		7471A, 7471A		0.6 g	50 mL	1 mL			
LCSD 580-359280/24		7471A, 7471A		0.6 g	50 mL	1 mL			

Batch Notes	
Balance ID	sea241
Blank Matrix ID	2062632
Temperature - Corrected - End	92.4 Degrees C
Temperature - Corrected - Start	90.4 Degrees C
Digestion End Time	06/15/2021 12:20
Digestion Start Time	06/15/2021 11:50
Digestion Unit ID	Block B
Hydrochloric Acid ID	2880273
Nitric Acid ID	2849253
Hydroxylamine ID	2883412
Potassium Permanganate ID	2882365
Nominal Amount Used	0.6g g
Pipette/Syringe/Dispenser ID	hg prep 1
Analyst ID - Spike Analyst	see above
Sufficient Volume for Batch QC	yes
Thermometer ID	1108438
Digestion Tube/Cup ID	2839286
Temperature - Uncorrected - End	93.0 Degrees C
Temperature - Uncorrected - Start	91.0 Degrees C

The pound sign (#) in the amount added field denotes that the reagent was used undiluted. All calculations are performed using the stated concentration for this reagent.

METALS BATCH WORKSHEET

Lab Name: Eurofins FGS, Seattle Job No.: 580-103655-1

SDG No.:

Batch Number: 359280 Batch Start Date: 06/15/21 11:02 Batch Analyst: Knight, Christine 1

Batch Method: 7471A Batch End Date: 06/15/21 12:20

Basis	Basis Description
T	Total/NA

The pound sign (#) in the amount added field denotes that the reagent was used undiluted. All calculations are performed using the stated concentration for this reagent.

METALS BATCH WORKSHEET

Lab Name: Eurofins FGS, Seattle Job No.: 580-103655-1

SDG No.:

Batch Number: 359417 Batch Start Date: 06/16/21 13:34 Batch Analyst: Hua, Tammy M

Batch Method: 7471A Batch End Date: 06/16/21 14:36

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	FinalAmount	Hg_SPK_WORK 00054			
580-103655-A-5	21GH-SO-004	7471A, 7471A	T	0.8211 g	50 mL				
580-103655-A-5 DU	21GH-SO-004	7471A, 7471A	T	0.8973 g	50 mL				
580-103655-A-5 MS	21GH-SO-004	7471A, 7471A	T	0.8109 g	50 mL	1 mL			
580-103655-A-5 MSD	21GH-SO-004	7471A, 7471A	T	0.8703 g	50 mL	1 mL			
580-103655-A-6	21GH-SO-005	7471A, 7471A	T	0.6917 g	50 mL				
580-103655-A-7	21GH-BKG-001	7471A, 7471A	T	0.8349 g	50 mL				
580-103655-A-8	21GH-BKG-002	7471A, 7471A	T	0.6261 g	50 mL				
580-103655-A-9	21GH-BKG-003	7471A, 7471A	T	0.7715 g	50 mL				
580-103655-A-10	21GH-BKG-004	7471A, 7471A	T	0.8832 g	50 mL				
580-103655-A-11	21GH-BKG-005	7471A, 7471A	T	0.8969 g	50 mL				
580-103655-A-12	21GH-BKG-006	7471A, 7471A	T	0.7344 g	50 mL				
580-103655-A-13	21GH-BKG-007	7471A, 7471A	T	0.6757 g	50 mL				
580-103655-A-14	21GH-BKG-008	7471A, 7471A	T	0.9533 g	50 mL				
580-103655-A-15	21GH-BKG-009	7471A, 7471A	T	0.9480 g	50 mL				
580-103655-A-16	21GH-BKG-010	7471A, 7471A	T	0.7092 g	50 mL				
MB 580-359417/22		7471A, 7471A		0.6 g	50 mL				
LCS 580-359417/23		7471A, 7471A		0.6 g	50 mL	1 mL			
LCSD 580-359417/24		7471A, 7471A		0.6 g	50 mL	1 mL			

The pound sign (#) in the amount added field denotes that the reagent was used undiluted. All calculations are performed using the stated concentration for this reagent.

METALS BATCH WORKSHEET

Lab Name: Eurofins FGS, Seattle Job No.: 580-103655-1

SDG No.:

Batch Number: 359417 Batch Start Date: 06/16/21 13:34 Batch Analyst: Hua, Tammy M

Batch Method: 7471A Batch End Date: 06/16/21 14:36

Batch Notes	
Balance ID	sea228
Blank Matrix ID	2062632
Temperature - Corrected - End	91.4 Degrees C
Temperature - Corrected - Start	91.4 Degrees C
Digestion End Time	06/16/2021 14:36
Digestion Start Time	06/16/2021 14:06
Digestion Unit ID	Block B
Hydrochloric Acid ID	2880273
Nitric Acid ID	2849253
Hydroxylamine ID	2883412
Potassium Permanganate ID	2882365
Nominal Amount Used	0.6g g
Pipette/Syringe/Dispenser ID	hg prep 1
Analyst ID - Spike Analyst	see above
Sufficient Volume for Batch QC	yes
Thermometer ID	1108438
Digestion Tube/Cup ID	2839286
Temperature - Uncorrected - End	92.0 Degrees C
Temperature - Uncorrected - Start	92.0 Degrees C

Basis	Basis Description
T	Total/NA

The pound sign (#) in the amount added field denotes that the reagent was used undiluted. All calculations are performed using the stated concentration for this reagent.

GENERAL CHEMISTRY BATCH WORKSHEET

Lab Name: Eurofins FGS, Seattle Job No.: 580-103655-1

SDG No.:

Batch Number: 358719 Batch Start Date: 06/09/21 11:09 Batch Analyst: Roberts, Jacob H

Batch Method: 2540G Batch End Date: 06/09/21 16:57

Lab Sample ID	Client Sample ID	Method Chain	Basis	DishWeight	SampleMassWet	SampleMassDry	%_Moisture	%_Solid	AnalysisComment
580-103655-A-1	21GH-SO-001	2540G	T	0.819 g	8.873 g	7.785 g	13.508815495406 %	86.491184504594 %	
580-103655-A-3	21GH-SO-002	2540G	T	0.809 g	9.016 g	6.753 g	27.574022176191 1 %	72.425977823808 9 %	
580-103655-A-3 DU	21GH-SO-002	2540G	T	0.824 g	8.567 g	6.429 g	27.612036678290 1 %	72.387963321709 9 %	
580-103655-A-4	21GH-SO-003	2540G	T	0.808 g	8.705 g	6.754 g	24.705584399138 9 %	75.294415600861 1 %	
580-103655-A-5	21GH-SO-004	2540G	T	0.824 g	8.344 g	6.683 g	22.087765957446 8 %	77.912234042553 2 %	
580-103655-A-6	21GH-SO-005	2540G	T	0.819 g	9.008 g	5.762 g	39.638539504213 %	60.361460495787 %	Rich in red-brown organic matter
580-103655-A-7	21GH-BKG-001	2540G	T	0.813 g	8.390 g	5.405 g	39.395539131582 4 %	60.604460868417 6 %	
580-103655-A-8	21GH-BKG-002	2540G	T	0.823 g	8.325 g	3.899 g	58.997600639829 4 %	41.002399360170 6 %	Clear stratified layers of decayed organics.
580-103655-A-9	21GH-BKG-003	2540G	T	0.826 g	8.345 g	4.315 g	53.597552866072 6 %	46.402447133927 4 %	
580-103655-A-10	21GH-BKG-004	2540G	T	0.828 g	8.548 g	4.490 g	52.564766839378 2 %	47.435233160621 8 %	
580-103655-A-11	21GH-BKG-005	2540G	T	0.819 g	8.444 g	4.395 g	53.101639344262 3 %	46.898360655737 7 %	
580-103655-A-12	21GH-BKG-006	2540G	T	0.820 g	8.448 g	4.673 g	49.488725747247 %	50.511274252753 %	
580-103655-A-13	21GH-BKG-007	2540G	T	0.825 g	8.673 g	4.756 g	49.910805300713 6 %	50.089194699286 4 %	
580-103655-A-14	21GH-BKG-008	2540G	T	0.822 g	9.020 g	4.455 g	55.684313247133 4 %	44.315686752866 6 %	
580-103655-A-15	21GH-BKG-009	2540G	T	0.814 g	8.429 g	4.578 g	50.571240971766 3 %	49.428759028233 7 %	
580-103655-A-16	21GH-BKG-010	2540G	T	0.820 g	9.266 g	4.462 g	56.878995974425 8 %	43.121004025574 2 %	
580-103655-A-2	21GH-SO-901	2540G	T	0.822 g	8.302 g	7.139 g	15.548128342246 %	84.451871657754 %	Regulated FS-Rich in various organic content with used oil odor

The pound sign (#) in the amount added field denotes that the reagent was used undiluted. All calculations are performed using the stated concentration for this reagent.

GENERAL CHEMISTRY BATCH WORKSHEET

Lab Name: Eurofins FGS, Seattle Job No.: 580-103655-1

SDG No.:

Batch Number: 358719 Batch Start Date: 06/09/21 11:09 Batch Analyst: Roberts, Jacob H

Batch Method: 2540G Batch End Date: 06/09/21 16:57

Batch Notes	
Balance ID	SEA232
Date samples were placed in the oven	06/09/2021
Oven Temp In	113.8 Degrees C
Time samples were place in the oven	14:12
Date samples were removed from oven	06/09/2021
Oven Temp Out	113.7 Degrees C
Time Samples were removed from oven	16:57
Oven ID	Oven2
Thermometer ID	Digital readout
Temperature - Start - Uncorrected	110.1 Degrees C
Temperature - End - Uncorrected	110.0 Degrees C

Basis	Basis Description
T	Total/NA

The pound sign (#) in the amount added field denotes that the reagent was used undiluted. All calculations are performed using the stated concentration for this reagent.

Appendix D
Data Quality Review

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DATA QUALITY REVIEW

Date: 06/24/21

Project : Glacier Bay Groundwater
Laboratory: Eurofins Frontier Global Sciences, Seattle
Work Order: 580-103655

Reviewer Name: Marty Brewer, Ahtna
Reviewer Title: Project Chemist

INTRODUCTION

Table 1 lists the field sample numbers, corresponding laboratory numbers, and identifies quality control (QC) samples.

TABLE 1: FIELD SAMPLE PLAN OVERVIEW

Field Sample ID	Lab Sample ID	Matrix	Quality Control
21GH-SO-001	580-103665-1	Soil	Matrix Spike/Duplicate (Arsenic)
21GH-SO-901	580-103665-2	Soil	Field duplicate
21GH-SO-002	580-103665-3	Soil	
21GH-SO-003	580-103665-4	Soil	
21GH-SO-004	580-103665-5	Soil	Matrix Spike/Duplicate (Mercury)
21GH-SO-005	580-103665-6	Soil	
21GH-BKG-001	580-103665-7	Soil	
21GH-BKG-002	580-103665-8	Soil	
21GH-BKG-003	580-103665-9	Soil	
21GH-BKG-004	580-103665-10	Soil	
21GH-BKG-005	580-103665-11	Soil	
21GH-BKG-006	580-103665-12	Soil	
21GH-BKG-007	580-103665-13	Soil	
21GH-BKG-008	580-103665-14	Soil	
21GH-BKG-009	580-103665-15	Soil	

21GH-BKG-010	580-103665-16	Soil	

DATA QUALIFIER DEFINITIONS

For the purpose of this Data Quality Review (DQR) the following code letters and associated definitions are provided for use by the project chemist to summarize the data quality.

R Reported value is "rejectable." Resampling or reanalysis may be necessary to verify the presence or absence of the compound.

J The associated numerical value is an estimated quantity because QC criteria were not met, may be biased high or low.

UJ The reported quantitation limit is estimated because QC criteria were not met and the element or compound was not detected.

Q The result is qualified due to quality control criteria not being met

DATA REVIEW

This DQR includes a review, where appropriate, of the following parameters:

- Data completeness
- Chain of Custody (COC) and Cooler Receipt Forms
- Holding times and preservation
- Analytical reporting limits (reporting limit [RL] and method detection limits [MDL])
- Blank analysis results
- Surrogate recoveries (organics only)
- Field duplicates
- Laboratory control sample (LCS)/laboratory control sample duplicate (LCSD) results
- Matrix spikes (MS)/matrix spike duplicates

Each analysis that was performed is evaluated in the following subsections of this report, and only the criteria exceedances that impact data qualification or require assessment beyond laboratory documentation are discussed.

Validation was conducted in accordance with the USEPA document "*Test Methods for Evaluating Solid Wastes, SW-846, revision 6*" (July, 2014 and updates) and USEPA *Contract Laboratory Program National Functional Guidelines for Inorganic Data Review (January, 2017),* where and when applicable.

Sample Receipt Conditions

Samples were submitted to Eurofins Frontier Global Sciences located in Seattle, Washington. Sixteen samples including one field duplicate set were submitted, all received in good condition, and properly preserved on ice. Data was reported in sample delivery group (SDG) 580-103655.

Holding Times and Preservatives

All samples were received within hold times and with proper preservation.

PRECISION

Field Duplicates

One field duplicate set was submitted for analysis.

- 21GH-SO-001 and 21GH-SO-901

RPDs were calculated using the following equation for the primary and duplicate field samples when both analytes were detected.

EQUATION 1 – RELATIVE PERCENT DIFFERENCE

$$RPD\ (\%) = \text{Absolute Value of: } \frac{(R_1 - R_2)}{((R_1 + R_2)/2)} \times 100$$

Where R_1 = Sample Concentration

R_2 = Field Duplicate Concentration

Table 2 presents the calculated soil field duplicate RPDs.

Table 2. Water Field Duplicate RPDs

Analyte	Units	FTF-14R-20 Primary	FTF-14R-DP-20 Duplicate	%RPD
Arsenic	mg/kg	410	510	21.8
Mercury	mg/kg	0.092	0.20	37

Notes:
mg/kg – milligrams per kilograms
RPD – relative percent difference

Field duplicate RPDs were within the 50% criteria for soils: therefore, no data were qualified based upon the duplicate precision.

Laboratory Control Samples/Duplicates

There were no exceedances of precision criteria for LCS and LCSDs.

Sample Duplicates

Per the SW6020B and SW7471A methods, one sample duplicate was analyzed per batch. The sample duplicate precision for arsenic in sample 21GH-SO-001 in preparation batch 359455 and analytical batch 580-359769 was outside control limits. The sample duplicate precision for mercury for project samples in preparation batch 580-359417 and analytical batch 580-359579 was outside control limits. Sample heterogeneity was suspected for both instances. LCS/LCSD were in control and therefore no project sample results were qualified.

Matrix Spike/Duplicates

Sample 21GH-SO-001 arsenic MS/MSD RPD was outside criteria due to high parent sample concentration. Sample 21GH-SO-005 mercury MS/MSD RPD was outside criteria due to high parent sample concentration. The parent sample results were qualified QN as estimated with unknown bias due to MS/MSD precision.

ACCURACY

Laboratory Control Samples/Duplicates

The LCS and LCSD for arsenic and mercury were recovered within criteria and therefore no sample results were qualified based on LCS/LCSD accuracy.

Matrix Spike/Duplicates

Sample 21GH-SO-001 arsenic MS/MSD recoveries were outside criteria due to high parent sample concentration. Sample 21GH-SO-005 mercury MS/MSD recoveries were outside criteria due to high parent sample concentration. Parent sample results were qualified QN.

REPRESENTATIVENESS

All samples were collected in accordance with the work plan. Samples collected are considered representative of conditions and meet data quality objectives discussed in the work plan.

COMPARABILITY

One laboratory was used for all analyses and one SDG was received for this project. The results, methods, procedures, quantitation units, and format of the work order are comparable in quality and data validity to all applicable regulations.

COMPLETENESS

All data necessary to complete the data validation on this SDG was provided. These soil samples had no rejectable results and 100% of the results are usable.

SENSITIVITY

All results were evaluated to the RL. All laboratory RLs supported data quality objectives.

Method Blanks

There were no laboratory method blank detections at or above the RL.

OVERALL ASSESSMENT

Based on the data review completed there were no data qualified based on hold time exceedances, surrogate and laboratory control sample recoveries, and duplicate precision. Some data was qualified based on MS/MSD accuracy and precision, but data are considered usable. All analytical data are considered usable for the purpose of evaluating the presence or absence and magnitude of the suspected site contaminants.

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Laboratory Data Review Checklist

Completed By:

Marty Brewer

Title:

Project Chemist

Date:

06/23/21

Consultant Firm:

Ahtna Solutions LLC

Laboratory Name:

Eurofins Frontier Global Sciences

Laboratory Report Number:

580-103655-1

Laboratory Report Date:

06/23/21

CS Site Name:

2021 NPS -Glass Heifner Mine Site

ADEC File Number:

2332.38.053

Hazard Identification Number:

27212

580-103655-1

Laboratory Report Date:

06/23/21

CS Site Name:

2021 NPS -Glass Heifner Mine Site

Note: Any N/A or No box checked must have an explanation in the comments box.

1. Laboratory

   a. Did an ADEC CS approved laboratory receive and perform all of the submitted sample analyses?

   Yes☒ No☐ N/A☐ Comments:

   Eurofins Frontier Global Sciences, Seattle WA

   b. If the samples were transferred to another "network" laboratory or sub-contracted to an alternate laboratory, was the laboratory performing the analyses ADEC CS approved?

   Yes☐ No☐ N/A☒ Comments:

2. Chain of Custody (CoC)

   a. CoC information completed, signed, and dated (including released/received by)?

   Yes☒ No☐ N/A☐ Comments:

   b. Correct analyses requested?

   Yes☒ No☐ N/A☐ Comments:

   Arsenic & Mercury

3. Laboratory Sample Receipt Documentation

   a. Sample/cooler temperature documented and within range at receipt (0° to 6° C)?

   Yes☒ No☐ N/A☐ Comments:

   1.4° C

   b. Sample preservation acceptable – acidified waters, Methanol preserved VOC soil (GRO, BTEX, Volatile Chlorinated Solvents, etc.)?

   Yes☒ No☐ N/A☐ Comments:

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Laboratory Report Date:

06/23/21

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2021 NPS -Glass Heifner Mine Site

c. Sample condition documented – broken, leaking (Methanol), zero headspace (VOC vials)?

Yes☒ No☐ N/A☐ Comments:

d. If there were any discrepancies, were they documented? For example, incorrect sample containers/preservation, sample temperature outside of acceptable range, insufficient or missing samples, etc.?

Yes☐ No☐ N/A☒ Comments:

e. Data quality or usability affected?

Comments:

Data quality/usability not affected by sample receipt

4. Case Narrative

a. Present and understandable?

Yes☒ No☐ N/A☐ Comments:

b. Discrepancies, errors, or QC failures identified by the lab?

Yes☒ No☐ N/A☐ Comments:

Method 6020B: Due to the high concentration of Arsenic in sample 21GH-SO-001 (580-103655-1), the matrix spike/matrix spike duplicate (MS/MSD) recoveries and precision for preparation batch 580-359455 and analytical batch 580-359769 could not be evaluated for accuracy and precision.

Method 6020B: The sample duplicate precision (%RPD) for sample 21GH-SO-001 (580-103655-1) in preparation batch 359455 and analytical batch 580-359769 was outside control limits.

Method 7471A: Due to the high concentration of Mercury in sample 580-103655-5, the matrix spike/matrix spike duplicate (MS/MSD) recoveries for preparation batch 580-359417 and analytical batch 580-359579 could not be evaluated for accuracy and precision.

Method 7471A: The sample duplicate precision (%RPD) for job 580-103655-5 in preparation batch 580-359417 and analytical batch 580-359579 was outside control limits.

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c. Were all corrective actions documented?

Yes☒ No☐ N/A☐ Comments:

The associated 6020B laboratory control sample/laboratory control sample duplicate (LCS/LCSD) recoveries and precision met acceptance criteria.

Sample non-homogeneity is suspected in case of sample duplicate precision (%RPD) for sample 21GH-SO-001 (580-103655-1) in preparation batch 359455 and analytical batch 580-359769.

High concentration of Mercury in the parent sample 580-103655-5 prevented assessment of MS/MSD accuracy & precision. The associated 7471A laboratory control sample/laboratory control sample duplicate (LCS/LCSD) recoveries met acceptance criteria.

Sample non-homogeneity is suspected in case of sample duplicate precision (%RPD) for job 580-103655-5 in preparation batch 580-359417 and analytical batch 580-359579.

d. What is the effect on data quality/usability according to the case narrative?

Comments:

According to the case narrative, data quality/usability not affected.

5. Samples Results

a. Correct analyses performed/reported as requested on COC?

Yes☒ No☐ N/A☐ Comments:

Asenic & mercury

b. All applicable holding times met?

Yes☒ No☐ N/A☐ Comments:

c. All soils reported on a dry weight basis?

Yes☒ No☐ N/A☐ Comments:

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d. Are the reported LOQs less than the Cleanup Level or the minimum required detection level for the project?

Yes☒ No☐ N/A☐ Comments:

e. Data quality or usability affected?

Data quality/usability not affected.

6. QC Samples

a. Method Blank

i. One method blank reported per matrix, analysis and 20 samples?

Yes☒ No☐ N/A☐ Comments:

ii. All method blank results less than limit of quantitation (LOQ) or project specified objectives?

Yes☒ No☐ N/A☐ Comments:

iii. If above LOQ or project specified objectives, what samples are affected?

Comments:

iv. Do the affected sample(s) have data flags? If so, are the data flags clearly defined?

Yes☐ No☐ N/A☒ Comments:

v. Data quality or usability affected?

