NPS Preliminary Assessment Report

Wrangell-St. Elias National Park and Preserve (WRST)

Kennecott Mill Site
EDL# 5AKR3347

Prepared by

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Adopted by WRST on July 8, 2019 as a working draft document for field review and amendment through December 2020, in coordination with the Contaminated Site Interim Strategy and The Comprehensive Safety Plan

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Signatories:

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By signing above, the signatories verify that they understand and concur with the information and recommendations presented herein **as a working draft document for field review and amendment through December 2020, in coordination with the Contaminated Site Interim Strategy and The Comprehensive Safety Plan**		

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List of Abbreviations and Acronyms

µg/ft^2	micrograms per square foot
µg/L	micrograms per liter
ACM	asbestos-containing material
ADEC	Alaska Department of Environmental Conservation
Amec Foster Wheeler	Amec Foster Wheeler Environment & Infrastructure, Inc.
AST	aboveground storage tank
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CSM	conceptual site model
ESV	ecological screening value
EPA	U.S. Environmental Protection Agency
GIS	geographic information system
Kennecott NHL	Kennecott National Historic Landmark
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NPL	National Priorities List
NPS	National Park Service
PE	Professional Engineer
RCRA	Resource Conservation and Recovery Act
RSLs	regional screening levels
TCLP	toxicity characteristic leaching procedure
XRF	x-ray fluorescence
WRST	Wrangell-St. Elias National Park and Preserve

1. Introduction

This Preliminary Assessment was performed by Amec Foster Wheeler Environment and Infrastructure, Inc. (Amec Foster Wheeler), for the Kennecott Mine National Historic Landmark (referred to as the site or Kennecott NHL), located in Wrangell-St. Elias National Park and Preserve (WRST), which is managed by the National Park Service (NPS). The park is located in Eastern Alaska, bordering Canada. The Environmental and Disposal Liabilities site number is 5AKR3347. The site location is shown on Figure 1. The current NPS-designated site contact information can be found in the Statement of Services for the Kennecott Mill Site Preliminary Assessment dated May 8, 2017 (NPS, 2017a). The Kennecott Mill and mines were named after the Kennicott Glacier and valley below the site, although the spelling of the Kennecott Mill is different from the spelling for the Kennicott Glacier and local geographical features.

This Preliminary Assessment is organized as follows:

- Section 1 provides an overview of the regulatory framework for the Preliminary Assessment.
- Section 2 summarizes the site operational history and current uses of the site. A summary of waste characteristics can be found in Section 2.3.
- Section 3 summarizes the exposure pathways for contamination at the site: groundwater, surface water, soil, and air.
- Section 4 summarizes conclusions and recommendations based on the information presented in the Preliminary Assessment.
- Section 5 presents a list of references cited in the Preliminary Assessment.

This Preliminary Assessment was developed by first reviewing historical reports and documentation made available by the NPS, including historical preliminary site assessments and site characterizations, the Phase I Environmental Site Assessment performed by NPS prior to acquisition of the site in 1996, and subsequent environmental investigations conducted by NPS to assess the extent of environmental contamination and site hazards. On August 22, 2017, Charles Hand, PE, of Amec Foster Wheeler conducted a site reconnaissance, which consisted of a site walk to observe site features and interviews with the following knowledgeable staff:

- Michael Loso, Geologist, WRST;
- Wayne Challoner, former Facility Manager, WRST;
- Greg Biddle, Cultural Resources Management Specialist, WRST;
- Dave Williams, Maintenance Worker, Kennecott NHL, WRST;
- Diane Thorn, Maintenance Worker, Kennecott NHL, WRST;
- Matthew Smith, Acting Maintenance Worker Supervisor, Kennecott NHL, WRST; and
- Stephen Harper, Acting Kennecott NHL Unit Manager, South District Ranger, WRST

1.1. CERCLA and NPS 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 releases and threatened releases of hazardous substances. The NCP prescribes two processes for responding to releases: removal actions and remedial actions. Under either process, the initial step is to perform a Preliminary Assessment. (See NCP Sections 300.410 and 300.420.)