Comments:

Data quality/usability not affected by method blank contamination

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b. Laboratory Control Sample/Duplicate (LCS/LCSD)

i. Organics – One LCS/LCSD reported per matrix, analysis and 20 samples? (LCS/LCSD required per AK methods, LCS required per SW846)

Yes☐ No☐ N/A☒ Comments:

No organics

ii. Metals/Inorganics – one LCS and one sample duplicate reported per matrix, analysis and 20 samples?

Yes☒ No☐ N/A☐ Comments:

iii. Accuracy – All percent recoveries (%R) reported and within method or laboratory limits and project specified objectives, if applicable? (AK Petroleum methods: AK101 60%-120%, AK102 75%-125%, AK103 60%-120%; all other analyses see the laboratory QC pages)

Yes☒ No☐ N/A☐ Comments:

iv. Precision – All relative percent differences (RPD) reported and less than method or laboratory limits and project specified objectives, if applicable? RPD reported from LCS/LCSD, and or sample/sample duplicate. (AK Petroleum methods 20%; all other analyses see the laboratory QC pages)

Yes☒ No☐ N/A☐ Comments:

v. If %R or RPD is outside of acceptable limits, what samples are affected?

Comments:

vi. Do the affected sample(s) have data flags? If so, are the data flags clearly defined?

Yes☐ No☐ N/A☒ Comments:

vii. Data quality or usability affected? (Use comment box to explain.)

Comments:

Data quality/usability not affected by LCS/LCSD.

580-103655-1

Laboratory Report Date:

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CS Site Name:

2021 NPS -Glass Heifner Mine Site

c. Matrix Spike/Matrix Spike Duplicate (MS/MSD)

Note: Leave blank if not required for project

i. Organics – One MS/MSD reported per matrix, analysis and 20 samples?

Yes☐ No☐ N/A☒ Comments:

No organics

ii. Metals/Inorganics – one MS and one MSD reported per matrix, analysis and 20 samples?

Yes☒ No☐ N/A☐ Comments:

iii. Accuracy – All percent recoveries (%R) reported and within method or laboratory limits and project specified objectives, if applicable?

Yes☐ No☒ N/A☐ Comments:

Sample 580-103655-1 (21GH-SO-001) arsenic MS/MSD %R outside criteria due to high parent sample concentration.

Sample 580-103655-5 (21GH-SO-005) mercury MS/MSD %R outside criteria due to high parent sample concentration.

iv. Precision – All relative percent differences (RPD) reported and less than method or laboratory limits and project specified objectives, if applicable? RPD reported from MS/MSD, and or sample/sample duplicate.

Yes☐ No☒ N/A☐ Comments:

Sample 580-103655-1 (21GH-SO-001) arsenic MS/MSD RPD outside criteria due to high parent sample concentration.

Sample 580-103655-5 (21GH-SO-005) mercury MS/MSD RPD outside criteria due to high parent sample concentration.

v. If %R or RPD is outside of acceptable limits, what samples are affected?

Comments:

580-103655-1 (21GH-SO-001) arsenic

580-103655-5 (21GH-SO-005) mercury

580-103655-1

Laboratory Report Date:

06/23/21

CS Site Name:

2021 NPS -Glass Heifner Mine Site

vi. Do the affected sample(s) have data flags? If so, are the data flags clearly defined?

Yes☒ No☐ N/A☐ Comments:

vii. Data quality or usability affected? (Use comment box to explain.)

Comments:

Following sample results should be qualified QN as estimated with unknown bias due to poor MS/MSD accuracy & precision:
580-103655-1 (21GH-SO-001) arsenic
580-103655-5 (21GH-SO-005) mercury

d. Surrogates – Organics Only or Isotope Dilution Analytes (IDA) – Isotope Dilution Methods Only

i. Are surrogate/IDA recoveries reported for organic analyses – field, QC and laboratory samples?

Yes☐ No☐ N/A☒ Comments:

No organics

ii. Accuracy – All percent recoveries (%R) reported and within method or laboratory limits and project specified objectives, if applicable? (AK Petroleum methods 50-150 %R for field samples and 60-120 %R for QC samples; all other analyses see the laboratory report pages)

Yes☐ No☐ N/A☒ Comments:

iii. Do the sample results with failed surrogate/IDA recoveries have data flags? If so, are the data flags clearly defined?

Yes☐ No☐ N/A☒ Comments:

iv. Data quality or usability affected?

Comments:

580-103655-1

Laboratory Report Date:

06/23/21

CS Site Name:

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e. Trip Blanks

i. One trip blank reported per matrix, analysis and for each cooler containing volatile samples? (If not, enter explanation below.)

Yes☐ No☐ N/A☒ Comments:

No volatiles

ii. Is the cooler used to transport the trip blank and VOA samples clearly indicated on the COC? (If not, a comment explaining why must be entered below)

Yes☐ No☐ N/A☒ Comments:

iii. All results less than LOQ and project specified objectives?

Yes☐ No☐ N/A☒ Comments:

iv. If above LOQ or project specified objectives, what samples are affected?

Comments:

v. Data quality or usability affected?

Comments:

f. Field Duplicate

i. One field duplicate submitted per matrix, analysis and 10 project samples?

Yes☒ No☐ N/A☐ Comments:

580-103655-1 (21GH-SO-001) & 580-103655-2 (21GH-SO-901)

ii. Submitted blind to lab?

Yes☒ No☐ N/A☐ Comments:

580-103655-1

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iii. Precision – All relative percent differences (RPD) less than specified project objectives? (Recommended: 30% water, 50% soil)

RPD (%) = Absolute value of: $\frac{(R_1-R_2)}{((R_1+R_2)/2)} \times 100$

Where R_1 = Sample Concentration
R_2 = Field Duplicate Concentration

Yes☒ No☐ N/A☐ Comments:

Arsenic RPD 21.8%

Mercury RPD 37%

iv. Data quality or usability affected? (Use the comment box to explain why or why not.)

Comments:

Data quality/usability not affected by field duplicate precision

g. Decontamination or Equipment Blank (If not applicable, a comment stating why must be entered below)?

Yes☐ No☐ N/A☒ Comments:

Disposable sampling equipment used

i. All results less than LOQ and project specified objectives?

Yes☐ No☒ N/A☐ Comments:

ii. If above LOQ or project specified objectives, what samples are affected?

Comments:

Several samples above project limits

iii. Data quality or usability affected?

Comments:

Data quality/usability not affected.

580-103655-1

Laboratory Report Date:

06/23/21

CS Site Name:

2021 NPS -Glass Heifner Mine Site

7. Other Data Flags/Qualifiers (ACOE, AFCEE, Lab Specific, etc.)

   a. Defined and appropriate?

      Yes☐ No☐ N/A☒ Comments:

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Appendix E
Background Statistical Information

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Normal Background Statistics for Uncensored Full Data Sets

User Selected Options

Date/Time of Computation	ProUCL 5.111/16/2021 1:00:02 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Coverage	95%
New or Future K Observations	1

Mercury

General Statistics

Total Number of Observations	10	Number of Distinct Observations	7
Minimum	0.075	First Quartile	0.1
Second Largest	0.15	Median	0.13
Maximum	0.18	Third Quartile	0.138
Mean	0.121	SD	0.0328
Coefficient of Variation	0.27	Skewness	0.147
Mean of logged Data	-2.143	SD of logged Data	0.282

Critical Values for Background Threshold Values (BTVs)

Tolerance Factor K (For UTL)	2.911	d2max (for USL)	2.176

Normal GOF Test

Shapiro Wilk Test Statistic	0.949	Shapiro Wilk GOF Test
5% Shapiro Wilk Critical Value	0.842	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.203	Lilliefors GOF Test
5% Lilliefors Critical Value	0.262	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Background Statistics Assuming Normal Distribution

95% UTL with 95% Coverage	0.217	90% Percentile (z)	0.163
95% UPL (t)	0.184	95% Percentile (z)	0.175
95% USL	0.193	99% Percentile (z)	0.198

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers and consists of observations collected from clean unimpacted locations.
The use of USL tends to provide a balance between false positives and false negatives provided the data represents a background data set and when many onsite observations need to be compared with the BTV.

Arsenic

General Statistics

Total Number of Observations	10	Number of Distinct Observations	9
Minimum	5.6	First Quartile	17.1
Second Largest	110	Median	44.5
Maximum	130	Third Quartile	63.75
Mean	51.48	SD	41.93
Coefficient of Variation	0.814	Skewness	0.815
Mean of logged Data	3.511	SD of logged Data	1.109

Critical Values for Background Threshold Values (BTVs)

Tolerance Factor K (For UTL)	2.911	d2max (for USL)	2.176

Normal GOF Test

Shapiro Wilk Test Statistic	0.895	Shapiro Wilk GOF Test
5% Shapiro Wilk Critical Value	0.842	Data appear Normal at 5% Significance Level

Lilliefors Test Statistic	0.176	Lilliefors GOF Test	
5% Lilliefors Critical Value	0.262	Data appear Normal at 5% Significance Level	
Data appear Normal at 5% Significance Level			
Background Statistics Assuming Normal Distribution			
95% UTL with 95% Coverage	173.5	90% Percentile (z)	105.2
95% UPL (t)	132.1	95% Percentile (z)	120.4
95% USL	142.7	99% Percentile (z)	149

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers and consists of observations collected from clean unimpacted locations.
The use of USL tends to provide a balance between false positives and false negatives provided the data represents a background data set and when many onsite observations need to be compared with the BTV.

Appendix F
Sampling and Analysis Plan (Final Version Only)

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Kenai Fjords National Park

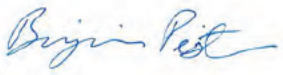
Glass-Heifner Mine Site Preliminary Assessment/Site Inspection EDL Number 5AKR2659

Prepared by

Ahtna Solutions, LLC

09/2020

Signatories:

Benjamin Pister [Park Point of Contact]	 [Signature]	9/25/20 [Date Signed]
Benjamin Pister [Park Chief of Natural Resources]	[Signature]	9/25/20 [Date Signed]
Sarah Venator [CERCLA Program Manager]	 [Signature]	09/24/2020 [Date Signed]
By signing above, the signatories verify that they understand and concur with the information, procedures, and recommendations presented herein.		

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List of Abbreviations and Acronyms

°C	degrees Celsius
°F	degrees Fahrenheit
µg/kg	micrograms per kilogram
µg/l	micrograms per liter
AAC	Alaska Administrative Code
ADEC	Alaska Department of Environmental Conservation
Ahtna	Ahtna Solutions, LLC
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COC	chain of custody
CSM	conceptual site model
DQI	data quality indicator
DQO	data quality objective
EDD	electronic data deliverable
EE/CA	Engineering Evaluation/Cost Analysis
EPA	United States Environmental Protection Agency
FSP	Field Sampling Plan
GPS	Global Positioning System
ID	identification
IDQTF	Intergovernmental Data Quality Task Force
IDW	investigation-derived waste
KEFJ	Kenai Fjord National Park
LOQ	limit of quantitation
MDL	method detection limit
mg/kg	milligrams per kilogram
MS/MSD	matrix spike/matrix spike duplicate
NCP	National Oil and Hazardous Substances Pollution Contingency Plan (also known as National Contingency Plan)
NPS	National Park Service
PA	preliminary assessment
PPE	personal protective equipment

PQL	practical quantitation limit
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
RPD	relative percent difference
SAP	Sampling and Analysis Plan
SI	site inspection
SOP	standard operating procedure
USC	United States Code
USGS	United States Geological Survey
UTL	upper tolerance limit
XRF	X-ray fluorescence

1 Introduction

This document serves as the Sampling and Analysis Plan (SAP) to support a Preliminary Assessment (PA)/Site Inspection (SI) at the Glass-Heifner Mine Site (Site) in the Kenai Fjords National Park (KEFJ; Figures 1 and 2), Alaska. The work is being conducted by Ahtna Solutions, LLC, (Ahtna) under National Park Service (NPS) notice-to-proceed number 140P9720Q0021.

The Site is a former gold mine under the management authority of KEFJ since the mining claims lapsed in 2002. KEFJ staff have conducted several environmental response activities at this Site since 1998, including a tailing stabilization project, a hazardous waste inventory, and a drum removal. At the end of the 2008 drum removal effort, five soil samples were collected from a ruined rock crusher/ball mill at the Site. Results indicated approximately one-third of a cubic yard of soil containing mercury above Alaska Department of Environmental Conservation (ADEC) cleanup levels exists at the area of the ball mill. One sample result of arsenic also exceeded ADEC cleanup levels, as well as background levels. The ADEC File No. for the site is 2332.38.053 and the Hazard Identification No. 27212.

The purpose of this SAP is to define:

- The level and extent of mercury and arsenic impacts in the soil at the ball mill area
- Background levels of arsenic in the area
- Regulatory status of metal contaminants in the soil to assess potential disposal options
- Data quality objectives (DQOs) that will ensure the amount of data collected is sufficient and that the quality of data meets the project needs
- The methods that will be used to collect site and analytical data

1.1 CERCLA and NPS Authority

This SAP was generated in accordance with the United States Environmental Protection Agency's (EPA's) *Guidance on Systematic Planning Using the Data Quality Objectives Process* (EPA, 2006a), *Guidance for Quality Assurance Project Plans* (EPA, 2002a), *EPA Requirements for Quality Assurance Project Plans* (EPA, 2001), and the Intergovernmental Data Quality Task Force's (IDQTF's) *Uniform Federal Policy for Quality Assurance Project Plans* (IDQTF, 2005). The NPS is authorized under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 United States Code (USC) §§ 9601 et seq., to respond as the Lead Agency to a release or threatened release of hazardous substances and/or a release or threatened release of any pollutant or contaminant that may present an imminent and substantial danger to public health or welfare on NPS land. For this project, the NPS will defer to ADEC for primary oversight. The regulations covering this site are under Title 18 of the Alaska Administrative Code Chapter 75 (18 AAC 75).

CERCLA's implementing regulations, codified in the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 Code of Federal Regulations (CFR) Part 300, establishes the framework for responding to such releases and threatened releases. The NCP prescribes two similar processes for responding to releases: removal actions and remedial actions (See NCP Sections 300.400 through 300.440). If environmental samples are to be collected under either process, a SAP is required (See NCP

Sections 300.415 and 300.430). The SAP consists of two parts: the Field Sampling Plan (FSP) and the Quality Assurance Project Plan (QAPP). The FSP describes the number, types, and locations of samples as well as the types of analyses that will be conducted on the samples. The QAPP describes the project's policy, organization, and functional activities as well as the DQOs, and measures necessary to achieve the goals of the study.

In addition, the NPS has a number of regulations that apply to the release of hazardous substances on NPS land (see NPS 2014) including the NPS Organic Act of 1916 (16 USC §1, et seq. 36 CFR Part 1), which requires that the NPS manage parks in order to conserve the scenery, natural and historic objects, and wildlife and to provide for their enjoyment by such means as will leave them unimpaired for the enjoyment of future generations. Therefore, whether the Site poses risks to the interaction of organisms and the environment is especially relevant to the NPS responsibility to protect park resources.

1.2 Purpose of Field Sampling

The purpose of this sampling event is to determine the lateral and vertical extent and the concentration of mercury and arsenic impacts present in the soil underneath the ball mill area and to assess background levels of arsenic at the Site.

Due to the COVID-19 health concernws, the sampling event, originally slated for June of 2020, is now scheduled to occur in summer 2021. The NPS will use data collected during this field investigation to support potential response actions that may be undertaken by the NPS or other parties. This SAP proposes the following activities:

- Soil field screening and analytical samples will be collected at the vertical and horizontal extent of the mercury and arsenic impacted area.
- Background samples will be collected for arsenic. The background samples will be taken as far back from the impacted area as possible and as practicable.

The NPS will use the data obtained from these investigations in accordance with the provisions outlined in the DQOs detailed in Section 4.

1.3 Site Location

The Site is located on the southeastern coast of the Kenai Peninsula in Beauty Bay, approximately 60 miles southwest of the City of Seward, Alaska. The Glass-Heifner Mine Site is located within KEFJ approximately 1 mile from the beach at the head of Beauty Bay (Figure 2). The geographic coordinates of the Site are approximately 59 degrees 33 minutes north latitude and 150 degrees 40 minutes west longitude.

2 Site Description, Previous Investigations, and Conceptual Site Model

This section summarizes all the known environmental information and historical activities that have occurred at the Site and presents this information in the form of a graphical conceptual site model (CSM). The development of a clear and thorough CSM is a critical component for ensuring that key site elements are considered before any samples are collected, gaining stakeholder approval, assisting the Contaminated Site Team in developing the DQOs (Section 4), and assisting the field team in making decisions in the field. Figure 5 is a graphical CSM that illustrates the information detailed in the following subsections.

2.1 Key Site Features

2.1.1 Site Description

The former Glass-Heifner mine is one of many small gold mines in the Nuka Bay area. The Site comprises approximately 40 acres of unpatented mining claims, which are located on the west side of Ferrum Creek at the head of Beauty Bay, at an elevation of about 200 feet above sea level. The area surrounding the site is densely vegetated with conifers and alder. The site is located approximately 200 feet to the southwest of Ferrum Creek.

The Site is developed with a mill building, several storage sheds, a bunkhouse, and the remains of another bunkhouse, which are located on a level pad approximately 200 feet by 225 feet in size (Figure 4). The milling equipment included two jaw crushers, a ball mill, and a Wilfrey concentrating table. The mine workings consist of surface trenches and a collapsed adit.

Previous studies have shown that arsenic is found in high concentrations in background soil samples.

Access to the mine is very limited because the Site is extremely remote. The Site is not shown on any major maps of the park. The nearest residential structure to the Site is a seasonal recreational cabin approximately 6 miles away.

Operational History

Gold ore was mined from at least three east-west trending, near-vertical quartz veins, ranging from 1 to 5 feet in width. The principal sulfide within the vein system was arsenopyrite, which occurred in lenses, sheets, and irregular masses. The gold was apparently free-milling and was liberated by crushing (Shannon & Wilson, 1996).

There are a series of tailings ponds that have been the focus of previous studies and led to the solidification and stabilization mitigations project after concentrations near 25% arsenic by weight in the ponds was encountered (Shannon & Wilson, 2006).

The ball mill, the focus of this PA/SI, was believed to have been in use for a limited period of time between 1965 and 1967 by the Glass and Heifner claimants (as opposed to other claimants at this site). The area sampled by the NPS measured approximately 3 feet wide by 4 feet long and was visually distinct from the surrounding soil. The ball mill has since been removed (NPS, 2008).

Waste Characteristics

Sample results collected by the NPS in 2008, indicated that approximately 1/3 cubic yard of mercury-contaminated soil is still in place at the ball mill area. Sample results also indicated the presence of arsenic at the Site at concentrations above ADEC cleanup levels. Due to the elevated levels of arsenic present in background soils, it has been noted that successfully completing a removal action of arsenic-contaminated soil is improbable (NPS, 2008). For the purpose of this investigation, mercury and arsenic are the contaminants of concern.

Site Geology and Hydrogeology

KEFJ has been shaped by glaciers, with active glacial processes and past glaciations being largely responsible for the fundamental morphology of the landscape. The area is characterized by steep mountain side slopes and cirque walls, formed during glaciation that shed the source rocks for surficial deposits. The deposits consist of primarily graywacke, schist, and phyllite, which cover the majority of KEFJ, and include alluvium on river floodplains (NPS, 2018).

The former Glass-Heifner mine presumably rests on a veneer of glacio-alluvial deposits. An impermeable layer of bedrock or glacial till is expected at a relatively shallow depth. Subsurface water has not been encountered regularly in previous investigations, however there is a possibility of a perched aquifer on the impermeable layer with the only vertical migration being limited to cracks and faults in the bedrock or till (Shannon & Wilson, 2006).

Site Hydrology

According to previous investigations by Shannon & Wilson, the depth to the regional aquifer is unknown. Assumptions have been made with regional geology that the subsurface hydrology is controlled by the presence of bedrock or impermeable glacial till. It is also likely there is a colluvial/alluvial gravel aquifer along the base of the hillslope along Ferrum Creek (Shannon & Wilson, 2006).

It was noted that there was no observed evidence of large volumes of surface water running through the site, meaning that the risk of a large redistribution of contamination was low.

Local Climate

The Site is located within a maritime climatic zone, characteristics of which are: small temperature variations, high precipitation, high humidity, gusty winds, and regular occurring fog and clouds. According to United States Climate Data (U.S. Climate Data, April 2020), the average annual high temperature in the Seward area is 46 degrees Fahrenheit (ºF) and the average annual low temperature is 34ºF. The average annual precipitation is 71.82 inches.

Sensitive Environments

The Site is located within a national park; therefore, the entire area is considered a sensitive environment. The area has runs of anadromous fish (salmon) along with resident fish (e.g. dolly varden). It is home to many species of birds including bald eagles and small and large mammals. As the surface water from the site drains to Ferrum Creek, which terminates into Beauty Bay, saltwater species of fish and marine mammals may also be affected.

2.2 Summary of Previous Investigations

Various investigations have been performed by the NPS in attempts to characterize the site. These investigations are summarized as follows:

- June 1994 – Discovery of arsenic-bearing mine tailings at the Beauty Bay Mine
- July and August 1994 – NPS site visit and sampling
- May 1995 – NPS site visit and sampling
- August 1995 – NPS and Shannon & Wilson site visit and sampling
- January 1996 – Beauty Bay Mine Evaluation/Cost Analysis (EE/CA) released
- July 1998 – Removal Action completed
- August 1999 – NPS site visit to observe condition of stabilized tailings
- July 2000 – NPS site visit to observe condition of stabilized tailings
- August 2006 – Site visit to observe condition of stabilized tailings
- September 2006 – Removal Action Summary released
- July 2008 – Hazardous barrel and container removal, with sampling conducted under ball mill/rock crusher and amalgamator

2.2.1 Data Quality/Usability

A total of five soil samples were taken at the ball mill in July 2008 by the NPS. They were then stored and submitted to TestAmerica Laboratories, Inc., for laboratory analysis. Soil samples were analyzed for total metals by the EPA 6010/7000 Method Series. Mercury in soil was analyzed by EPA Method 7471A.

One sample (SO7280803) exceeded both the background value (7.6 mg/kg) and ADEC cleanup level (18 mg/kg) for mercury with a concentration of 101 mg/kg. A separate sample (SO7280805) exceeded the background value (8,700 mg/kg) and ADEC cleanup level (4.5 mg/kg) for arsenic with a concentration of 42,200 mg/kg.

The analysis methods used in the July 2008 investigation are concurrent with the planned investigation and may be used for site characterization.

2.2.2 Preliminary Identification of Data Gaps

The primary data gaps are as follows:

- The lateral and vertical extent of mercury and arsenic impacts in the ball mill area
- Potential impacts to ground and surface water

Applicable information from previous investigations teamed with data collected during this investigation will be used to close these data gaps.

2.2.3 Contaminants of Potential Concern

The Site is a former gold mine. The area of specific concern is the ball mill area, where a small release of mercury occurred upon the degradation of the mill. Arsenic is a known contaminant of varying concentrations around the site and surrounding area.

2.2.4 Media of Potential Concern

The media of potential concern at the Site are soil, groundwater, and surface water, though groundwater has not been encountered in previous investigations at the ball mill and there are no indications of regular surface water drainage (Shannon & Wilson, 2006). Soil is the medium of primary concern because the mercury is not believed to be abundantly mobile in the Site.

2.3 Current and Future Property Use Scenarios

The site is currently used by visitors of KEFJ for recreation purposes. Potential human receptors are visitors to KEFJ and the NPS personnel who work there and maintain the area.

Potential ecological receptors include birds nesting in the area, fish living in or traveling through potentially impacted waters of Ferrum Creek, mammals crossing the site or consuming plants, and animals living within the impacted area that may be exposed to contaminants.

The primary potential human exposure route is direct contact with the contaminated soil. The ingestion of groundwater pathway by humans is considered complete but at this time insignificant because no drinking water well exists in this immediate area. As the NPS is the land owner, no well will be installed in the foreseeable future.

For wildlife, the primary exposure route would also be direct contact of animals burrowing or digging into the impacted soils. Exposure through ingestion could also occur through consumption of plants and animals living within the impacted zone, such as wild plants, fish, birds, or mammals that are gathered/hunted for subsistence.

2.4 Graphical Conceptual Site Model

Figure 5 presents the CSM for the Site. The CSM provides visual representations of the potentially impacted receptors (humans, birds, mammals, fish, and plants) and soil layers, and the potential transport of contaminants from the site through precipitation/leaching to the groundwater and into Ferrum Creek.

2.4.1 Key CSM Assumptions

The following assumptions were made in preparation of the graphical CSM:

- Approximately one-third of a cubic yard of soil contains mercury above ADEC cleanup levels.
- Arsenic exists naturally at the Site above ADEC cleanup levels.
- Plant roots extend into the impacted zone.
- Invertebrates and insects preyed upon by small mammals are living in the impacted soils.

- Groundwater is present beneath the Site at just above the level of the river.
- Groundwater flow is to the north and west, toward the river.

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3 DQO Planning Team and Stakeholders

The DQO Planning Team develops the project DQOs according to the DQO process. The DQO process is iterative, and team members may be added or changed in order to address technical issues that were not initially identified.

3.1 DQO Planning Team

Table 3-1: DQO Planning Team

Team Members	Title	Contact Information	Roles and Responsibilities in DQO Process
Bill Heubner	NPS Project Manager	907-644-3384	The NPS Project Manager will ensure the needs and goals of the NPS are met.
Nino Muniz, PG	Ahtna Project Manager	907-433-0731	The Ahtna Project Manager will provide the analytical and hydrogeological information or the NPS Project Manager to allow him to achieve the NPS needs and goals.
Marty Brewer	Ahtna Senior Chemist	907-433-0702	The Ahtna Chemist will help establish laboratory and field QC criteria and project action limits. The chemist will communicate any data validation issues and data review corrective actions with the Ahtna Project Manager and the Laboratory Project Manager.

NPS: National Park Service
PG: Professional Geologist

3.2 Decision-Makers

The decision-makers have the ultimate authority for making final decisions based on the recommendations of the DQO Planning Team. The decision-maker for this project is Bill Heubner (NPS Project Manager).

3.3 Stakeholders

Stakeholders are parties who may be affected by the results of the investigation and/or persons who may later use the data resulting from the DQO process. The stakeholder for this project is the NPS.

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4 Data Quality Objectives

The DQO process specifies anticipated project decisions, the data quality required to support those decisions, specific data types needed, data collection requirements, and analytical techniques necessary to generate the specified data quality. The process also ensures that the resources required to generate the data are justified.

4.1 State the Problem

The claim for the former Glass-Heifner Mine lapsed in 2002, at which time the abandoned claim was reverted to the KEFJ management authority. In July 2008, the NPS collected soil samples from an area where a mercury release was suspected due to the degradation of an onsite ball mill. Analytical results confirmed the presence of mercury and arsenic above ADEC cleanup levels, which have the potential to leach into the surrounding soil, groundwater, and the nearby Ferrum Creek. The primary concern for the site is direct contact of contaminants with KEFJ visitors, NPS personnel, and wildlife.

4.2 Identify the Goal of the Investigation

The goal of this PA/SI is to determine the current status of the mercury and arsenic impacts at the project site, whether there is a risk for future migration of these metals to groundwater and surface water, and whether or not they pose a risk to future site users and wildlife. This PA will provide analytical data showing the concentration, and vertical and horizontal extent of mercury and arsenic impacts in soils at the ball mill, and may answer the question of whether the impacted soils can migrate to the groundwater or surface water in the future. With this information, a SI report will be written and recommendations for remedial action, continued monitoring, or no further action, can be made.

4.2.1 Principal Investigation Questions

The principal investigation questions are the following:

- What is the extent of the mercury and arsenic impacts at the ball mill of the Glass-Heifner Mine Site?
- Are the arsenic impacts observed due to mining activities or within naturally occurring levels?
- Is there potential for contamination to migrate into the area's groundwater or surface water drainages?
- Is the contamination currently posing an unacceptable risk to human health and ecological receptors, or could it in the future?

The primary receptors are as follows:

- KEFJ visitors/recreational users
- NPS personnel accessing the site
- Vegetation

- Invertebrates in the soil
- Birds and small mammals ingesting invertebrates or plants
- Fish that may encounter contaminated surface water
- Large mammals ingesting fish, birds, other mammals or plants

4.3 Identify Information Inputs

4.3.1 Previous Data Usability

A total of five soil samples were collected at the ball mill in July 2008. They were then stored and submitted to TestAmerica Laboratories, Inc., for laboratory analysis. Soil samples were analyzed for total metals by the EPA 6010/7000 Method Series. Mercury in the soil was analyzed by EPA Method 7471A.

One sample (SO7280803) exceeded both background values and ADEC cleanup standards for mercury with a concentration of 101 mg/kg. A separate sample (SO7280805) exceeded background values and ADEC cleanup standards for arsenic with a concentration of 42,200 mg/kg.

The analysis methods used in this investigation are concurrent with the planned investigation and may be used for site characterization.

4.3.2 Data to be Collected in the Current Investigation

The new data required to answer the principal investigation questions are as follows:

- Five primary samples and one duplicate sample collected and analyzed for the following:
  - Mercury
  - Arsenic
- 10 total samples to evaluate the naturally occurring levels of arsenic
- Sample locations by Global Positioning System (GPS) coordinates or swing ties from known features collected by NPS personnel.

Table 4-1 shows the specific requirements for the sampling event to be conducted June 2020 and how each type of data will be used. The FSP is detailed in Section 5.

Table 4-1: Soil Project Sampling Requirements

Sample Type	Sample Use
Discrete Soil	Assessment of extent and concentration of mercury/arsenic impacts
Background Soil	Assessment of existing arsenic levels

4.4 Define the Boundaries of the Investigation

4.4.1 Spatial Boundaries

The boundary of the investigation will consist of the impacted area directly adjacent to the former ball mill. Background samples will be collected from unimpacted media near the project site.

4.4.2 Temporal Boundaries

One mobilization will take place as part of this SI, and the sample collection will take place over a single day in June 2020.

4.4.3 Sampling Units

The sample units for this project are defined as:

- Five primary soil samples
- One duplicate soil sample
- 10 background soil samples

4.4.4 Decision Units

The decision unit associated with this PA/SI is the former ball mill area within the Site.

4.5 Develop the Analytic Approach

4.5.1 Decision or Estimation Parameters

The population of this project is all the samples collected at the Site. ADEC Method Two Cleanup levels will be used to evaluate the analytical results of the samples collected.

4.5.2 Action Levels

The ADEC Method Two Cleanup levels will define the action levels for this site. Data from background samples may be used to adjust arsenic action levels.

4.6 Performance or Acceptance Criteria

The purpose of this step is to establish the criteria needed to maximize the ability of the investigation to obtain the data needed to attain the principal investigation objectives accurately and with confidence. Those objectives include the vertical and horizontal extent of mercury impacts and the background concentration of arsenic at the site.

4.6.1 Quality Assurance/Quality Control

This section details the quality assurance/quality control (QA/QC) measures that will be implemented during the investigation to minimize variability, mitigate the potential for false positive and/or false negative error, and increase accuracy and defensibility in the collected data. QA/QC procedures apply to both the laboratory and field operations. Soil QC criteria can be found in Table 4-2.

Table 4-2: Soil QC Criteria

Analyte	Method	Container	Preservation	Holding Time	Laboratory MDL (mg/kg)	Laboratory PQL (mg/kg)	ADEC (Method Two, Most Conservative Cleanup Level (mg/kg)
Arsenic	SW6020	4-ounce jar	none	6 months	0.05	0.25	0.20
Mercury	SW7471	4-ounce jar	none	28 days	0.009	0.03	0.36

ADEC: Alaska Department of Environmental Conservation
MDL: method detection limit
mg/kg: milligrams per kilogram
PQL: practical quantitation limit

Data quality indicator (DQI) criteria have been specified relative to the performance needs of the project. The DQIs include precision, accuracy, representativeness, completeness, comparability, and sensitivity. See Table 4-4 for DQIs. The laboratory's reporting limits have also been evaluated to ensure DQOs can be met.

Laboratory QA/QC

The laboratory will be approved by ADEC to perform analysis of soil samples for arsenic by SW6020 and mercury by SW7471A. Laboratory SOPs for the preparation as well as those for the analyses of soil samples by these methods and the laboratory Quality Assurance Manual are available in Appendix B.

Laboratory QC Samples

The laboratory will perform method-required batch QC as per its SOPs (Appendix B).

Field QA/QC

Field quality procedures will follow Ahtna SOP-10 (see Appendix A).

Field QC Samples

There will be one field duplicate for arsenic and mercury associated with the five primary soil samples collected that are not for background purposes. The duplicate will be qualified by a "D" designation following the corresponding primary sample identification (ID).

Background Samples

Background samples are collected when naturally occurring or ambient concentrations of one or more contaminants may be present at the Site, and/or to delineate the contribution of contaminants from the Site versus off-site sources. The rationale for choosing appropriate background reference sample locations is presented in Section 4.7, and background sample collection protocols are presented in Section 5.

According to ADEC's March 2009 *Arsenic in Soil Technical Memorandum*, arsenic is both naturally occurring and variable in concentration; therefore, evaluation on a site-specific basis is warranted.

Ahtna will also follow EPA Guidance for *Comparing Background and Chemical Concentrations in Soil for CERCLA Sites* (EPA, 2002) as suggested by ADEC, and ADEC *Guidance for Evaluating Metals at Contaminated Sites* (ADEC, 2018) in calculating an upper tolerance limit (UTL) for use in comparison to data collected from within the mercury-impacted area.

Ten discrete soil samples will be collected from outside the impacted area and analyzed for arsenic by SW6020 to provide a sufficient number of results for statistical analysis. The background samples will be taken as far away from the mercury-impacted area as possible and as practicable.

Decontamination Procedures

All non-disposable sampling equipment will be cleaned off with a wire brush and then wiped with paper towel. . The brush and paper towels used for decontamination will be bagged along with all disposable sampling equipment and personal protective equipment (PPE).

Instrument/Equipment Testing, Inspection, and Maintenance

The field team will take care to protect the X-ray fluorescence (XRF) analyzer during transport to the site. All equipment will be calibrated, maintained, and operated according to manufacturer recommendations provided by TTT Environmental in Anchorage, Alaska.

Instrument/Equipment Calibration and Frequency

An XRF analyzer calibrated (prior to mobilization) to mercury will be used to field-screen soils. Starting at the middle of the impacted area, step-out samples will be taken in each of four directions until the presence of mercury is no longer detected by XRF.

In the middle of the area, a hand auger will be used to drill down in 6-inch increments. Each 6-inch increment will be field screened until the presence of mercury is not indicated, until the extent of the hand auger is reached (5 feet), or refusal is met.

Inspection/Acceptance of Supplies and Consumables

The field team will inspect containers provided by the laboratory prior to mobilization to ensure that the correct number of containers was provided.

Special Training and Certification

Sampling will be performed by a qualified environmental professional, as defined by 18 AAC 75.333.

Field Audits

A field audit will not be required for this small, straightforward, field sampling effort.

DQIs Table

DQIs that apply to this project are summarized in Table 4-3.

Table 4-3: Data Quality Indicators

DQIs	Matrix	Parameter	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC for Field (F), Laboratory (L), or Both (F&L)
Precision	Soil	Mercury, Arsenic	RPD ≤ 50% for both field samples when ≥ the PQL	Field duplicates	F&L
Precision	Soil	Mercury, Arsenic	RPD ≤ lab limits % for both field samples when ≥ the PQL	MS/MSD	L
Accuracy	Soil	Mercury, Arsenic	Spike recovery ± lab limits %	MS/MSD	L
Accuracy	Soil	Mercury, Arsenic	Contamination – no target compounds ≥ the PQL	Field blanks, equipment blanks, trip blanks, instrument blanks	F&L
Representativeness	Soil	Mercury, Arsenic	Appropriate sample design and SOPs developed through DQO process	Data verification and data validation, reconciliation with DQOs, and data usability evaluation will be conducted (Section 4.6.3 and Section 7.3).	F
Completeness	Soil	Mercury, Arsenic	95%	Number of valid samples relative to field sample plan	F

DQIs	Matrix	Parameter	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC for Field (F), Laboratory (L), or Both (F&L)
Comparability	Soil	Mercury, Arsenic	Appropriate sample design developed through DQO process; one laboratory and one analytical method used for each type of analysis; SOPs for sample collection and analysis will be followed – data verification	Data verification and data validation will be conducted (Section 4.6.3) during the investigation and after data are received from the laboratory.	F&L
Sensitivity	Soil	Mercury, Arsenic	± 20% at PQL	Laboratory standard blank at PQL	L

DQI: data quality control
DQO: data quality objective
F: field
L: laboratory
QC: quality control
MS/MSD: matrix spike/matrix spike duplicate
PQL: practical quantitation limit
RPD: relative percent difference
SOP: standard operating procedure

4.6.2 Decision Error Limits and Uncertainty Evaluation

The acceptable limit is 0.1 for both Type I (false positive that the null hypothesis is rejected) decision error and Type II decision error (false negative that null hypothesis is not rejected).

4.6.3 Data Validation and Usability

All analytical data will be reviewed by the Ahtna Project Chemist in accordance with this SAP.

Data Verification

The Ahtna Project Chemist will verify approximately 10% electronic data deliverable (EDD) results against the final hard-copy laboratory deliverables in order to assure accuracy of the data as well as a verification that the lab-provided data are as planned and/or requested.

Data Validation

All analytical data generated will undergo a Stage 2A data review in accordance with the EPA document *Test Methods for Evaluating Solid Wastes*, SW-846, revision 8 (EPA, 2014); EPA *Contract Laboratory Program National Functional Guidelines for Inorganic Review* (EPA, 2017); ADEC's *Minimum Quality Assurance Requirements for Sample Handling, Reports, and Laboratory Data Technical Memorandum* (ADEC, 2019); and ADEC's *Treatment of Non-Detect Values, Data Reduction for Multiple Detections and Comparison of Quantitation Limits for Cleanup Values Technical Memorandum* (ADEC, 2017) where and when applicable. An ADEC Laboratory Data Review Checklist will be completed for each sample delivery group provided by the laboratory.

4.7 Plan for Obtaining the Data

Five discrete soil samples will be collected from the impacted soil area along with one duplicate sample. Four of the samples will be collected at the horizontal extents of the impacted area, as determined by XRF field screening; one sample will be collected from the vertical extent at the center of the impacted area as determined by XRF field screening.

Ten background samples will be collected for analysis of the presence of arsenic. The samples will be collected as far away as practical from the impacted zone and known areas of elevated concentrations from previous investigations. The Ahtna field team lead will coordinate with the NPS engineer to determine sample locations.

5 Field Sampling Plan

The procedures outlined in this section will be followed for soil screening and sampling in the field. The following SOPs will be used and are included in Appendix A:

- SOP-01 – Logbook Documentation and Field Notes
- SOP-03 – Soil Sampling
- SOP-10 – Quality Control Samples
- SOP-11 – Sample Chain of Custody
- SOP12 – Labeling/Packaging/Shipping Samples
- SOP-13 – Equipment Decontamination
- SOP-18 – Field Screening of Soil with XRF

In addition, prior to boarding charter aircraft to mobilize to the site, all Ahtna and NPS personnel will change into footwear that has been brushed/cleaned of all plant seeds and soil that could potentially carry seeds to prevent the spread of invasive plant species into this area of the park.

5.1 Soil Sampling

Prior to discrete soil sampling, an XRF analyzer calibrated to mercury will be used to field-screen soils. Starting at the middle of the impacted area, step-out samples will be collected in each of four directions until the presence of mercury is no longer detected by XRF. In the middle of the area, a hand auger will be used to drill down in 6-inch increments. Each 6-inch increment will be field screened until the presence of mercury is not indicated, until the extent of the hand auger is reached (5 feet), or refusal is met.

After completion of field screening, soil confirmation samples will be collected using disposable sampling spoons at the vertical and horizontal extent of the mercury impacts. Five samples (plus a duplicate) will be collected for the presence of mercury and arsenic. In addition, 10 background samples will be collected for arsenic.

5.1.1 Soil Sampling Locations

Soil confirmation samples will be collected at the four horizontal extents of the mercury-impacted area designated by the XRF field screening, as well as one sample at the determined vertical extent in the center of the contaminated area. The approximate anticipated locations of the confirmation samples are shown on Figure 4. The background samples will be taken as far back from the mercury-impacted area as possible and as practicable.

5.1.2 Soil Sampling Protocol

Field screening samples will be collected with the XRF analyzer in accordance with SOP-18. Soil samples will be collected in accordance with SOP-03. Samples will be labeled, packed, and shipped

according to SOP-12 and chain-of-custody (COC) forms will be filled out according to SOP-11. All SOPs are included in Appendix A.

5.1.3 Soil Sampling Health and Safety

Elevated levels of arsenic are a known risk at the Site. Field personnel will use proper PPE and hygiene practices to prevent exposure.

5.1.4 Soil Field Measurements

As discussed in Section 5, an XRF analyzer calibrated to mercury will be used to field-screen soils, using step-out methodology to find the vertical and lateral extent of the mercury in the soils.

5.1.5 Soil Analytical Measurements/Methods

All discrete soil samples will be analyzed for mercury and arsenic by methods SW7471 and SW6020, respectively. Background samples with be analyzed for arsenic by method SW6020. Table 5-1 presents the analytical methods for the site characterization. Laboratory performance and analytical results will be checked through a QA review, which will include ADEC's Laboratory Data Review Checklist. The review will assess analytical quality through six DQIs: precision, accuracy, representativeness, comparability, completeness, and sensitivity.

Table 5-1: Soil Analytical Methods

Analyte	Matrix	Number of Samples	Method	Container	Preservation	Holding Time
Arsenic	Soil	16	SW6020	4-ounce jar	none	6 months
Mercury	Soil	6 (5 primaries, 1 duplicate)	SW7471	4-ounce jar	none	28 days

5.2 Sample Handling

This section describes the sample handling protocol for environmental samples collected during the investigation.

5.2.1 Sample Designation

Each sample will receive a unique designator. Unique designators may be an alphanumeric combination that signifies the location or decision area, matrix, depth, or river reach, etc.

5.2.2 Sample Labeling

All samples will be labeled with the following:

- Sample ID

- Matrix
- Date collected (MM/DD/YYYY)
- Time collected (24-hour format)
- Preservative (if applicable)

5.2.3 Sample Handling and Chain of Custody

All samples will be placed in a cooler with sufficient gel ice to keep sample temperatures at 4 degrees Celsius (°C) ± 2°C until delivery to the project laboratory under standard COC procedures. A temperature blank will be included with each cooler.

Sample coolers will be shipped to Eurofins TestAmerica (Eurofins) in Seattle, Washington, for analysis. The Eurofins Project Manager is Elaine Walker.