The purpose of this Preliminary Assessment is to investigate suspected releases of heavy metals from ore, tailings, ore processing wastes, and deposits from lead- and arsenic-based paint. Fuel and asbestos contamination is also suspected. Contamination is associated with historical copper ore mining and ore processing activities that were conducted at the site. In accordance with the Statement of Services for the Kennecott Mill Site Preliminary Assessment (NPS, 2017a), the Preliminary Assessment is also intended to include a summary of data related to contaminants and explosives, identify data gaps, and provide a comprehensive assessment of the health hazards posed by each substance.

This Preliminary Assessment will support decisions by NPS to 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 meet the NCP criteria for no further action determination (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 and do not include the surrounding mines, tailings deposits, or tramways where the ore was mined from and transported to the site. Available historical data were used to the extent practicable. Emphasis is placed on activities that routinely or non-routinely may have led to or may lead to releases of hazardous substances into the environment and may result in human or ecological exposure to the hazardous substances.

2. Site Description, Operational History, and Waste Characteristics

This section provides a physical and operational description of the site as well as information regarding locations where waste storage, handling, disposal, and deposition may have occurred.

2.1. Site Description

The site is a historic mill located on McCarthy road, approximately five miles north of McCarthy, Alaska (Figure 1). The site coordinates are 61°29'06.6" N, 142°53'19.4" W. It is located on the northeast corner of the McCarthy B-6 NE, AK United States Geological Survey 7.5-minute quadrangle. The site is located on a valley wall near the confluence of the Root and Kennicott Glaciers, south of the Wrangell Mountains, and west of Bonanza Ridge (Figure 2). Currently the site is owned by the NPS and is a popular tourism destination, where people come to visit the historic mines and buildings. The site is accessible by car via McCarthy Road and is a National Historic Landmark that is open to the public.

Figure 3 shows a layout of all the site buildings and features owned by the NPS. Surface water drainage routes are evident on Figure 2. The site is a visitor use area in Wrangell-St. Elias National Park and Preserve, and visitors have access to many of the old buildings. Visitors are warned to avoid contact with

the mine tailings, soil, and other mining debris. Signage is used to discourage visitors from entering historic buildings that are unsafe or conducting other hazardous activities, including unguided tours through the mill building, the machine shop, and the leach plant.

The area surrounding the site is mostly owned by the NPS, with private property interspersed. Buildings not outlined on Figure 3 are privately owned and were not evaluated as part of this Preliminary Assessment. The privately owned buildings are generally used as vacation residences; however, as of 1995, one permanent resident was living in Cottage 24 on the site, and a family of five was living approximately 1 mile south of the site, along the road to McCarthy. At the time of the site walk, approximately 65 people worked and 20 people lived within 0.25 mile of the site during the summer months. Winter resident populations varied from 5 to 8 in Kennecott. The number of residents varies both seasonally and from year to year. The Kennicott Glacier Lodge is a privately owned facility located south of the site along the road to McCarthy that employs approximately 15 people during the summer months, and these employees live at the Kennecott NHL during the summer months.

Site accessibility and land use were described in the Kennicott Pre-Acquisition Environmental Site Assessment (Document 1, Appendix A):

> *"... today circulation patterns in the Mill Site generally mimic the historic routes, with the older roads and trails still in use. Several new roads have been established in the southern part of the townsite while others in the National Creek drainage have been abandoned or destroyed by flood or bank failure. All roads have gravel surfaces; much of the surface material is mill tails."*

The NPS office in Anchorage, Alaska, provided Amec Foster Wheeler with geographic information system (GIS) data sets in July 2017. The data sets provided were for Wrangell-St. Elias National Park and Preserve and included data collected for the Natural Resource Condition Assessment. Amec Foster Wheeler reviewed the GIS data set provided by NPS and performed a visual analysis to see if any sensitive environments or threatened/endangered species occurred in the site area, and none was found in the GIS data provided. Because the site contains several buildings and features that are cultural resources and is a unit of the National Park System, the site is considered a sensitive environment. Wetland data was obtained from the U.S. Fish & Wildlife Service National Wetlands Inventory. That data was also visually reviewed, and no wetlands were found within the site area.