The laboratory-provided COC forms will be used to track the possession of each sample from the time it is collected to the time it is accepted by Eurofins. COC procedures will be followed as outlined in SOP-11, included in Appendix A. One COC form will be required per cooler. An example COC form is provided along with other field forms in Appendix D.

5.2.4 Documentation and Records

A written record of all field activities will be kept in a field logbook. All entries will be legible, written in waterproof ink, and contain accurate and inclusive documentation of the field activities. Errors or changes will be noted using a single line to cross out the entry and will be dated and initialed. The logbook will be maintained as part of the permanent record for the site. All field logbook entries will be dated and signed. Activities and observations to be noted in the logbook include the following:

- Name of author and date and time of entry
- Documentation of equipment calibration
- Location of activity and site conditions
- Names and affiliations of onsite personnel
- Field observations and comments
- Weather conditions
- Rationale for sampling locations and for any changes to sampling protocol
- Locations of site photographs
- Site sketches with sample location measurements
- Health and safety comments

5.3 Investigation-Derived Waste Handling

Investigation-derived waste (IDW) streams expected from this project include soil used for field screening, decontamination materials, disposable PPE, and sampling materials.

Any soil removed for field screening will be returned to the hole from which it was removed. Paper towels used for decontamination water will be bagged along with all disposable sampling equipment and PPE. This IDW will be taken off site and disposed as solid waste.

5.4 Health and Safety

A Site-Specific Health and Safety Plan is included in Appendix C.

6 Data Management

The laboratory will provide an Excel EDD for this project as well as a pdf document of the Level 2 laboratory report. Ahtna's Project Chemist and Database Manager will be responsible for data handling and tabulating results including any appropriate data validation qualifiers. Ahtna will use ProUCL 5.1 to calculate the background UTL for arsenic.

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7 Assessment and Oversight

This section describes the measures that will be employed to ensure that this SAP is implemented properly.

7.1 Assessment and Corrective Actions

7.1.1 Field Audit and Response Actions

During field activities, QA audits will be completed to ensure that the procedures outlined in this SAP are being followed. Baley Lenhart, Ahtna Environmental Engineer, is responsible for QA/QC in the field. The samples collected for laboratory analysis will be entered onto COC forms and cross-checked with the sample label to verify all sample names, dates, and times are correct. If discrepancies are found between the COC and samples, the QA/QC responsible person will make the necessary corrections and initial any changes made. The discrepancies will be noted in the field logbook for that day and reported to the Ahtna Project Manager.

7.1.2 Laboratory Audit and Response Actions

The laboratory QC manual and all QC procedures associated with each method can be found in Appendix B.

7.2 QA Reporting

A QA report detailing any deviations from the SAP will be generated at the end of the project or as required. Project QC forms will be maintained in three-ring binders at the site and will be readily available. Other forms to be used on this project include but are not limited to the following:

- Copies of all contract modifications, arranged in numerical order, including documentation that modified work was accomplished
- An up-to-date copy of the deficiency tracking system
- Audit checklists (if necessary)

All field records will be maintained at the site until fieldwork is completed. At that time, the field team will transfer all records for archival in the project file. Reports will be generated by the Ahtna field team, and reviewed by the Ahtna Project Manager.

7.2.1 Data Verification

All field documents, along with laboratory deliverables, will be collected and verified. This step includes, but is not limited to, ensuring that data for all samples have been provided, all relevant laboratory internal QC data (including raw data) have been provided in the report, and the specified analytical methods were used by the laboratory.

7.2.2 Data Validation

Ahtna will perform a validation assessment of data quality on all laboratory data. This validation step includes, but is not limited to, documenting the data verification process, summarizing the samples and analyses, reviewing samples and analyses, reviewing sample handling, reviewing the laboratory QC data, assigning qualifiers, reviewing the QA data from the third-party laboratory, reviewing limits of quantitation (LOQs) and limits of detection to determine if non-detect results are greater than the project quantitation limits (PQLs), defining LOQs greater than the PQLs, compiling a table of rejected data, and compiling a sample summary table.

7.3 Reconciliation with DQOs and Data Usability

Ahtna will use the Data Assessment Goals defined in Table 4-4 as guidance for DQOs. Deviations from these goals and laboratory DQOs will be evaluated against the data collected to determine usability.

8 Investigation Outputs

A final SI report will be completed to meet the NPS requirements, as stipulated in the scope of work. The report will be prepared in pre-draft, draft, and final form with responses to the NPS and/or ADEC's comments addressed in a written response to comments. The report shall utilize the NPS SI report format and include the following information:

- Cover page for the SI report with the name and signature of the NPS Project Manager and KEFJ representative
- A narrative report describing fieldwork activities, including variances from the planning documents
- Tables, drawings, and figures to support the narrative report, summarize site data, show locations of field activities, and illustrate processes and decision matrices
- Appendices containing copies of all chemical data generated; copies of waste manifests, waste profile sheets, certificates of disposal, and other pertinent documentation; copies of all field notes, logs, forms, and Daily Contractor QC Report, and photographs
- Analytical data review, which summarizes the completed ADEC Laboratory Data Review Checklists; these checklists shall be complete and submitted with laboratory data in the draft report
- Recommendations for the Site

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9 References

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Appendix A – Standard Operating Procedures

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Ahtna Solutions, LLC

STANDARD OPERATING PROCEDURE FOR LOGBOOK DOCUMENTATION AND FIELD NOTES No. 01

1.0 INTRODUCTION

1.1 Purpose

The purpose of this standard operating procedure (SOP) is to direct field personnel in the techniques and requirements for recording information in logbooks and to ensure that field activities are properly documented. See SOP No. 100 for instructions on how to collect field notes during per- and polyfluoroalkyl substances (PFAS) investigations.

Adequate documentation is necessary to describe the work performed. Attention to detail is vital as field logbooks have been shown to be useful in administrative and judicial proceedings and for cost recovery measures.

1.2 Scope

The scope of this SOP is to describe the data entry requirements and suggested format for field log books.

2.0 RESPONSIBILITIES

Field Personnel – Each person in the field is responsible for maintaining a field logbook, as applicable.

Field Team Lead (FTL) – The FTL is responsible for reviewing the adequacy of the logbooks during fieldwork.

Project Manager (PM) – The PM is responsible for reviewing the adequacy of the logbooks after fieldwork.

3.0 DEFINITIONS

Field logbook – A portable, bound, project dedicated, paginated, weatherproof notebook used to record daily field activities and act as a historical, factual record of events.

Field datasheets – Any documentation that is supportive of the field logbook information that is important for preserving an accurate historic record of field activities but is recorded on unbound paper. These records should be referenced in the field logbook and include groundwater sampling

datasheets, equipment calibration datasheets, photograph logs, soil boring logs, chain of custody forms, shipping manifests, daily tailgate meeting records, etc.

Electronic Datasheets – Any documentation that is supportive of the field logbook information that is important for preserving an accurate historic record of field activities but is recorded electronically through field instruments. These records should be referenced in the field logbook and include global position system (GPS) coordinates, pressure transducer data, photographs, etc.

4.0 EQUIPMENT

The following equipment is required:

- A bound field logbook with pre-numbered consecutive pages
- blank waterproof, indelible pens/markers in black or blue ink (Note: waterproof materials should not be used during PFAS investigations)

5.0 PROCEDURE

5.1 Field Logbooks

Logbooks shall be specific to a specific team member(s) for the duration of the project and/or specific task.

Each logbook shall contain the following information on the cover:

- Owner of the book
- Book number
- Job name and project number
- Project task, if applicable
- Start date
- End date

It is useful to include project contact information on the inside front cover or first page of the logbook. Contact information includes names and phone numbers of subcontractors, project assistants, field team members, and emergency numbers from the site-specific health and safety plans.

Each logbook page shall include the following:

- Top of each page
    - Job name and/or project number
    - Date
    - Weather
    - Team members names or initials

- Bottom of each page

    - Date and signature of the field author
    - It is also helpful to number the pages of the logbook created each day
        - Example: 5 pages of notes were created. The first page would read "1 of 5"
- Date and signature of the field author over any remaining blank lines

Logbooks entries shall adhere to the following guidelines:

- Pages shall never be removed from the logbook
- All information must be printed legibly and in black or blue waterproof, indelible ink
- Entries shall be written using objective and factual language, without subjective conclusion
- Entries shall be made in chronological order
- Entries shall be made on subsequent lines such that no blank lines exist on each page
- If any space remains on the bottom of the last page of field entries at the conclusion of the day's entries, a diagonal line shall be drawn to obscure any additional entries on that page
- If corrections are necessary, a single line may be drawn through the original entry, initialed, and dated. The corrected information may then be added and should be initialized and dated.
- If it is necessary to transfer the logbook to an alternative team member during the course of the field work, the person relinquishing the logbook shall sign and date the logbook at time of transfer.

At a minimum, the standard daily entries shall include the following:

- Date and time; time shall be based on the 24-hour clock (i.e., 2100 instead of 9 pm)
- Weather conditions and changing weather that may impact site conditions
- Site conditions and other important observations
- Full names and titles/roles of personnel on-site, including visitors, subcontractors
- Daily objectives
- Time and location of activities
- Work start/stop times
- Level of PPE
- All relevant field observations, major task decisions, comments, or other valuable site investigation information
- References to relevant datasheets and documentation preserved outside the logbook such as groundwater sampling datasheets, soil boring logs, etc. It is not necessary to duplicate all the information referenced on the datasheets in the logbook. Examples of data that would be duplicated include, sample ID, sample time/date, sample QC information, sample analyses, sample matrix, etc.
- Location of work areas (sketches or photographs when appropriate, with north arrow and approximate scale)
- Survey and/or location of any sampling points, including swing-tie measurements
- Type of field instrumentation (model number and serial number) and all calibrations performed
- Decontamination times and methods
- All field measurements
- Type, amount, and method of disposal for investigation-derived waste

- Changes/deviations from the work plan and reason for deviations
- Any general observations or notes
- Sample record (sample identification, date, time, media, number of samples, and location)
- Any communication with the PM or client pertaining to decisions being made in the field
- Persons contacted and topics discussed

Correct erroneous field record or logbook entries with a single line through the error. Do not erase incorrect information. Date and initial revised entries. Logbooks and field forms will be kept in the project file when complete or when not in use.

5.2 Field Datasheets

All unbound data documentation is a part of the field records and should be maintained with safe document handling and archiving procedures. These records should be recorded in black or blue waterproof, indelible ink and on weatherproof paper as necessary. As soon as possible, the unbound records shall be scanned to create an electronic record to ensure document preservation.

5.3 Electronic Datasheets

All electronic data that are part of the field records shall be downloaded to a designated location and maintained for project use. Care must be taken when downloading the electronic data to ensure that the original record is preserved. Naming conventions should be used to indicate the project, date, and other relevant information to ensure accurate use.

5.4 Document Control

At the conclusion of a task or project, all field documentation, including the field logbook, field datasheets, and electronic data, shall be scanned in and placed on the server in the appropriate folder. All original documents shall be submitted to the PM and kept in the project file.

6.0 REFERENCES

Alaska Department of Environmental Conservation (ADEC), 2017. *Site Characterization Work Plan and Reporting Guidance for Investigation of Contaminated Sites*, March 7.

ADEC, 2019. *Field Sampling Guidance*, October.

7.0 REVISION LOG

Revision Date	Author	Revision Details
1/2/2014	Brandie Hofmeister	Initial Issue
4/15/2016	Andrew Weller	Reference Section: ADEC Field Sampling Guidance Updated, Project-Specific Statement of Work Removed
12/1/2016	Ashley Olson	Logo
2/23/2017	Katelyn Barnett	Logo

Revision Date	Author	Revision Details
10/31/2017	Leslie Davis	Reference Section: ADEC Field Sampling Guidance Update (2017)
12/12/2017	Lexie Lucassen	Updated ADEC Site Characterization Reference (3/7/2017)
4/17/2019	Ashley Olson	Updated various components of the SOP for clarity
4/12/2020	Mike Records	Reference Section: ADEC Field Sampling Guidance Update (2019)

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Ahtna Solutions, LLC

STANDARD OPERATING PROCEDURE FOR SOIL SAMPLING No. 03

1.0 INTRODUCTION

1.1 Purpose

The purpose of this standard operating procedure (SOP) is to direct field personnel in the techniques and requirements for collecting soil samples from both the surface and subsurface soils.

1.2 Scope

The scope of this SOP is to cover all aspects of soil sampling conducted by Ahtna personnel including, but not limited to, surface soils and subsurface soils, such as stockpiles, excavations, and drilling cores. The techniques described in this SOP are primarily based on the Alaska Department of Environmental Conservation (ADEC) Field Sampling Guidance, dated October 2019. This SOP does not apply to sediment sampling.

2.0 RESPONSIBILITIES

Project Manager (PM) – The PM is responsible for providing adequate resources to the field staff and ensuring that field staff has adequate experience and training to successfully comply with the SOP. The PM is responsible for approving and documenting techniques that are not specifically described in this SOP, but are considered the best sampling methods for the current project.

Site Safety and Health Officer (SSHO) – The SSHO oversees site-specific health and safety activities and ensures compliance with the project requirements. The SSHO conducts personal protective equipment (PPE) evaluations, selects the appropriate PPE, lists the requirements in the site-specific safety and health plan (SSHP), and coordinates with the field team to implement the SSHP.

Sampler – The sampler is responsible for the collection of samples as specified in this SOP and shall meet the minimum qualifications listed in 18 Alaska Administrative Code (AAC) 75.333(c) to be a “qualified sampler” (ADEC, 2018).

3.0 DEFINITIONS

Auger flight – A steel section (typically 5-feet long) attached to an auger to extend the auger as coring depth increases.

Composite sample – Two or more grab sub-samples (aliquots) taken from a specific soil and site at a specific point in time. The aliquots are collected and homogenized, and then a single average sample is collected from the mixture.

Grab sample – A discrete portion or single aliquot collected from a specific location at a given point in time. Grab samples are not composited.

Hand auger – A stainless steel cylinder (bucket or tube) approximately 3–4-inches in diameter and one foot long, open at both ends with the bottom edge designed to twist into the soil and cut out a soil core. The bucket or tube collects the soil sample. The auger has a T-shaped handle (for hand operation) attached to the top of the bucket by extendable stainless-steel rod(s). A slide hammer can be attached, in place of the T- handle to drive a tube sampler.

Liner – A cylindrical sampling device generally made of plastic, brass, stainless steel, or Teflon, that is placed inside a split-spoon, macro-core or hand auger bucket to collect soil samples.

Macro-core – A piston rod sampling device, typically 4 or 5-feet long, generally made of carbon steel, which fits onto hollow push rods. A direct-push probe rig pushes the sampler to the desired sample depth, then extension rods are lowered through the hollow push rods to release a stop-pin which allows the sampler to be filled when advanced at the desired sampling interval.

Incremental Sampling Methodology (ISM) – A sampling method used to determine an average concentration of contaminants representative of soil contained within a defined area (decision unit), that is typically used in stockpiles, biocells, and excavation pits. The method uses a primary, replicate, and triplicate sample of the decision unit that are each collected from many (30-50) sub-samples (aliquots) to create a statistically valid result (see SOP No. 34).

Sampling spoon – a small, stainless steel device (typically disposable) that is operated with one hand to scoop soils into a sampling container or other vessel if homogenization is required. A small shovel may also be used to collect soil samples.

Sample syringe – Cut or open-end syringe used to core a measured quantity of soil that can be extruded into a sample jar that contains sodium bisulfate or methanol preservative.

Shelby tube – A cylindrical sampling device generally made of steel, which is driven into the subsurface soil through the hollow-stem auger or hand auger device with a slide hammer. The tube, once retrieved, may be capped and the undisturbed soil sample extruded in the laboratory prior to analysis.

Split-spoon sampler - A cylindrical sampling device generally made of carbon steel, which fits into a hollow stem auger. The split spoon is hinged lengthwise, which allows the sample to be retrieved by opening ("splitting") the spoon.

Surface soils – Under Alaska regulation 18 AAC 75.990(127), surface soil is defined as soil that extends from the surface to 2 feet below ground surface (bgs). However, the surface soils may be considered a different depth depending on the project goals. Note that surface soils may reside under a paved surface.

Subsurface soils – Under Alaska regulation 18 AAC 75.990(123), subsurface soil is defined as soil that is deeper than 2 feet bgs. However, subsurface soils may be considered a different depth depending on the project goals. Typically, subsurface soils are located above bedrock or any other consolidated material.

TerraCore® (Or EnCore®) sampler – A coring device that allows a specific quantity of soil to be collected (e.g., 5 grams and 25 grams). This device has a tight-fitting cap that seals with an O-ring. Samples collected in this manner may be frozen prior to shipment to the lab.

4.0 EQUIPMENT

The following equipment is typically used for sampling but does not include all types of equipment that may be used. Prior to mobilizing for fieldwork, the necessary equipment must be identified based on the type of sampling being conducted.

Equipment needed for all types of sampling includes the following.

- Bound field logbook with consecutive page numbers and waterproof, indelible pens/markers
- Sampling gloves
- Laboratory-supplied sample containers, preservatives, labels, chain of custody, custody seals, and temperature blanks
- Ice (gel ice or wet ice)
- Zip-top plastic bags and/or stainless-steel bowls, pans, or trays
- Survey stakes, flags, or whiskers
- PPE

Note that this SOP is intended to be used in conjunction with the following SOPs, and as such, the equipment and materials needed for those activities are not included in this SOP:

- Logbook Documentation and Field Notes (No. 01)
- Quality Control Samples (No. 10)
- Sample Chain of Custody (No. 11)
- Labeling, Packaging, and Shipping Samples (No. 12)
- Equipment Decontamination (No. 13)
- Incremental Sampling Methodology (No. 34)

4.1 Manual (Hand) Sampling

- Shovel, pickax, pick mattock, or other excavating tools
- Hand auger with extension rods, as necessary
- Toolkit

4.2 Split-Spoon or Shelby Tube Sampling

- Drill rig equipped with hollow-stem augers and a drop hammer
- Split-spoon or Shelby tube samplers (at least two)

- Split-spoon liners, as necessary
- Basket or spring retainers for loose soils
- Toolkit
- Boring log sampling forms

4.3 Continuous Sampling

- Drill rig equipped with direct-push capabilities and push rods
- Sufficient number of drill rod liners for the planned number of sampling intervals
- Hook-blade utility knife to cut the liners
- Basket retainers and caps for the liner ends for loose soils
- Boring log sampling forms
- Toolkit

5.0 PROCEDURE

5.1 Preparation

Prior to sample collection, follow these general steps:

1. Ensure that all dedicated sampling equipment is new, and all reusable, non-dedicated sampling equipment is decontaminated per the SOP.
2. Don the appropriate PPE, as specified in the SSHP.
3. Determine the sample collection locations based on the project goals and work plan specifications.

5.2 Soil Retrieval

5.2.1 Manual Retrieval

Soil samples may be collected from surface soils using hand tools, from subsurface soils using hand tools such as shovels or a hand-auger, or from subsurface soils exposed at the surface by heavy equipment in an excavation. For manual sampling, follow these general steps:

1. Ensure that the sampling area is safe for entry. If the sample is to be collected from within an excavation, ensure that the excavation meets all criteria for safe entry.
2. Use hand tools to access the depth required for sampling. If using a shovel or hand auger, place the soil cuttings on plastic sheeting or as specified in the work plan. If possible, lay the cuttings in stratigraphic order.
3. Collect soil for the samplefrom freshly uncovered soil using a disposable sampling spoon.

5.2.2 Split-Spoon Soil Retrieval

Subsurface soil samples may be collected from soil recovered from a split-spoon sampler when drilling with a hollow-stem auger drill rig. For sampling from this device, follow these general steps:

1. Remove any pavement or sub-base material that is obstructing access to subsurface soils from an area twice the diameter of the drill bit, as necessary.
2. Ensure that the drill rig and all tooling are decontaminated prior to drilling.
3. Set up the drill rig with the hollow-stem auger, the drill bit, and the center rod, and drill to the first sample depth.
4. As soil is brought to the surface with the auger flights, periodically remove these cuttings from the area as specified in the work plan.
5. When the sample depth is reached, remove the center rod and deploy the split-spoon sampler. Insert a liner prior to sampler deployment, as necessary.
6. With the sampler shoe at the ground surface in the sample location, mark the center rod with four 6-inch increments to allow for blows to be counted.
7. Drive the sampler using the hammer. Use a full 30-inch drop as specified by the American Society of Testing and Materials (ASTM) Method D-1586. Record the number of blows required to drive the spoon through each 6-inch increment.
8. Cease driving upon reaching the sampler length or refusal. Refusal is when little to no progress is made for 50 hammer blows.
9. Pull up the center rod and sampler and remove the sampler from the drill rods.
10. Open the sampler to access the soil, being careful not to disturb the soil. If using a sampler liner, slide the liner from the sampler without disturbing the soil. Wipe the outside of the sealed liner with a paper towel and mark the depth on the outside of the liner with a marker. Open the liner using a hook-blade utility knife. Typically, a ground cover should be placed in the working area so that soil unsettled from the sampler does not fall to the ground.

5.2.3 Direct-Push Soil Retrieval

Subsurface soil samples may be collected from a dual-tube sampler or a single rod sampler when using a direct-push drill rig or sonic drill rig, or a Shelby-tube sampler when using a hollow-stem auger drill rig with a hydraulic direct-push capability. All samplers use a plastic liner to allow for soil removal from the sampler. For sampling from these devices, follow these general steps:

1. Ensure that the drill rig and all tooling are decontaminated prior to drilling.
2. Drill to the first sample depth.
3. When the sample depth is reached, remove the drive tooling and deploy the sample barrel with a liner and a drive tip.
4. Advance the sample barrel through the desired sample interval and then retrieve the sample by retrieving the rods.
5. Retrieve the soil by sliding the liner from the sample barrel. The liner may need to be removed using a hydraulic extruder.
6. Wipe the outside of the sealed liner with a paper towel and mark the sample depth and top and bottom of the sample on the outside of the liner with a marker.
7. Open the sampler to access the soil by cutting twice along the liner length using a hook-blade utility knife. Typically, a ground cover should be placed in the working area so that soil unsettled from the liner does not fall to the ground.

5.3 Sample Collection

For all soil samples, follow these general steps:

1. Remove bits of vegetation and large gravel from the sample as these items are not analyzed and reduce the available sample volume for analysis.
2. Take care to prevent cross-contamination and misidentification of samples.
3. Properly label the sample according to the SOP.
4. Record the sample location (both horizontal and vertical), the sample date and time, and any other applicable information in the field notebook and on any applicable sampling forms prior to moving on to another sampling location. Note that samples collected from a soil recovery device during drilling should be collected from a discrete (short) depth interval.
5. Decontaminate any non-dedicated, reusable sampling equipment according to the SOP, prior to moving on to another sampling location.
6. Properly package and ship all samples according to the SOP.
7. Samples that are degraded by aeration (volatiles) shall be collected first and with the least disturbance as possible and immediately preserved. Collect a volatile grab sample using a sampling spoon or gloved hand, or as necessary, use a TerraCore® or EnCore® sampler to collect a pre-determined volume. Place volatile samples directly into a laboratory-supplied jar and preserve with applicable materials.
8. Samples that are not degraded by aeration will be collected after soil is homogenized. Collect a non-volatile grab sample using a sample spoon or gloved hand, and place the soil into a re-sealable plastic bag or bowl/pan/tray to homogenize the soil. Place the homogenized soil directly into a laboratory-supplied jar and preserve with applicable materials.
9. Make notes on the boring log regarding the soil characterization and geologic features, including any staining or olfactory observations (see SOP on soil logging). Note that samples should generally be collected prior to characterization of soil to preserve the integrity of the volatile samples.
10. Wipe down the jar threads to remove any bits of soil and close the jar with the lid, and wipe the outside of the jar, using a paper towel or other clean, dry wipes.
11. Label the sample container with the appropriate information, typically using a label with waterproof adhesive, or if not, securing the label with clear tape.
12. Place the sample container in the shipping container, typically a chilled cooler, and proceed with further sampling.
13. When sampling is complete, remove the drill rig to the decontamination area.

For specific types of sampling, follow the steps outlined in the following sections.

5.3.1 Discrete Sampling

Typically, discrete sampling is the preferred method of sampling unless otherwise dictated for the specific project. The locations where discrete samples are to be collected should be explained in a site-specific work plan.

5.3.2 Composite Sampling

Composite sampling may only be conducted if previously approved in a site-specific work plan. Composite samples should have equal aliquots of soil (as measured by mass) collected as discrete samples from all sub-locations. Aliquots of volatile samples will be collected directly into

laboratory-supplied jars and preserved immediately. Aliquots of non-volatile samples should be homogenized before placing into laboratory-supplied jars.

5.3.3 Incremental Sampling Methodology

ISM sampling may only be conducted if previously approved in a site-specific work plan. The ISM sampling approach shall be conducted in accordance with the Interstate Technology & Regulatory Council (IRTC) *Incremental Sampling Methodology Guidance*, dated February 2012. ISM sampling is similar to a composite sample in that equal aliquots of soil (as measured by mass) are collected in each gridded or celled decision unit (grid/cell dimensions to be determined based on decision unit size), using a random number generator to establish random planer and depth coordinates. A duplicate and triplicate sample should be collected using the same techniques as the primary sample, in order to verify than the ISM sample truly represents the decision unit. Care should be taken to ensure triplicate samples are not collected from co-located or adjacent locations. See SOP No. 34 for greater detail on collecting ISM samples.

5.3.4 Geotechnical Sampling

Note that for geotechnical sample collection, the soil should be left in the sampler liner, the ends capped to preserve the soil matrix integrity, and the sample transported to the laboratory for analysis. The soil should not be removed from the sampler liner prior to laboratory analysis.

6.0 REFERENCES

Alaska Department of Environmental Conservation (ADEC), 2018. 18 Alaska Administrative Code 75, *Oil and Other Hazardous Substances Pollution Control.* As amended through October 27.

ADEC, 2019. *Field Sampling Guidance*, October.

American Society of Testing and Materials (ASTM), 2008. *Standard Practice for Standard Penetration Test and Split Barrel Sampling of Soils, Standard,* Method D-1586-84, October 1.

ASTM, 2009. *Standard Practice for Soil Exploration and Sampling by Auger Borings*, Method D 1452, February 15.

Interstate Technology Regulatory Council (IRTC), 2012. *Incremental Sampling Methodology*, February.

7.0 REVISION LOG

Revision Date	Author	Revision Details
1/4/2013	Olga Stewart	Initial Issue
12/1/2016	Ashley Olson	Updated based on final ADEC sampling guidance, updated logo
2/23/2017	Katelyn Barnett Decker	Logo

10/31/2017	Leslie Davis	Updated ADEC sample guidance reference to 2017; removed old ADEC 2002 UST sampling guidance no longer referenced
3/9/2018	Lexie Lucassen	Replaced 2009 ADEC Draft Guidance on MI Soil Sampling with 2012 IRTC Guidance. Definition of sampler: Added "…and shall meet the minimum qualifications listed in 18 AAC 75.333(c)." Added this to the references section.
5/19/2019	Lexie Lucassen	Updated MI to ISM throughout. Added in-text reference to SOP No. 34, *Incremental Sampling Methodology*
9/30/2019	Lexie Lucassen	Removed double spacing, minor grammar edits, updated ADEC Field Sampling Guidance reference to 2018
1/23/2020	Mike Records	Section 5.2.3: Revised Step 6 to: "Wipe the outside of the sealed liner with a paper towel and mark the sample depth and top and bottom of sample on the outside of the liner with a marker."
4/12/2020	Mike Records	Reference Section: ADEC Field Sampling Guidance Update (2019)

Ahtna Solutions, LLC

STANDARD OPERATING PROCEDURE FOR QUALITY CONTROL SAMPLES No. 10

1.0 INTRODUCTION

1.1 Purpose

The purpose of this standard operating procedure (SOP) is to direct field personnel in the techniques and requirements for collecting field quality control (QC) samples from any matrix. Field QC samples are collected to ensure the reliability and validity of field and laboratory data.

1.2 Scope

The scope of this SOP is to describe the purpose and methods for collection of QC samples by Ahtna personnel for all sample matrices. The types and quantities of QC samples will be determined per project in the site-specific work plans.

2.0 RESPONSIBILITIES

Project Manager (PM) – The PM is responsible for providing adequate resources to the field staff and ensuring that field staff has adequate experience and training to successfully comply with the SOP. The PM is responsible for approving and documenting techniques that are not specifically described in this SOP but are considered the best QC methods for the current project. The PM is responsible for ensuring that project plans are complete and reviewed and approved by the appropriate personnel and organizations.

Site Supervisor (SS) – The SS is responsible for coordination of field activities including adhering to site-specific plans and ensuring that personnel are properly trained in the techniques necessary to follow this SOP.

Quality Control Manager – The QC manager is responsible for designing a QC plan and ensuring that the field staff has an understanding of the methods and procedures to implement the QC plan.

Sampler – The sampler is responsible for the collection of QC samples as specified in this SOP.

3.0 DEFINITIONS

Aliquot - A portion of a sample.

Ambient blank – A blank sample of reagent-grade water poured into a volatile organic compound (VOC) sample vial at the sampling site near other VOC sample collection. Used to assess the introduction of contaminants from ambient sources such as fuel motors in operation.

Background sample – A sample collected from an area similar to the one being sampled but located in an area free of contaminants.

Data quality objectives – Quantitative and qualitative statements that clarify the study objectives, define the most appropriate type of data to collect, determine the appropriate conditions from which to collect the data, and specify tolerable limits on decision errors that will be used as the basis for establishing the quality and quality of data needed to support site decisions.

Equipment blank – A blank sample of reagent-grade water, typically supplied by the laboratory, poured into, through, or over equipment used for sampling and collected in a sample container. Used to assess the efficacy of decontamination procedures and therefore should be collected immediately following equipment decontamination.

Field duplicate – Two samples taken from, and representative of, a single location and carried through all steps of the sampling and analytical procedures in an identical manner. Duplicate samples are homogenized prior to placing the matrix into a sample container. Used to assess variance of the total method including sampling and analysis.

Field replicate – Two samples taken from, and representative of, a single location and carried through all steps of the sampling and analytical procedures in an identical manner. Replicate samples are not homogenized prior to placing the matrix into a sample container but are collected in rapid succession. Used to assess variance of the total method including sampling and analysis.

Matrix spike / matrix spike duplicate – An aliquot of a client sample spiked in the laboratory with known concentrations of all analytes listed in the method at a level less than or equal to the midpoint of the analytical calibration curve for each analyte. Used to document the accuracy and bias of a method due to the sample matrix and therefore should be collected from a sample area free of contaminants, if possible.

Quality control samples – Samples used to check the operation of a measurement system to obtain a measure of the quality of data generated.

Quality assurance project plan (QAPP) – A specific plan for the collection of data used to assess the quality of data generated for a project.

Relative percent different (RPD) – A measure used to evaluate the difference between contaminant concentrations in two samples. This is primarily used for duplicate samples. The equation is as follows: $RPD = \frac{X_1 - X_2}{(X_1 + X_2)/2} \times 100$

Temperature blank – A blank sample of water, typically provided by the laboratory, and placed in sample coolers before or during sample collection to ensure temperature equilibration with

samples. Used to determine the temperature at which samples were delivered to the laboratory for analysis and required for samples needing temperature preservation.

Trip blank – A blank sample of reagent-grade water provided by the laboratory that accompanies VOC sample jars through their life-cycle. Used to assess the introduction of contaminants from sample containers or during transportation and storage procedures and for this reason trip blanks are not opened.

4.0 EQUIPMENT

The equipment used for the associated sampling (SOP No. 02, 03, 04, 05) should be used for the collection of the QC samples. It is important that the sample collection procedures used to collect the primary samples be used for the collection of all QC samples. If preparing blanks in the field, reagent-grade water will be necessary.

5.0 PROCEDURE

The site-specific work plan will determine which QC sample types are required for the project. For the collection of the QC samples, follow the applicable procedures outlined in the following sections.

5.1 Field Duplicates and Field Replicates

The QC check of the field duplicate is a low relative percent difference (RPD) between the laboratory results for the primary and duplicate sample. An exceedance of the allowable tolerance limits suggests that the precision of the sampling effort is insufficient. Inadequate precision could be due to various issues including poor sampling methodology.

A minimum of one field duplicate must be collected for every 10 field samples for each matrix samples and for each target analyte. Field duplicates must be collected from locations of known or suspected contamination, and duplicate soil and water samples must be collected in the same manner and at the same time and location as the primary sample. For a sampling event occurring over multiple days, all field duplicates must not be collected in one day and the goal should be to collect a minimum of one field duplicate per day.

Field duplicates must be:

- Submitted as blind samples to the approved laboratory for analysis,
- Given unique sample numbers (or names) and sample collection times, and
- Adequately documented in the field records or log book.

To collect a field duplicate of a pumped water sample, ensure that the water being collected is representative of the field conditions and fill the laboratory-supplied jars in immediate succession for each analysis (replicate). For example, if three vials are required for the primary sample, collect six vials in succession and label three for the primary sample and three for the duplicate sample.

To collect a field duplicate of a non-volatile soil sample, determine the sample interval that ensures enough soil volume required to fill all of the jars. Gather and homogenize the soil and fill the two sample containers simultaneously. Preserve as required.

To collect a field replicate of a volatile soil sample, for each grab of soil, fill the primary and duplicate sample containers simultaneously, placing equal amounts of the soil in the jar for the primary and the jar for the duplicate. Preserve as required.

Field duplicates require disguised sample identification to the laboratory including a unique sample name and time.

5.2 Matrix Spike and Matrix Spike Duplicates

The purpose of a matrix spike (MS) sample is to evaluate matrix effects on the analysis method. The matrix spike duplicate (MSD) sample is used to corroborate the contaminant concentrations in the matrix spike sample, as measured by the RPD. MS/MSDs should be collected from locations designated in the site-specific plan, and preferably from an area with little to no contamination. For water samples, triplicate sample volume should be collected from the same location at the same time. Typically only one sample volume is required for soil MS/MSD samples. However, if multiple analyses are being requested for a single soil MS/MSD sample, additional volume may be required. The laboratory PM should be contacted to confirm MS/MSD sample volumes if there is any uncertainty. The samples should have the same matrix to ensure a valid result; if the sample interval does not consist of similar visual and olfactory observations, choose another location for collection of MS and MSD samples.

MS and MSD samples should be labeled with the same sample name and time as the primary sample and denoted on the chain of custody. The laboratory will analyze the parent sample to determine the background analyte concentrations present in the sample. The laboratory will then spike the MS and the MSD samples with known concentrations of analytes prior to analysis and run the analysis in the same manner as the parent sample. The background concentration from the parent sample will be subtracted from the MS and MSD results and the RPD calculated.

5.3 Blanks

The primary purpose if quality control blanks (i.e. trip, field, and equipment blanks) is to trace sources of artificially introduced contamination.

5.3.1 Field Blanks

Field blanks area a sample of preservative or deionized water poured into the laboratory provided container in the field, and shipped to the laboratory with the field samples. Per project specifications, a minimum of one field blank will be collected per 20 samples per matrix and per analyses.

5.3.2 Equipment Blank / Rinsate Blank

The purpose of an equipment blank is to evaluate the efficacy of a decontamination procedure of non-disposable sampling equipment. Equipment blanks are samples if analyte-free water poured over or through decontaminated field sampling equipment prior to the collected of environmental samples. Per project specifications, a minimum of equipment blank will be collected per 20 samples per matrix and per analyses.

5.3.3 Temperature Blank

The purpose of a temperature blank is to record the temperature of all samples upon receipt at the laboratory. A temperature blank must be kept in the cooler with the samples at all times. If a temperature blank is not included in the cooler from the laboratory, one can be prepared in the field by filling a jar or bottle with tap water and labeling it as the temperature blank. Upon receipt by the laboratory, the temperature will be recorded on the chain of custody.

5.3.4 Trip Blank

Trip blanks area a clean sample of a matrix that is taken from the laboratory to the site and then transported back to the laboratory without having been exposed to the sampling procedures. The purpose of a trip blank is to assess the introduction of contaminants from sample containers or during transportation and storage procedures. Trip blanks are required for volatile analyses and must accompany all volatile sample jars. For this reason, it is best to put all volatile analysis jars into one cooler to allow for a limited number of trip blanks, as one trip blank is required per cooler of volatile samples. Exceeding allowable tolerance limits for trip blanks suggests that contamination was introduced during shipping and field handling procedures.

5.4 Labeling

All quality control samples should be labeled and included on the chain of custody, with the exception of the temperature blank. The naming conventions should be specified in the site-specific work plan. In the absence of a naming convention, adding a suffix of EB for equipment blank and TB for trip blank should suffice.

6.0 REFERENCES

Environmental Protection Agency (USEPA), 1990. *Samplers Guide to the Contract Laboratory Program*, EPA/540/P-90/006, December.

Alaska Department of Environmental Conservation (ADEC), 2019. *Field Sampling Guidance*, August.

7.0 REVISION LOG

Revision Date	Author	Revision Details
12/26/2013	Olga Stewart	Initial Issue
4/7/2016	Andrew Weller	Minor Grammar Edits

11/30/2016	Ashley Olson	Updated based in the new ADEC sampling guidance, updated logo
10/31/2017	Leslie Davis	Updated ADEC Field Sampling Guidance to 2017
9/10/2018	Lexie Lucassen	Added detail to MS/MSD collection procedures
2/21/2019	Mike Records	ASL Logo
4/12/2020	Mike Records	Reference Section: ADEC Field Sampling Guidance Update (2019)

STANDARD OPERATING PROCEDURE
FOR SAMPLE CHAIN OF CUSTODY (COC)
No. 11

1.0 INTRODUCTION

1.1 Purpose

The purpose of this standard operating procedure (SOP) is to direct field personnel in the techniques and requirements for maintaining the sample chain of custody (COC).

Proper handling, chain of custody, and documentation are necessary to provide an accurate written record to track the possession, handling, and location of samples from the moment of collection through reporting.

1.2 Scope

The scope of this SOP is to cover aspects of sample handling, with respect to custody, and the proper techniques for documenting the custody on the COC form.

2.0 RESPONSIBILITIES

Project Manager (PM) – The PM is responsible for providing adequate resources to the field staff and ensuring that field staff has adequate experience and training to successfully comply with the SOP. The PM is responsible for approving and documenting techniques that are not specifically described in this SOP but are considered the best sampling methods for the current project.

Sampler – The sampler is responsible for the handling and documentation of sample custody as specified in this SOP.

3.0 DEFINITIONS

Chain of custody (COC) – The chronological documentation of sample custody, showing the control, transfer, and analysis of samples.

Custody seal – An adhesive label placed across an opening that is used to detect tampering with samples after they have been packed for shipping.

Sample – A material that is housed in containers and identified with a unique sample identification number that is to be analyzed by a laboratory.

Sample custody – A sample is considered under custody if it is in your possession, if it is in your view after having been in your possession, if it was in your possession and is then locked up to prevent tampering, or if it is in a designated and identified secure area.

Sample label – An adhesive paper or tag that is placed on sample containers to designate a sample identification number and other identifying information.

4.0 EQUIPMENT

Equipment needed for chain of custody documentation includes the following:

- Sample jars that have been filled and labeled in accordance with the work plan
- Quality control (QC) sample containers
- Coolers with return address written on inside lid
- COC forms
- Custody seals
- Gallon-sized re-sealable plastic bag
- Clear tape

Note that this SOP is intended to be used in conjunction with the following SOPs, and as such, the equipment and materials needed for those activities are not included in this SOP:

- Logbook Documentation and Field Notes (No. 01)
- Labeling, Packaging, and Shipping Samples (No. 12)

5.0 PROCEDURE

Sample identification documents will be carefully prepared so that sample identification and chain of custody are maintained. Sample identification documents include the field logbook, sample labels, custody seals, and COC records.

A sample is in custody if it meets one of the following conditions:

- In an authorized person's physical possession
- In an authorized person's view after being in possession
- Was in an authorized person's possession then locked up
- Kept in a secured area that is restricted to authorized personnel

5.1 Field Custody Procedures

The following procedures shall be used by field personnel:

- As few persons as possible will handle samples.
- The sample collector will be personally responsible for the care and custody of samples collected until they are transferred to the laboratory.
- The sample collector will record sample data (time of collection, sample number, analytical requirements, and matrix) in the field logbook.

- Sample labels shall be completed for each sample, using waterproof ink.

5.2 Chain of Custody Record

All samples will be accompanied by a COC record. The COC form is typically provided by the laboratory unless otherwise specified in the work plan. The chain of custody record will be fully completed in duplicate. Information to be included on a chain of custody form includes the following.

- Project name and number
- Contractor name and address
- Laboratory name and address
- Name of person that collected the sample(s)
- Sample identification number
- Sample date and time (time in 24-hour format)
- Laboratory analysis methods required for each sample jar
- Preservatives added to each sample jar
- Sample matrix (soil, water, or other)
- Number of containers per sample
- Airway bill tracking number

Additional remarks can be added to the COC record to alert the laboratory including the following:

- Matrix spike/matrix spike duplicate (MS/MSD) sample volume. The note "MS/MSD" should be added within the same line as the primary sample.
- A request for rapid turnaround time.
- A note regarding the potential concentrations in a highly contaminated soil sample.

Indication of a duplicate sample should never be included on a COC record.

5.3 Sample Packaging

Samples will be labeled and packaged according to the labeling, packaging, and shipping SOP. The COC record will accompany all sample shipments. One COC record shall be prepared for each shipment. One COC record will be prepared for each cooler, even if multiple coolers are included in one shipment. The cooler name and NPDLWO# are required on the COC. The samples in the cooler must be listed on the COC record.

The COC record will be placed in a re-sealable plastic bag, the bag sealed shut to prevent water intrusion from the ice in the cooler, and the bag taped to the inside lid of the cooler. If one sample is contained in two coolers (i.e. one sample has too many containers to fit in one cooler), then a copy of the COC record will suffice to accompany the second cooler as long as the original is in the first cooler and the copy is denoted as a copy.

The duplicate copy of the COC record will be retained by the sampler and distributed as necessary to the sample coordinators. Airway bills will also be retained with the COC record as documentation of transport.

Custody seals are pre-printed, adhesive-backed seals with security slots designed to break if the seals are disturbed. Seals will be signed and dated at the time of use. Sample shipping containers will be sealed in as many places as necessary to ensure that the container cannot be opened without tearing the custody seals. Typically one custody seal will be placed along the front opening, and one along the side opening of a cooler. Strapping tape will be placed over the seals to ensure that seals are not accidentally broken during shipment.

If a sampler hand transports the samples to the laboratory without sample shipment, custody seals are not required.

5.4 Transfer of Custody

When transferring the possession of samples from the field sampler to a transporter or to the laboratory, the sampler will sign, date, and note the time as "relinquished by" on the COC record. The receiver will also sign, date, and note the time as "received by" on the COC record. The date and time of the receiver and relinquisher shall be the same.

When samples are transported by a common commercial carrier such as Alaska Airlines or Federal Express, the carrier will not sign the COC record. However, the airway bill tracking number should be recorded on the COC record. For this reason, the date and time of the receiver and relinquisher will not match when shipping through a common commercial carrier.

5.5 Laboratory Custody Procedures

A designated sample custodian will accept custody of the shipped samples and verify that the sample identification number matches the COC record. Pertinent information about shipment, pickup, and courier will be entered in the "Remarks" section. Temperature of the coolers at the time of receiving will be noted on the COC record.

6.0 REFERENCES

Alaska Department of Environmental Conservation (ADEC), 2019. *Field Sampling Guidance*, October.

American Society for Testing and Materials (ASTM), 2010. *Standard Guidance for Chain of Custody Procedures*, ASTM D4840-99.

7.0 REVISION LOG

Revision Date	Author	Revision Details
1/2/2014	Brandie Hofmeister	Initial Issue
6/2/2016	Andrew Weller	Referenced 2016 ADEC Field Sampling Guidance and Minor Grammar Edits
12/1/2016	Ashley Olson	Updated logo
10/31/2017	Leslie Davis	Referenced 2017 ADEC Field Sampling Guidance
2/21/2019	Mike Records	ASL Logo
4/12/2020	Mike Records	Reference Section: ADEC Field Sampling Guidance Update (2019)

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STANDARD OPERATING PROCEDURE
FOR LABELING/PACKAGING/SHIPPING SAMPLES
No. 12

1.0 INTRODUCTION

1.1 Purpose

The purpose of this standard operating procedure (SOP) is to direct field personnel in the techniques and requirements for labeling, packaging, and shipping samples.

1.2 Scope

The scope of this SOP is to cover all aspects of labeling samples for identification, packaging samples for safe transport, and shipping samples from the field to the laboratory for analysis, as conducted by Ahtna personnel.

2.0 RESPONSIBILITIES

Project Manager (PM) – The PM is responsible for providing adequate resources to the field staff and ensuring that field staff has adequate experience and training to successfully comply with the SOP. The PM is responsible for approving and documenting techniques that are not specifically described in this SOP but are considered the best methods for the current project.

Sampler/Technician – The sampler/technician is responsible for the collection and labeling of samples as specified in this SOP. The sampler/technician is responsible for ensuring adequate packaging and proper shipping as specified by this SOP.

3.0 DEFINITIONS

Air waybill - The shipping document that identifies the sender and addressee, transport carrier, size, and priority of a shipment transported by aircraft.

Bill of Lading – a detailed list of a shipment of goods in the form of a receipt given by the carrier to the person consigning the goods to acknowledge receipt of goods.

Dangerous Goods - Under the International Air Transport Association (IATA) definition, dangerous goods are articles or substances which can pose a hazard to health, safety, property or the environment and which are shown in the list of dangerous goods in the IATA regulations, IATA 1.0.

Hazardous materials - Department of Transportation (DOT) defines a hazardous material as any item or chemical which, when being transported or moved in commerce, is a risk to public safety or the environment, and is regulated as such under its Pipeline and Hazardous Materials Safety Administration regulations (49 CFR 100-199), which includes the Hazardous Materials Regulations (49 CFR 171-180).

Environmental sample – Any sample that has less than reportable quantities of any hazardous constituents according to the DOT 49 CFR Section 172.101 Appendix A.

Excepted Quantity (DOT & IATA Definition) - A hazardous substance whose class is permitted on passenger aircraft but in such a small defined amount as to pose a low risk during transport by aircraft. Hazardous substances that meet the definition of Excepted Quantity may be exempted from documentation, packaging, marking, and labeling requirements typically required when presenting hazardous materials for passenger air transportation. Items shipped as excepted quantities are limited to volumes as specified in IATA Dangerous Goods Regulations (DGR) Table 2.6.A and DOT 49 CFR 173.4a.

Limited Quantity of Dangerous Goods – Dangerous goods that may be carried at "Limited Quantity" when they comply with the restrictions provided in IATA, Section 5, Subsection 2.7, 4.1.5.2 and 4.1.4.3.

Sample label – An adhesive paper that is placed on sample containers (soil, water) or a tag that is tied to a sample container (air) to designate a sample identification number and other identifying information.

4.0 EQUIPMENT

Equipment needed for labeling, packaging, and shipping samples includes:

- Coolers
- Heavy-duty plastic bags
- Plastic zip-top bags, small and large
- Clear tape
- Strapping tape
- Duct tape
- Bubble wrap and/or foam inserts
- Gel ice packs
- Custody seals
- Completed chain of custody (COC) record
- Completed Bill of Lading
- Labels ("Keep cool/refrigerate", "This end up", "Do not freeze", "Fragile", "Address", "Dangerous goods", "Excepted quantities", "Saturday delivery" (as necessary), etc.

Note that this SOP is intended to be used in conjunction with the following SOPs, and as such, the equipment and materials needed for those activities are not included in this SOP:

- Logbook Documentation and Field Notes (No. 01)

- Sample Chain of Custody (No. 06)

5.0 PROCEDURE

5.1 Sample Labeling

Samples should be labeled using nomenclature defined in the applicable work plan. All sample labels should be written in indelible ink and contain the following information:

- Sample name/identification
- Date/time (in 24-hour format)
- Sampler's initials
- Analysis requested
- Job name/number
- Preservative
- "PRODUCT" for flammable liquid waste characterization samples

Adhesive sample labels should be placed directly on the sample containers. If the labels are not adequately adhered due to moisture, secure the label by placing clear packaging tape over the label. Sample containers that are weighed by the laboratory prior to use should not have any additional labels placed on the container as it affects the weight. For those containers, use the label that is already provided on the jar. Only one label should be placed on each sample container.

5.2 Sample Cooler Packaging

Environmental and waste characterization samples should be packaged in separate coolers in order to prevent cross-contamination. If this is not possible, waste samples should be placed inside zip lock bags, in order to provide additional segregation from environmental samples.

The following steps must be followed when packing sample containers for shipment:

1. Choose a cooler with structural integrity that will withstand shipment. Secure and tape the drain plug (if present) with duct tape.
2. Be sure that the caps on all containers are tight and will not leak. Make sure not to over tighten and break the cap.
3. Check to make sure that the sample labels are intact, completed with the correct information, that identification exactly matches the COC record.
4. If samples are required to be chilled, place enough ice (see below) in packaging to ensure that samples are received by the laboratory at the proper temperature of 0-6 °C.
5. Include a temperature blank in each cooler, as well as a trip blank in each cooler with volatile samples.
6. Wrap and package containers sufficiently to prevent cross-contamination and ensure that containers remain intact during shipment.
7. Sign and date the completed COC record. It should be placed inside a Ziploc® bag and taped to the inside lid of the cooler. Include all project-specific requirements, complete all fields, and include location IDs for each sample in the sample notes. Waste samples and

MS/MSD samples should be clearly identified on the COC (duplicates should be submitted blindly to the lab).

8. Do not mix soil and water samples in the same coolers as practicable. It increases risk of breakage and reporting errors. Samples from multiple projects should never be combined in the same cooler.
9. Sign and date custody seal stickers and place them on two opposing seals of the cooler lid. Place all applicable stickers (e.g. excepted quantity, this side up, fragile, refrigerate do not freeze, etc.) on a minimum of two visible sides of the cooler. Stickers and seals may be wrapped with clear packaging tape to prevent tearing or damage. Strapping tape is also recommended to secure the cooler, but it must not block the necessary stickers or custody seals.
10. Coolers may need to be opened and re-iced during shipment to maintain a temperature of 0-6 °C. If this occurs, the person opening the cooler should sign the COC and repackage the cooler in accordance with this SOP.

To ship samples with gel ice packs, follow the steps below. Note that gel ice for sample shipping should be laid flat prior to freezing for use when frozen. Partially melted or soft gel ice packs should not be used to pack coolers for transport. A minimum of 8 frozen gel ice packs are required to maintain sample temperature during transit for 24 hours. Sample containers should not be directly touching ice as this can cause breakage and sample freezing; rather, they should be separated from the ice by a layer of bubble wrap or soft packaging material.

1. Place a layer of frozen gel ice packs, lying flat on their sides, along the bottom of the cooler. Cover the ice packs with a layer of bubble wrap and then place a sorbent pad over the bubble wrap.
2. Place all sample containers in bubble wrap, bubble bags, in their original boxes, or in re-sealable bags with sorbent pads, depending on the type of container. One-liter glass bottles should be double-bagged to prevent damage during transport.
3. Place the containers into the cooler with caps up. No containers should be placed on their sides, as there is significantly less chance of breakage when packed vertically.
4. Place additional gel ice packs in between sample containers in a manner that maximizes surface contact with the containers. If packaging water samples, each sample container should adjacent to a gel ice pack.
5. Fill excess space between sample containers with additional bubble wrap.
6. Place another layer of bubble wrap along the top of the cooler, and as possible, place a layer of gel ice packs, lying flat on their sides, along the top of the cooler.
7. Fill remaining headspace with additional packing material.

5.3 Shipping

This section addresses the shipment of preservatives, preserved samples, and flammable liquid samples. Preservatives and preserved samples can be shipped in small quantities in accordance with IATA and DOT Excepted Quantity exemptions. Flammable liquid samples shipped in 4- or 8-ounce containers must be shipped as Dangerous Goods in limited quantities (IATA). These provisions preclude the usual requirements for marking, labeling, packaging, and documentation. However, other less restrictive requirements (specified herein) must be met.

5.3.1 Air Transport

Transportation regulations followed by air carries is airline specific, some use only IATA and others allow either IATA or DOT. Due to this difference between shippers, it is recommended that IATA requirements are followed for all air shipments. Sample airway bills prepared in accordance with IATA regulations are provided at the end of this document.

Keep in mind that IATA requirements and the FAA and TSA "Prohibited Items List" will not allow you to check dangerous goods, in any quantity, as baggage on a commercial flight. You need to plan ahead and ship via an air cargo carrier.

5.3.2 Ground and Vessel Transportation

Ground and vessel transportation are guided by DOT regulations. If shipping by highway or rail, no shipping paperwork is required as stated in 49 CFR 173.4a(h)1. When shipping by vessel, "Dangerous Goods in Excepted Quantities" along with the number of packages must be listed. Sample DOT bill-of-ladings for vessel transport are provided at the end of this document.

5.3.3 Common Preservatives and Flammable Liquids Excepted Quantities Shipping Guidance

Common preservatives used in sampling include methanol, nitric acid, sulfuric acid, and hexane. Flammable liquid samples are common waste samples submitted for shipment. The volume of preservative per container from the lab are listed below (the largest possible volume from the lab), along with their **excepted quantity code** and the IATA shipping information:

- Methanol, 25 mL, **E2, UN1230, Methanol, 3 (6.1), PG II**
- Nitric Acid (<20%), 8 mL, **E2, UN2031, Nitric Acid, 8, PG II**
- Sulfuric Acid, 8 mL, **E2, UN1830, Sulfuric Acid, 8, PG II** (Concentrated)
- Sulfuric Acid, 8 mL **E2, UN2796, Sulfuric Acid, 8, PG II** (<51% acid)
- Hexane, 25 mL, **E2, UN1208, Hexanes, 3, PG II**

Preservatives with E2 exception codes have the following inner and outer packaging limits as described in Table 5-1. A maximum of 20 methanol or hexane preserved containers or samples may be placed in a single cooler. A maximum of 62 acid-preserved containers may be shipped in one cooler. Note: Once water has been added to containers with acid preservatives, the containers are no longer acidic, and therefore are no longer a hazardous material.

TABLE 5-1: IATA TABLE 2.6.A - EXCEPTED QUANTITY FOR E1 AND E2 CODES

Code	Maximum Quantity/Inner Package	Maximum Quantity/Outer Package
E1	30 g/30 mL	1kg/1 L
E2	30 g/30 mL	500 g/500 mL

Note: DOT excepted quantities for the preservatives listed above are identical to the IATA excepted quantities.

The following provides the standard shipping volume for waste flammable liquid samples, the excepted quantity code, and the IATA shipping name.

- Flammable Liquids, 118 mL, **E1, "UN1993 Flammable liquids, n.o.s., 3 PG III"**

Flammable liquids with the E1 exception codes have the inner and outer packaging limits as described in Table 5-1. The volume of waste flammable liquid submitted for analysis is typically 4 ounces (118 mL). This volume exceeds the excepted quantity limit and flammable liquids must be shipped at **Dangerous Goods in Limited Quantities.** The **Limited Quantity** limit for flammable liquids, n.o.s, PG III is 2.5 L per glass container and 10 L per cooler for passenger or cargo plane. The packaging, labeling, and shipping of Dangerous Goods in Limited Quantities is discussed in Section 7.0.

If shipping more than excepted quantity limits, you must follow the more stringent requirements for that particular preservative, or you must package the materials in separate outer containers. See the individual Hazardous Material & Dangerous Goods Shipping Guidelines for the acid or solvent being shipped if you include these materials in a single outer container. It is highly recommended to try and ship the packages as excepted quantities when possible. It saves time and money.

6.0 DOT AND IATA EXAMPLES FOR DANGEROUS GOOD IN EXCEPTED QUANTITIES

Preserved sample containers transported to the site, and samples preserved with methanol or hexane shipped from the site, are shipped as "Dangerous Goods in Excepted Quantities". When shipping items as Dangerous Goods in Excepted Quantities, the label must be:

- Placed on the shipping package, and overpack, with
- The Hazard Class written below the "E" in black permanent maker.
- The name and address of the shipper and consignee if there is not a shipping label.

The materials must then be declared as "Dangerous Goods in Excepted Quantities" to the airline and vessel carrier on the shipping paperwork (see samples at the end of this document). However, no dangerous goods "candy-striped" form is required and no Notification to Captain (NOTOC) is required.

Prior to shipping samples, complete the appropriate air waybill or bill-of-lading. Make sure to include the following:

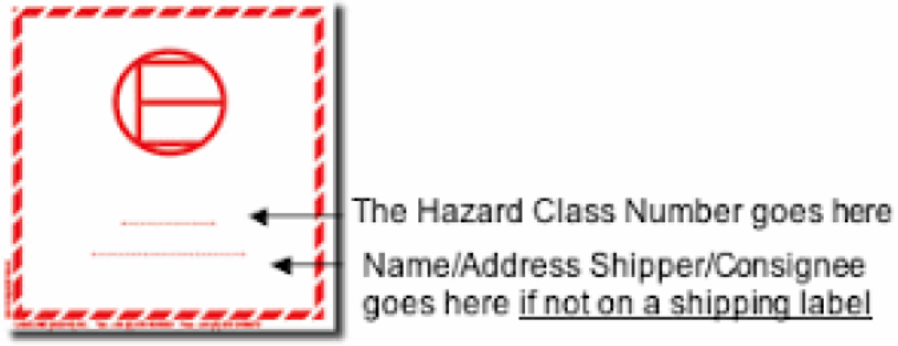
- Laboratory name, address, and phone number
- Ahtna contact name, address, and phone number
- Project number
- Special handling requests
- Include statement: "Dangerous Goods in Excepted Quantities

Keep a copy of the air waybill or bill of lading and submit it, with a copy of the COC, to the field Ahtna PM, the lab PM, and ahtna.lab@ahtna.net. Upon shipping samples, notify the laboratory contact that samples are en route and provide an estimated arrival time. Note that most labs are closed on weekends and holidays. Shipments should be coordinated with the laboratory contact to ensure timely delivery/pickup by the lab.

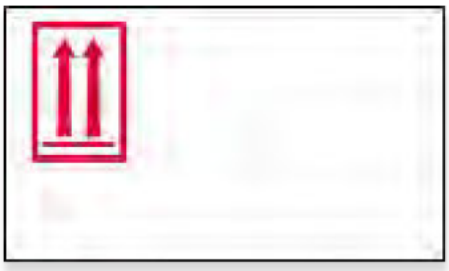
6.1 Marking and Labeling - Top View of Package or Cooler

To:
SGS North America
200 W. Potter Drive
Anchorage, AK 99518
907-562-2343

From:
Sam Jones - AES
110 W. 38th Avenue Suite 200A
Anchorage, AK 99503
907-646-2969
Project #20392-01



6.2 Marking - Front and Side View of Package or Cooler



IATA and DOT (Vessel Only) Shipping Paperwork Example - Dangerous Goods in Excepted Quantities

LYNDEN TRANSPORT (LTIA)

Non – Negotiable
BILL OF LADING

FREIGHT BILL PRO NUMBER (CARRIER USE ONLY)

Customer Service:

Anchorage	1-800-327-9390	Fairbanks	1-800-478-5535
Kenai	1-888-319-6119	Tacoma	1-800-326-5702
Houston	1-800-231-0582	Dallas	1-972-399-6401
Los Angeles	1-800-675-9633	Portland	1-800-214-6748
Edmonton, AB	1-800-661-9006	Calgary, AB	1-800-394-2766

Date Received:	Route:	Quote / PSE No:	Origin:	Destination:	Trailer No:	Seal#:	P.O. Number

SHIPPER (FROM):	CONSIGNEE (TO):	BILL TO:
Name: Sam Jones - AES	Name: SGS North America	Name: Ahtna Engineering
Street Address: 110 W. 38th Avenue Suite 200A	Street Address: 200 W. Potter Drive	Street Address: 110 W. 38th Avenue Suite 200A
City, State: Anchorage, AK 99503	City, State: Anchorage, AK 99518	City, State: Anchorage, AK 99503
Ref No: Project #20392-01 Phone: 907-646-2969	Ref No: PO123456 Phone: 907-562-2343	Ref No: Project #20392-01 Phone: 907-646-2969

FREIGHT CHARGES: ☐ Prepaid ☑ Collect **Freight Charges are Prepaid unless Collect box is marked**

Additional Services (fees apply)
☐ Lift Gate ☐ Inside Delivery (Businesses Only) ☐ KFF (Keep from freezing) ☑ NOA (Notify on arrival)

Units	HM X	Description provided by Shipper *For Hazmat:* (UN/NA Number, Proper Shipping Name, Hazardous Classification, and Packing Group)	Length	Width	Height	Weight in Lbs. (Subject to Corr.)
2		Coolers with Dangerous Goods in Excepted Quantities	26	14	14.5	50

24 HOUR EMERGENCY RESPONSE NUMBER:

This is to certify that the above named materials are properly classified, described, packaged, marked and labeled and are in proper condition for transportation according to the applicable regulations of the Department of Transportation (49 C.F.R. 172.204).

Unless otherwise provided herein or unless agreed to in advance between LTIA and Shipper, Carrier's liability will be limited to the lesser of $20.00 per pound (or CAN $2.00 per pound (CAN $4.41/kg) for shipments originating in Canada), up to a maximum of $200,000 per shipment.
Declared Value: $ per

It is understood and agreed all household goods/personal effects will be released at $.10/lb unless otherwise specified, but in no event will exceed $5.00/lb.
INITIAL RELEASE VALUE NOT TO EXCEED:_____PER LB

Shipper agrees that the custody and carriage of goods identified shall be subject to the terms and conditions on the reverse as well as the Carrier's tariff, which may be viewed at: www.lta.lynden.com

Refrigerated Temp Loads:
(Nose) Set Temperature:_____ (Nose) Temp at Receiving:_____
(Tail) Set Temperature:_____ (Tail) Temp at Receiving:_____
Date_____Time_____

Shipper must identify in writing prior to shipment any perishable, temperature controlled, keep from freezing, chilled or frozen goods. **Carrier shall not be responsible for pulling down or reducing the core temperature of goods.**

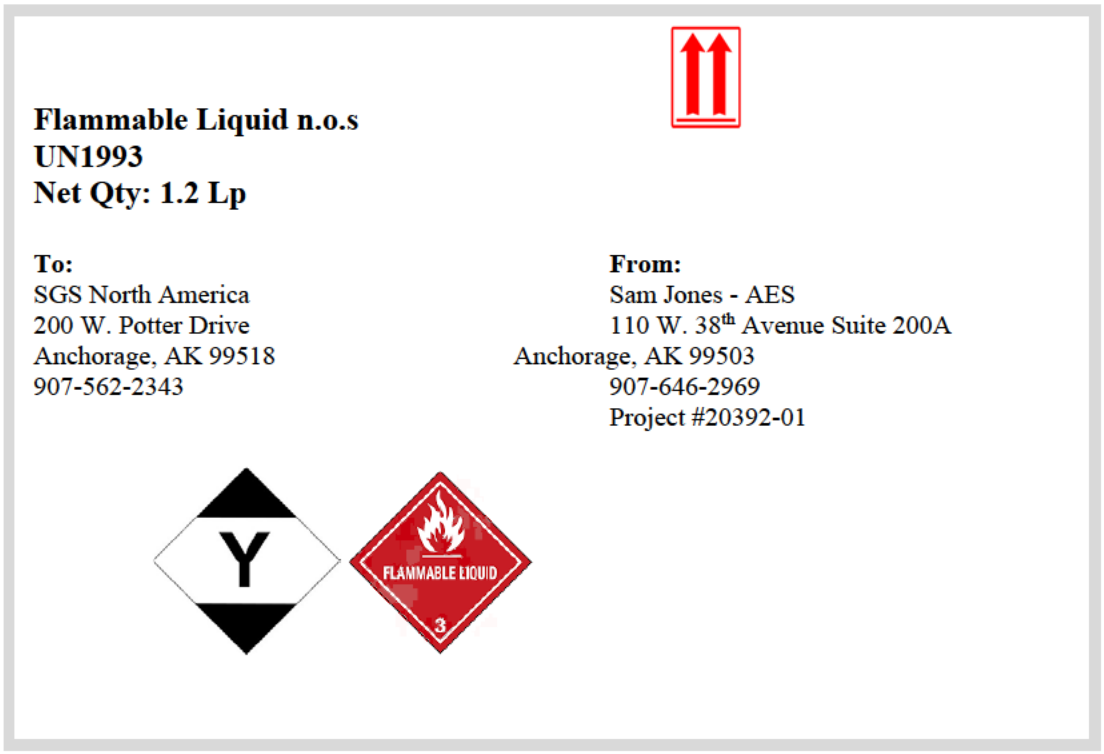
SHIPPER (SIGNATURE REQUIRED)		CARRIER		PALLET POSITION(S)
PER	DATE	PER	DATE	PIECE COUNT

LTIA-OP55 (Rev. 09/17)

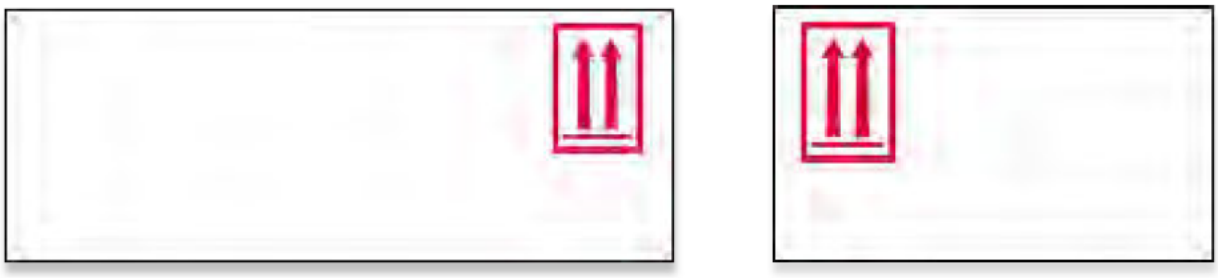
7.0 IATA EXAMPLES FOR DANGEROUS GOOD IN LIMITED QUANTITIES

The volume of waste flammable liquid submitted for analysis is typically 4 ounces (118 mL). This volume exceeds the excepted quantity limit and flammable liquids must be shipped at Dangerous Goods in Limited Quantities. The Limited Quantity limit for flammable liquids, n.o.s, PG III is 2.5 L per glass container and 10 L per cooler for passenger or cargo plane. The packaging, labeling, and shipping of Dangerous Goods in Limited Quantities is discussed in the following sub-sections.

7.1 Marking and Labeling - Top View of Package or Cooler



7.2 Marking - Front and Side View of Package or Cooler



IATA and DOT (Vessel Only) Shipping Paperwork Example - Dangerous Goods in Limited Quantities

SHIPPER'S DECLARATION FOR DANGEROUS GOODS

Shipper
Marsha Brady - AES
110 W 38th Avenue Suite 200A
Anchorage, AK 99503
Project # 20392-01 Phone 907-676-2929

Air Waybill No. 123456789

Page 1 of 1 Pages
Shippers Reference Number
(optional)

Consignee
SGS North America
200 W. Potter Drive
Anchorage, AK 99515
PO123456 Phone 907-562-2343

NORTHERN AIR CARGO.

Two completed and signed copies of this declaration must be handed to the operator

WARNING

Failure to comply in all respects with the applicable Dangerous Goods Regulations may be in breach of the applicable law, subject to legal penalties.

TRANSPORT DETAILS

This shipment is within the limitations prescribed for:

Passenger and Cargo Aircraft ~~Cargo Aircraft Only~~

Airport of Departure: Bethel, AK

Airport of Destination: Anchorage, AK

Shipment type: Non-Radioactive ~~Radioactive~~

NATURE AND QUANTITY OF DANGEROUS GOODS

Dangerous Goods Identification							
UN Or ID NO.	Proper Shipping Name	Class or Division	Sub-sidiary Risk	Packing Group	Quantity and type of packaging	Packing Inst.	Author-ization/ ERG#
UN1933	Flammable liquid n.o.s.	3		III	1 plastic material box x 1.2 L	Y344	

Additional Handling Information

24 Hr. Emergency Contact Telephone No. _____

I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, and are classified, packaged, marked and labeled/placarded, and are in all respects in proper condition for transport according to applicable international and national governmental regulations. I declare that all of the applicable air transport requirements have been met.

Name/Title of Signatory

Place and Date

Signature
(See warning above)

8.0 REFERENCES

Alaska Department of Environmental Conservation (ADEC), 2019. *Field Sampling Guidance*, October.

International Air Transport Association (IATA), 2019. *Dangerous Goods Regulations*.

Code of Federal Regulations (CFR), 2013. Chapter 49, Parts 100-185.

9.0 REVISION LOG

Revision Date	Author	Revision Details
1/2/14	Brandie Hofmeister	Initial Issue
1/12/2015	Sara Perman	Removed wet ice shipping details.
6/2/16	Andrew Weller	2016 ADEC Field Sampling Guidance Update and Minor Grammar Edits
12/1/2016	Ashley Olson	Updated Logo
9/5/2017	Lexie Lucassen	Updated to Aug 2017 ADEC *Field Sampling Guidance*
9/10/2018	Lexie Lucassen	Updated excepted quantity per outer package from 300 to 500 mL, per IATA regulations.
2/21/2019	Anne Kranawetter	Updated shipping information, references, added shipping paperwork samples.
2/26/2019	Mike Records	Check references, proofed, updated logo
5/2/2019	Anne Kranawetter	Added flammable liquid guidance
2/12/2020	Lexie Lucassen	Added packaging and shipment tips/details from Ahtna chemist. Updated Field Sampling Guidance. Removed double spacing

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STANDARD OPERATING PROCEDURE
FOR EQUIPMENT DECONTAMINATION
No. 13

1.0 INTRODUCTION

1.1 Purpose

The purpose of this standard operating procedure (SOP) is to provide the step-by-step procedures for field decontamination of environmental sampling equipment and personal protective equipment (PPE) and applies to work conducted in modified Level D PPE for the for the former Glass Heifner mine site PA/SI project.

Decontamination of equipment and PPE is designed to ensure that sample cross-contamination, human-health exposure, and contamination transport are minimized.

1.2 Scope

The scope of this SOP is to cover simple decontamination conducted by Ahtna personnel.

Simple decontamination procedures are generally applicable to field activities involving modified Level D PPE (steel toed boots, hard hat, safety glasses, and disposable nitrile gloves) where contact with hazardous substances is limited. Hazardous substances at the site are expected to be heavy metals in soil (Arsenic and Mercury). PPE decontamination is relatively straight forward under these circumstances.

The techniques described in this SOP are in general accordance with the Alaska Department of Environmental Conservation (ADEC) *Field Sampling Guidance*, dated October 2019.

2.0 RESPONSIBILITIES

Project Manager (PM) – The PM is responsible for providing adequate resources to the field staff and ensuring that field staff has adequate experience and training to successfully comply with the SOP. The PM is responsible for approving and documenting techniques that are not specifically described in this SOP but are considered the best sampling methods for the current project.

Site Safety and Health Officer (SSHO) – The SSHO oversees site-specific health and safety activities and ensures compliance with the project requirements. The SSHO conducts personal protective equipment (PPE) evaluations, selects the appropriate PPE, lists the requirements in the site-specific safety and health plan (SSHP), and coordinates with the field team to implement the

SSHP. SSHP provides guidance, ensures appropriate decontamination processes are implemented, and initiates corrective action.

Field Personnel – Field personnel are responsible for implementing the decontamination procedures outlined in this SOP and reporting and deficiencies.

3.0 DEFINITIONS

Decontamination Area – A location that is not expected to be contaminated and is upwind of suspected contaminants.

Exclusion Zone – A location designated to be used for decontamination of equipment and known to contain contaminated material.

Investigation-derived waste (IDW) – Waste that is generated in the process of investigation or examining a contaminated site.

Personal Protective Equipment (PPE) – Personal health and safety equipment used to protect the individual from contaminant exposure and physical injury.

4.0 EQUIPMENT

The following equipment will be used for decontamination.

- Sampling gloves
- Brushes, typically stiff bristle
- Paper towels
- Garbage bags
- Waste containers

5.0 PROCEDURE

All non-disposable sampling equipment used at the site should be decontaminated both before activities begin and after each sample is collected. Drilling and excavation equipment shall be decontaminated prior to beginning site activities, at the termination of site activities, and, if used for sampling, prior to each sampling event.

5.1 Decontamination Area

Identify a localized decontamination area for sampling equipment. Select the decontamination area so that soil wastes can be managed in a controlled area with minimal risk to the surrounding environment. The decontamination area should be large enough to allow temporary storage of cleaned equipment and materials before use, as well as to stage decontamination investigation-derived waste (IDW).

Smaller decontamination tasks may take place at the sampling locations. In this case, all required decontamination supplies and equipment must be mobilized to the site and smaller decontamination areas for personnel and portable equipment will be provided as necessary.

5.2 Personnel and Personal Protective Equipment

Personnel decontamination involves removal of gross contamination first. Contaminated solids such as mud should be scraped and wiped from boots, and gloves should be removed by rolling off the hands starting at the cuff in such a way that the gloves are turned inside out during removal. If necessary, a clean pair of gloves should be worn to complete the boot cleaning process. Boots can be cleaned while being worn or following removal. If boots are not laden with gross solid materials, a brush can simply be used to knock off or remove any residual solid materials.

Following removal and cleaning of reusable PPE, field personnel should wash their hands or any exposed body parts which may have been in contact with the associated hazardous substances.

5.3 Sampling Equipment Decontamination

All non-disposable sampling equipment should be cleaned prior to use. The following step by step procedure should be followed”

1. Remove as much gross contamination (such as pieces of soil) as possible off equipment at the sampling site.
2. Use a bristle brush or similar utensil to remove all visible soil.
3. Use of a clean, disposable paper towel to absorb/remove remaining residual contamination.

Clean, dry sampling equipment should be stored within a protective medium (plastic bag, etc.) or staged in a clean area for future use.

Cleaning and decontamination of the equipment should be accomplished in stages and in such a way that the contamination does not discharge into the environment. Cleaning and decontamination wastes must be properly contained and disposed of in accordance with applicable state and federal regulations.

Disposable sampling equipment should be used whenever possible (e.g. drum thieves, bailers, spoons, etc.) to minimize the need to decontaminate these items.

6.0 REFERENCES

Alaska Department of Environmental Conservation (ADEC), 2019. *Field Sampling Guidance*, October.

ASTM, 2008. *Standard Practice for Decontamination of Field Equipment Used at Nonradioactive Waste Sites*, Standard D5088-02.

7.0 REVISION LOG

Revision Date	Author	Revision Details
1/2/2014	Brandie Hofmeister	Initial Issue
6/7/2016	Andrew Weller	2016 ADEC Field Sampling Guidance Update
2/23/2017	Katelyn Barnett Decker	Logo
10/31/2017	Leslie Davis	Referenced 2017 ADEC Field Sampling Guidance
2/21/2019	Mike Records	ASL Logo
4/12/2020	Mike Records	Updated ADEC *Field Sampling Guidance* to October 2019
4/29/2020	Baley Lenhart	Project Specific Update

STANDARD OPERATING PROCEDURE
FOR FIELD SCREENING OF SOIL WITH AN XRF
No. 18

1.0 INTRODUCTION

1.1 Purpose

The purpose of this standard operating procedure (SOP) is to direct field personnel in the proper use of an X-ray fluorescence analyzer (XRF) to conduct elemental analysis of soil.

1.2 Scope

The scope of this SOP applies to all Ahtna personnel engaged in field screening with a XRF for the purpose of characterization of soil contamination. This SOP provides details for using the in-situ method, ex-situ (intrusive) bag method, and dry-grind-sieve method for detecting elements in soils with the Niton XLp 300 Series Analyzer. For other techniques or XRF models, see the applicable User's Manual; for analysis requirements for specific elements, see the User's Manual.

This SOP is intended to be used in conjunction with the following SOPs:

- Field Logbook (SOP 01)
- Soil Sampling (SOP 03)
- Quality Control Samples (SOP 10)
- Chain of Custody (SOP 11)
- Labeling, Packaging, Shipping (SOP 12)
- Equipment Decontamination (SOP 13)

2.0 RESPONSIBILITIES

Project Manager (PM) – The PM is responsible for providing adequate resources to the field staff and ensuring that field staff has adequate experience and training to successfully comply with the SOP. The PM is responsible for approving and documenting techniques that are not specifically described in this SOP, but are considered the best sampling methods for the current project.

Site Safety and Health Officer (SSHO) – The SSHO oversees site-specific health and safety activities and ensures compliance with the project requirements. The SSHO conducts personal protective equipment (PPE) evaluations, selects the appropriate PPE, lists the requirements in the site-specific safety and health plan (SSHP), and coordinates with the field team to implement the SSHP.

Sampler/Technician – The sampler or technician is responsible for the collection of XRF data as specified in this SOP.

3.0 DEFINITIONS

millirem (mREM) – A unit of effective dose of radiation equal to 1/1000th of a REM.

X-ray Fluorescence Analyzer (XRF) – A device that uses a radioactive source to emit X-rays that are absorbed and subsequently reemitted. Each element produces a characteristic wavelength of radiation, which is detected by the XRF unit. Depending on the exact model used, the instrument is able to detect a variety of heavier elements and their concentrations in a sample.

4.0 SAFETY

The XRF works by emitting radiation. Virtually no radiation can escape when the shutter is closed. With the shutter open (reading in progress, trigger depressed), the instrument must be used in accordance with these instructions to ensure minimal radiation exposure.

Open the shutter (pull the trigger) only to analyze a sample. Radiation is emitted through the front and top-front of the analyzer while in use. Keep hands and all body parts away from the front of the analyzer when the shutter is open, and do not point the analyzer at any person.

Warning lights will blink when the shutter is open. If the shutter becomes stuck in the open position, or if the screen displays "shutter does not operate," remove the battery and replace instrument in its shielded holster, place in the carrying case, and call the manufacturer.

If using the dry-grind-sieve method, this produces dust that can be inhaled or ingested. Spread a drop cloth and wear a half-face respirator with particulate filtration cartridges, nitrile gloves, goggles, and hooded Tyvek® coveralls. Prepare all samples in a well-ventilated area and/or use a HEPA air filtration system.

5.0 EQUIPMENT

The following equipment is required.

5.1 In-Situ Method

- XRF device with spare battery and charger
- XRF calibration standards
- Tamping tool
- Spoons or trowel
- Nitrile gloves
- Paper towels

5.2 Bag Method

Same as in-situ, plus

- Clean, re-sealable plastic bags

5.3 Dry-Grind-Sieve Method

This method requires the same equipment as the in-situ and bag methods, plus:

- Polyethylene sample cups: 31-40 mm in diameter with collar, or equivalent
- X-ray window film: Mylar, Kapton, Spectrolene, polypropylene, or equivalent; 2.5-6 µm thick
- Mortar and pestle: glass, agate, or aluminum oxide
- Sieves: 10-mesh sieve (2 mm) and 60-mesh (0.25 mm): stainless steel, Nylon, or equivalent
- Polyester fiber
- Oven: standard convection or toaster oven
- Scale (100 g)
- Brush for cleaning sieves
- Paper towels for dry-decontaminating equipment between samples
- Lead In Soil Accessory (LISA) kit
- Drop cloth
- Disposable dust masks and/or half-face respirator and particulate cartridges (pink)
- Hooded Tyvek® coveralls
- Goggles
- HEPA air filtration system

6.0 PROCEDURE

6.1 General Use and Menus

On the XRF analyzer, the button to the left of the four-way controller is “on/off/escape.” Press and hold for three seconds to turn on. Press and hold for ten seconds to turn off. Pressing “on/off/escape” from any screen will return to the main menu. The button to the right of the four-way controller is “enter.” The device also has a touch screen.

When prompted for a password, enter “1 2 3 4 E.”

Check the date and time. They need to be set correctly for the device to work properly; this applies to record keeping, but also so the device can compensate for normal radioisotope decay. If the date and time are incorrect, readings will be incorrect. To set, select “Utilities,” then “Date & Time.”

On the menu, features greyed out are not available. Features with a diagonal line through them are turned off; selecting them will turn them on and remove the diagonal line.

For lead in soils ensure operation in “Bulk Sample Mode” (see table below). For other contaminants or mediums see User’s Manual.

The most pertinent menu options/setting are described in the following table.

Main Menu Icon	Sub Menu Icon	Second Sub Menu Icon	Function	Notes
Test	--	--	Will take a reading in the testing mode currently selected (select mode before beginning test readings).	The data screen displays data from the last reading taken. Pressing left will go to the previous reading, pressing right will display the next reading. Column headings double as "sort" buttons.
Mode	Bulk Sample Mode	--	Select this mode for lead in soils.	For other contaminants or mediums, see User's Manual.
Utilities	Calibrate	Calibrate Detector	Auto-calibration; the analyzer is preprogrammed to calibrate for a specific period of time.	Avoid any vibration, loud noise, strong electronic fields, or other interference when calibrating. Wait for calibration results screen.
	Date & Time	--	Set date and time.	Must be accurate to obtain accurate readings, as it takes into account radioisotope decay.
Data	--	--	View stored readings, erase data, etc.	--
Common Setup	Instrument Setup	Hardware Setup	Sets parameters for taking a reading	For basic use, uncheck all boxes. To set a standard time to read each sample, check the Proximity Sensor box and set the Max. Time field for analysis duration. This will automatically initiate a reading when the trigger is pulled and a sample depresses the proximity sensor on the front of the analyzer, then will automatically stop when time is up (no need to hold trigger).

6.2 Auto-Calibration

Allow device to warm up for 10 minutes before use. The XRF analyzer must be calibrated at least daily, prior to use, preferably onsite at the location and temperature at which it will be used.

1. Turn on the XRF and allow it to warm up.
2. Enter the calibration menu and select "calibrate detector."

3. Avoid any vibration, loud noise, or strong electric fields while the unit is calibrating.

Record calibration data on a field datasheet or in the field logbook. Note the instrument type, name, serial number, and owner, along with the weather conditions and calibration date and time.

6.3 Quality Control

Allow device to warm up for at least 10 minutes before proceeding with additional calibrations. Record the time, reading, and precision of each calibration on a datasheet or in the field logbook. Assess whether the reading is within the acceptance criteria in the work plan. If the test indicates that the instrument is not reading within the control limits (20%), recalibrate the instrument and re-test. If the reading remains outside the control limits, perform maintenance or replace the unit.

The device is operated by pointing the front of the XRF at a soil sample and pulling the trigger (or using preset parameters) to take a reading for a specified duration. Sixty seconds is a typical duration, but may be adjusted depending on the project.

6.3.1 Calibration Standards

The XRF should come with a blank, and low, medium, and high range calibration standards. If using the XRF stand (included in LISA kit), these are in the drawer of the stand.

The blank should be analyzed at the start of each day, and once per twenty samples (or every two hours). Results should be below LOD, which will be displayed on the XRF screen with results.

The low, medium, and high calibration standards should be analyzed at the start of each day, and once per twenty samples (or every two hours). The inside lid of the XRF and LISA kit cases include a spreadsheet indicating ppm of each element in each standard. The XRF reading should be within 20% of the true value.

6.3.2 Precision Assessment

At least one precision assessment should be run per day. Choose the calibration standard closest to the project action level, and perform seven replicate readings. Use the same analysis duration that is used for project samples.

The relative standard deviation of the sample mean is used to assess method precision, and should be less than 20%. The equation for calculating RSD is as follows:

RSD = (SD/Mean Concentration) x 100
where:
RSD = Relative standard deviation for the precision measurement for the analyte
SD = Standard deviation of the concentration for the analyte
Mean concentration = Mean concentration for the analyte

6.3.3 Confirmation Samples

Of all prepared soil samples, at least one per 20 should be submitted to a laboratory for confirmation analysis. These should be selected from samples from the lower, middle, and upper ranges, as well as one close to the project action level. More samples may be submitted for laboratory analysis or archive; see the project-specific work plan. Provide the lab with at least 5-10 grams of soil.

6.4 In-Situ Method

1. The XRF should be in the "Standard Bulk Mode" and should be started at least 10 minutes before use.
2. Using a gloved-hand, place the probe window of the XRF in direct contact with the soil surface to be analyzed. Remove any large or non-representative debris (i.e., rocks, pebbles, leaves, vegetation, roots, and concrete) from the soil surface before analyzing.
3. As much as possible, ensure the soil surface is smooth so that the probe window will have good contact with the ground surface. This may require some leveling of the surface with a stainless-steel trowel or similar tool.
4. Ensure the sample location is not saturated with water.
5. Tamp the soil sample location to increase soil density and compactness for better repeatability and representativeness.
6. Pull the trigger and hold for 60 seconds (or duration specified in work plan). Alternatively, set the analyzer to read for a specified window of time by navigating menus to Common Setup/Instrument Setup/Hardware Setup – check Proximity Sensor box and in the Max Time field enter 60 (or duration specified in work plan). This will allow the trigger to be pulled once and released, rather than holding it down for the full duration. Lights on the XRF will blink while the shutter is open to take a reading.
7. After the test, inspect the nose of the instrument for contamination, which may affect future analysis. If the nose appears to be soiled, clean it with a paper towel.

6.5 Bag Method

1. Collect soil from the area of interest using a gloved-hand or sample scoop. Remove any large, nonrepresentative debris, such as twigs, leaves, roots, asphalt, rock, etc.
2. Place at least 100 grams of soil in a resealable plastic bag. The bag type should be consistent throughout the site and sampling events to ensure comparability between results.
3. Thoroughly homogenize the sample within the bag by kneading, rotating and stirring the soil for 3-5 minutes. Shaking should be avoided to prevent stratification of the soil.
4. Place the sample bag on an uncontaminated surface and flatten the bag into a uniform layer of at least 1 cm. Do not hold the bag while testing samples as this will expose the handler to radiation.
5. Position the XRF analyzer against the surface of the bagged sample, and pull the trigger and hold for 60 seconds (or duration specified in work plan). Alternatively, set the analyzer to read for a specified window of time by navigating menus to Common Setup/Instrument Setup/Hardware Setup – check Proximity Sensor box and in the Max Time field enter 60 (or duration specified in work plan). This will allow the trigger to be pulled and released,

rather than holding it down for the full duration. Lights on the XRF will blink while the shutter is open to take a reading.

6. Per Alaska Department of Environmental Conservation recommendations, repeat this measurement at a second location on the bag then turn the bag over and repeat at two other locations to generate an average concentration.

6.6 Dry-Grind-Sieve

The dry-grind-sieve method is used for very wet soils, or where greater field screening accuracy is required.

6.6.1 Soil Preparation

1. Collect soil from the area of interest using a gloved-hand or sample scoop. Remove any large, nonrepresentative debris, such as twigs, leaves, roots, asphalt, rock, etc.
2. Place at least 200 grams of soil in a resealable plastic bag. The bag type should be consistent throughout the site and sampling events to ensure comparability between results.
3. Thoroughly homogenize the sample within the bag by kneading, rotating and stirring the soil for 3-5 minutes. Shaking should be avoided to prevent stratification of the soil.
4. Place an aliquot (approximately 100 grams) in a small pie tin (or equivalent) and dry in a standard convection or toaster oven for 2-4 hours at <300°F. Samples are "done" when weight remains consistent. Note: oven drying is inappropriate when volatile compounds may be present in the sample. For example, lead present as tetraethyl lead would be driven off by the heat. Some forms of mercury and arsenic are volatile. Air drying overnight in a shallow pan will preserve more of these volatile substances.
5. Grind sample with mortar and pestle, and sift using 10-mesh (2 mm) sieve to separate out large pieces of stone, organics, etc.
6. Grind sample with mortar and pestle, and sift using 60-mesh sieve.
7. Continue grinding and sieving until at least 10 grams and/or 90% of the sample has passed through the 60-mesh sieve. Mix the resulting sample. (Typically the grinding and sieving step takes about 10 minutes.)
8. Between each sample preparation, decontaminate the mortar, pestle, and sieves with dry paper towels or brush. If water is used, ensure everything is completely dry before next use.

6.6.2 Sample Cup Preparation

1. Place a circle of Mylar film (or equivalent) on the end of the sample cup with the indented ring, and secure the film with the collar. The flange inside the collar faces down and snaps into the indented ring of the cup. The installed film window should have a smooth, taut appearance. Cups can be prepared ahead of time.
2. Set cup on a flat surface with film-window side down. Fill with at least five grams of prepared soil (minimum half full to completely full).
3. Lightly tamp the sample into the cup. The end of the pestle can be used, or something similar.
4. Place a circular filter paper disk on the sample after tamping it.
5. Fill the rest of the cup with polyester fiber stuffing to prevent sample movement.
6. Cap the cup and label it. The sample is ready for testing with the XRF.

7. Any remaining prepared soil will typically go in a lab jar for analysis.

6.6.3 Using the XRF with Stand

1. Place a prepared soil sample cup in the stand's slide-out drawer, and close the drawer.
2. Set XRF on stand.
3. Pull the trigger and hold for 60 seconds (or duration specified in work plan). Alternatively, set the analyzer to read for a specified window of time by navigating menus to Common Setup/Instrument Setup/Hardware Setup – check Proximity Sensor box and in the Max Time field enter 60 (or duration specified in work plan). This will allow the trigger to be pulled and released, rather than holding it down for the full duration. Lights on the XRF will blink while the shutter is open to take a reading.
4. When the reading is complete, remove the XRF from the stand and record final measurement from the display on a datasheet.
5. Slide the drawer out and remove the soil sample cup.

IMPORTANT: The XRF stand drawer should not be slid in or out with the XRF in place, as this can damage the proximity sensor.

7.0 SHIPPING

The XRF analyzer contains radioactive material. It must be sent in cargo (cannot be hand-carried). Labeling guidance required for shipping radioactive material are included on the inside lid of the carrying case. The battery must be hand carried uninstalled from the analyzer.

8.0 REFERENCES

Alaska Department of Environmental Conservation (ADEC), 2019. *Field Sampling Guidance*, October.

EPA, 2007. *EPA Method 6200 Field Portable X-Ray Fluorescence Spectrometry for the Determination of Elemental Concentrations in Soil and Sediment*. February.

Thermo Scientific. *Niton XLp 300 Series Analyzer User's Guide.* Version 5.2.1 P/N 500-926.

9.0 REVISION LOG

Revision Date	Author	Revision Details
5/29/2014	Alex Geilich	Initial Issue
3/4/2015	Ashley Olson	Added *in situ* field screening procedure
8/1/2016	Nino Muniz	Change to 5.3, No. 6 procedure
2/23/2017	Katelyn Barnett Decker	Logo
12/12/2017	Lexie Lucassen	Updated Field Sampling Guidance reference (8/2017). Fixed header and title from SOP No.14 to 18.
3/23/2018	Casey Greenstein	Rewrite with more detail
5/1/2018	Casey Greenstein	Added details for safety with dry-grind-sieve method and minor edits
2/21/2019	Mike Records	ASL Logo
4/12/2020	Mike Records	Updated ADEC *Field Sampling Guidance* to October 2019

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Appendix B – Laboratory Quality Control Information

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Title: Acid Digestion of Sediments, Sludges, and Soils [Method 3050B]

Approvals

Signatures on File	
Tammy Hua — Date	Janet Muchiri — Date
Metals Department Manager	Health & Safety Coordinator
Terri Torres — Date	Shawn Kusma — Date
Quality Assurance Manager	Laboratory Director

Facility Distribution No. 001 **Distributed To:** Lab Intranet

Title: Mercury Analysis by CVAA [Methods 245.1, 7470A, 7471A]

Approvals

Stan Palmquist — Date Metals Department Manager	Manjit Nijjar — Date Health & Safety Manager / Coordinator
Terri Torres — Date Quality Assurance Manager	Regan McMorris — Date Laboratory Director

Facility Distribution No. _____ **Distributed To:_____**

Title: Inductively Coupled Plasma-Mass Spectrometry (ICP-MS) [Methods 6020, 6020A, 6020B, 200.8]

Approvals

Stan Palmquist — Date Metals Department Manager	Manjit Nijjar — Date Health & Safety Manager / Coordinator
Terri Torres — Date Quality Assurance Manager	Regan McMorris — Date Laboratory Director

Facility Distribution No. _____ **Distributed To:_____**

Quality Assurance Manual

Eurofins TestAmerica Seattle
5755 8th Avenue East
Tacoma, WA 98424
Phone No. (253) 922-2310
Fax No. (253) 922-5047
www.testamericainc.com

Contents of document redacted for public record copy to protect confidentiality

Facility Distribution No. _____ **Distributed To:_____**

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Appendix C – Site-Specific Health and Safety Plan (Under Separate Cover)

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Appendix D – Field Forms

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Daily Tailgate Safety Meeting

Ahtna Solutions, LLC

Site Location: Date:

HSE Hazard Identification/Considerations

Hazard possiblities	Considerations	Comments
☐ Slips, trips & falls	☐ Hazard areas acknowledged	
☐ Adverse weather conditions	☐ Proper clothing available	
☐ Noise	☐ Hearing protection	
☐ Power tools/hand tools	☐ Inspected & in good working condition ☐ Operator familiar with proper use	
☐ Presence of heavy equipment	☐ Communication/eye contact w/ operator	
☐ Electrical	☐ GFCI/Power shut-off switch or breaker	
☐ Flam./explosive materials	☐ Correct storage/secure if transporting	
☐ Hazardous materials	☐ Spill prevention measures in place ☐ MSDS readily available	
☐ Travel to and from site	☐ Load secured ☐ Vehicle in good working condition	
☐ Wildlife interaction	☐ Right of way to wildlife/avoid interaction	
☐ Travel over sensitive areas	☐ Minimize unnecessary impacts	
☐ Hazardous atmospheres	☐ Atmospheric monitoring devices (i.e. PID)	
☐ Below ground utilities	☐ Utility location complete	
☐ Pinch Points	☐ Hand protection	
☐ Vibration	☐ Anti-vibration gloves	
☐ Overhead hazards	☐ Power lines, loose items, pipelines, etc.	
☐ Site traffic	☐ Reflective and/or bright colored clothing	
Other – Perform site walk and talk through activities to recognize other hazards(Use comment section if necessary)		
☐	☐	
☐	☐	
☐	☐	
☐	☐	

PPE (As necessary to reduce or eliminate hazards)

☐ Hard hats	☐ Foot protection (i.e. steel toes,	☐ H2S monitor, PID, Multi-gas meter
☐ Safety glasses	☐ Hand (i.e anti-vibration, nitrile)	☐ Respirators or dust guard
☐ Hearing protection	☐ Flotation devices	☐ Fall protection
☐ Fire resistant clothing	☐ Slip Protection (ice grippers)	☐ Face Shields
☐ Other:	☐ Other:	☐ Other:

Other considerations

☐ Spill kit	☐ Viable means of communication available	☐ Safe site access/egress
☐ Fire extinguisher	☐ Ensure necessary permits are in place	☐ Proper waste disposal
☐ First aid kit	☐ Confined space/trenching hazards	

Emergency gathering area:

Location of nearest medical facility:

Emergency contacts:

Police: Ambulance: Fire:

Other:

Comments or special considerations:

I understand the HSE hazards of this job and agree to work safe and work smart.

Print name/company	Signature

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>>> Select a Laboratory <<<
#N/A
#N/A
#N/A
#N/A

Chain of Custody Record

eurofins | Environment Testing TestAmerica

Regulatory Program: ☐ DW ☐ NPDES ☐ RCRA ☐ Other:

TestAmerica Laboratories, Inc. d/b/a Eurofins TestAmerica

	Project Manager:		COC No:
Client Contact	Email:	**Site Contact:**	**Date:**	_____ of _____ COCs
Your Company Name here	**Tel/Fax:**	**Lab Contact:**	**Carrier:**	TALS Project #:
Address	**Analysis Turnaround Time**			Sampler:
City/State/Zip	☐ CALENDAR DAYS ☐ WORKING DAYS			**For Lab Use Only:**
(xxx) xxx-xxxx Phone	TAT if different from Below _____			Walk-in Client:
(xxx) xxx-xxxx FAX	☐ 2 weeks			Lab Sampling:
Project Name:	☐ 1 week			
Site:	☐ 2 days			Job / SDG No.:
P O #	☐ 1 day			

Sample Identification	Sample Date	Sample Time	Sample Type (C=Comp, G=Grab)	Matrix	# of Cont.	Filtered Sample (Y / N)	Perform MS / MSD (Y / N)																Sample Specific Notes:

Preservation Used: 1= Ice, 2= HCl; 3= H2SO4; 4=HNO3; 5=NaOH; 6= Other _____

Possible Hazard Identification:
Are any samples from a listed EPA Hazardous Waste? Please List any EPA Waste Codes for the sample in the Comments Section if the lab is to dispose of the sample.

☐ Non-Hazard ☐ Flammable ☐ Skin ☐ Poison B ☐ Unknown

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)

☐ Return to Client ☐ Disposal by Lab ☐ Archive for Months

Special Instructions/QC Requirements & Comments:

Custody Seals Intact: ☐ Yes ☐ No | Custody Seal No.: | Cooler Temp. (°C): Obs'd:_____ Corr'd:_____ | Therm ID No.:_____

Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received in Laboratory by:	Company:	Date/Time:

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Appendix E – ADEC Comments and Response

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THE STATE of ALASKA
GOVERNOR MIKE DUNLEAVY

Department of Environmental Conservation
SPILL PREVENTION & RESPONSE
Contaminated Sites Program

610 University Avenue
Fairbanks, Alaska 99709
Main: 907.451.2143
Fax: 907.451.2155
www.dec.alaska.gov

File: 2332.38.053

June 9, 2020

National Park Service
ATTN: Mr. Bill Heubner
240 West 5th Avenue
Anchorage, AK 99501

RE: DEC comments for the *Draft Glass-Heifner Mine Site Preliminary Assessment/Site Investigation, Kenai Fjords National Park, AK.* Dated May 2020.

Mr. Heubner:

The Alaska Department of Environmental Conservation (DEC) received the above-referenced document on May 6, 2020. DEC has reviewed the report, which details previous sampling efforts and future site characterization plans at a former gold mine near Beauty Bay.

Arsenic-laden tailings were discovered in 1994, and since then some remediation efforts have occurred at the site. The tailings were combined in Pond D, then solidified and stabilized with concrete in 1998. Drums containing various hazardous materials were removed in 2008, and soil samples underneath a ball mill/rock crusher were collected as the soil was visually distinct from its surroundings. These samples showed exceedances of mercury and arsenic above DEC migration to groundwater cleanup levels. Ahtna plans to delineate the extent of mercury contamination and compare arsenic contamination to background levels at the site.

DEC has reviewed this report, and provided comments (See Enclosure). If there are any questions please contact me at (907) 451-2131, or at tim.sharp@alaska.gov.

Sincerely,

Timothy Sharp

Environmental Program Specialist

Enclosure: DEC Review Comments

cc: Eric Breitenberger, DEC
Alexandra Hoyt, Ahtna Engineering
Nino Muniz, Ahtna Engineering

REVIEW COMMENTS

PROJECT: Glass-Heifner Mine Site

DOCUMENT: Draft Preliminary Assessment/Site Investigation 2020

ALASKA DEPT. OF ENVIRONMENTAL CONSERVATION	DATE: 6/9/2020 REVIEWERS: Timothy Sharp	Action taken on comment by: Nino Muniz, Ahtna Solutions, LLC

Item No.	Drawing Sheet No., Spec. Para.	COMMENTS	REVIEW CONFERENCE A - comment accepted W - comment withdrawn (if neither, explain)	RESPONSE	ADEC RESPONSE ACCEPTANCE (A-AGREE) (D-DISAGREE)	RESPONSE
1.	Section 1	Please add the site's Hazard ID (27212) and ADEC file number (2332.38.053) to this section.	A			
2.	Section 2.2.1	Please clarify at what depth the soil samples were collected.		The depth of sample collection is unknown, but it can be assumed that it was near surface (< 2 feet bgs).		
3.	Section 4.6.1, Decontamination Procedures	The work plan states the sampling equipment will be dry decontaminated. According to ASTM D5088 (Standard Practice for Decontamination of Field Equipment), typically alconox is used followed by rinsing with distilled water. Please modify the work plan to address this.		Due to the remoteness, the difficult (overgrown with alders) and steepness of the hike into the location, and with the XRF/coolers/ other sampling gear (e.g. shovel, hand auger) already needed, additional water (other than drinking water) and gear (bottles/buckets) cannot be hauled into the site, nor would decontamination water be able to be hauled out.		
		- End of comments -				

REVIEW COMMENTS

PROJECT: Glass-Heifner Mine Site

DOCUMENT: Draft Preliminary Assessment/Site Investigation 2020

ALASKA DEPT. OF ENVIRONMENTAL CONSERVATION	**DATE: 6/9/2020** **REVIEWERS: Timothy Sharp**	**Action taken on comment by: Nino Muniz, Ahtna Solutions, LLC**

Item No.	**Drawing Sheet No., Spec. Para.**	**COMMENTS**	**REVIEW CONFERENCE A - comment accepted W - comment withdrawn (if neither, explain)**	**RESPONSE**	**ADEC RESPONSE ACCEPTANCE (A-AGREE) (D-DISAGREE)**	**RESPONSE**
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3.	Section 4.6.1, Decontamination Procedures	The work plan states the sampling equipment will be dry decontaminated. According to ASTM D5088 (Standard Practice for Decontamination of Field Equipment), typically alconox is used followed by rinsing with distilled water. Please modify the work plan to address this.		Due to the remoteness, the difficult (overgrown with alders) and steepness of the hike into the location, and with the XRF/coolers/ other sampling gear (e.g. shovel, hand auger) already needed, additional water (other than drinking water) and gear (bottles/buckets) cannot be hauled into the site, nor would decontamination water be able to be hauled out.	A	DEC recommends bringing individual stainless steel sampling spoons to prevent cross contamination and, if possible, a squirt bottle of deionized water to rinse the hand auger and shovel between sampling events, with wipes to get rid of all the soil particles. Please describe the changes to sampling with individual spoons in section 5.1 as well.
		- End of comments -				

Appendix G
ADEC Comment and Response (Final Version Only)

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THE STATE of ALASKA
GOVERNOR MIKE DUNLEAVY

Department of Environmental Conservation
SPILL PREVENTION & RESPONSE
Contaminated Sites Program

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File: 2332.38.053

November 24, 2021

National Park Service
ATTN: Sarah Venator
240 West 5th Avenue
Anchorage, AK 99501

RE: ADEC Comments for the *Draft Glass-Heifner Mine Site Preliminary Assessment and Site Inspection Report, Kenai Fjords National Park, AK* Dated November 2021.

Ms. Venator:

The Alaska Department of Environmental Conservation (ADEC) received the above-referenced document on November 19, 2021. ADEC has reviewed the report, which details soil sampling in the vicinity of a ruined rock crusher/ball mill. Contaminants of concern at the site consist of arsenic and mercury due to mining activities. Background sampling of arsenic and mercury was conducted, and both are present at concentrations above ADEC migration to groundwater and human health levels as described in 18 AAC 75.341. NPS has recommended a more comprehensive characterization effort to delineate the area of impacted soil.

Based on the review of the report, ADEC has provided enclosed comments. If there are any questions, please contact me at (907) 451-2131, or at tim.sharp@alaska.gov.

Sincerely,

Digitally signed by Timothy Sharp
Date: 2021.11.24 13:30:36 -09'00'

Timothy Sharp
Environmental Program Specialist

Enclosure: ADEC Review Comments

cc: Nick Waldo, ADEC
Nino Muniz, Ahtna
Caley Lenhart, Ahtna
Alexandra Hoyt, Ahtna

REVIEW COMMENTS PROJECT: Glass-Heifner Mine Site DOCUMENT: Draft PA/SI Report

ALASKA DEPT. OF ENVIRONMENTAL CONSERVATION		DATE: 12/17/2021 REVIEWERS: Timothy Sharp	Action taken on comment by: Nino Muniz, PG ASL		
No.	**Location in Document**	**COMMENTS**	**RESPONSE**	**RESPONSE**	**RESPONSE**
1.	Section 5.2	With the data collected from soil samples this year, mercury should be considered mobile for future sampling events.	A		
2.	Section 5.2.2	The Sampling Analysis Plan (SAP) dictated that groundwater flowed to the north and west of the source area, yet this information is missing from this section. Is the current understanding of groundwater flow direction the same as it was for the SAP? Please describe how the groundwater flow direction was determined. Is it based on an assumption due to the location of the nearby creek? Or did the Shannon and Wilson report contain information on groundwater flow direction?	Groundwater is assumed to go to the north or northwest based on the presence of Ferrum Creek. A similar assumption was made by Shannon & Wilson in their report, they did not make specific groundwater flow direction determinations. Observed site topography also suggests flow towards Ferrum Creek. Text will be added to discuss assumed groundwater flow direction.	A	
3.	Section 6.0	ADEC recommends that the groundwater at the site be sampled and analyzed for mercury and arsenic if contaminant levels are above background levels at the groundwater interface. Metals can have increased detection in unscreened or undeveloped wells so care should be taken to ensure that the sample is not biased high when collected. Depending on feasibility, ADEC also recommends background sampling for arsenic and mercury in groundwater in this case.	At this time mobilization of a drill rig (cost/logistics) or installation of well points (logistics and till/gravelly soil type) for this site is not feasible. Accessing the site would first entail (at great expense and disturbance of revegetated roadway) mobilization of earthmoving equipment. Regrading a mile of revegetated and eroded old roadway into the site would be necessary before any other equipment could subsequently access the site. As this site is very remote, is within a national park, and future use of the area controlled by the NPS, groundwater at this site is not currently used and will not be used for drinking water at any time in the foreseeable future. The main concern for the NPS is whether	A, with comment Eventual closure of the site will require either delineation of impacted groundwater, or institutional controls to limit use of groundwater. DEC recommends further characterization of the presence or absence of groundwater, and mercury and arsenic concentrations therein, as soon as such characterization is feasible. Surface water exposure will be important to assess as well, but solely reviewing this pathway will not rule out impacts to groundwater. Please add the surface water/sediment couplet sampling to the recommendations section.	

			Ferrum Creek would be impacted by the mercury and above background arsenic at the ball mill. We suggest that surface water/sediment couplets be taken from Ferrum Creek upgradient, at, and downgradient of the site to assess potential impacts to the creek. If future NPS work does result in mobilization of heavy equipment to the site, monitoring points could potentially be installed at that time.		
4.	Figures	Please describe the groundwater flow direction if possible and indicate Ferrum Creek on Figures 3, 4, and 6.	Ferrum Creek notation will be added to Figure 3, and an assumed GW flow direction arrow will be added. Ferrum Creek is present on Figure 4 or 6.	A	
		- End of comments -			

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