2.2. Operational History

The Kennecott Mines and the Kennecott Mill were developed and used by the Kennecott Copper Corporation between 1906 and 1938 as a copper mine and copper milling town. The mill building received and concentrated ore mined from the nearby Bonanza, Jumbo, Glacier, and Erie Mines. The site consisted of a gravity concentrator and an ammonia leaching and floating process. A power plant, machine shops, repair shops, housing, administrative offices, and material stores were located around the mill to support copper ore processing operations. A tramway transported material from the mines to the mill, and a railroad was constructed to transport the concentrated ore from the mill to Cordova, Alaska. From Cordova, the ore was transported via steamship line to the American Smelting and Refining Company, a smelter located in Tacoma, Washington. The mines and mill closed in 1938, and the facilities were abandoned. Between 1911 and 1938, the mine produced 4,626,000 tons of ore. A summary of the

operational history of the mine, as reported in the 1990 Kay and Miller University of Alaska Hazardous Waste Audit (Document 2, Appendix A), can be seen in Table 1.

The current and past use of the adjacent properties is best described in the Kennicott Pre-Acquisition Environmental Site Assessment (Document 1, Appendix A):

> *"Historically, the adjacent properties were also associated with Kennecott Copper Corporation's mining operations. The 19 patented mining claims associated with the Mother Lode Coalition Mines are located in the McCarthy Creek drainage directly across the divide from the Bonanza Mine (Figure 4). The Mother Lode operation was established independently of Kennecott [Copper Corporation], but 51 percent of the company was acquired by Kennecott in 1919 and eventually integrated into the larger operations. The 19 patented claims are owned independently of the Kennecott properties subsequently deeded to the Consolidated Wrangell Mining Company and the Great Kennicott Land Company. Land use on the Mother Lode properties has been exclusively related to mining: there were upper and lower camps connected by an aerial tramway and a road connecting to the railway at McCarthy. The ore from the Mother Lode that was shipped before the acquisition of the company by Kennecott was all high-grade and did not require concentrating; hence there was no concentrator built on the property. Eventually, an underground connection was established with the Bonanza and Jumbo Mines, and supporting operations on the Mother Lode side were abandoned. More recently, principally in the late 1960s and 1970s, mineral explorations were conducted in the area using the Mother Lode mill site claims on McCarthy Creek as a base of operations. Since then, recreational uses of the area have predominated."*

The site primarily consists of historical buildings that were used to support copper ore processing operations. Historical buildings contained lead- and arsenic-based paint and asbestos for insulation. The area surrounding the mill was filled using tailings from the milling operations. A local power plant, which used a fuel believed to be a heavy oil similar to Bunker C, was used for heating the buildings and producing electrical power. It is unknown how the fuel was transported to the site. Aboveground storage tanks (ASTs) were used to store fuel, and utilidors were used to transport fuel to the power plant.

The site is currently accessible for visitors to view the historic mining town and serves as a center for exploring the surrounding park. Visitors can view the mill town on guided and self-guided trips. The expected future use is as a park.

2.3. Waste Characteristics

Table 2 summarizes the site buildings and hazards associated with the buildings, as identified in the hazardous waste audits conducted in 1990 and 1992. Buildings shown in bold were inspected during the Amec Foster Wheeler 2017 site reconnaissance. The 1992 Preliminary Assessment (Document 3, Appendix A) expanded on the findings from the 1990 Hazardous Waste Audit (Document 2, Appendix A); the 1992 Preliminary Assessment identified asbestos, mill tailings, boiler ash, ammonia tanks, oils and grease/oil spills, lead-based paint, ore, and garbage dumps as wastes present at the site. Table 3 summarizes the most recent estimated quantities reported for these hazardous materials found in historical documents.

Several site investigations and limited remedial activities have been conducted at the site. Some of the hazards identified in Table 2 and Table 3 had been mitigated prior to acquisition of the site by the NPS in 1998. After acquiring the site, the NPS began mitigating the hazards identified in the Kennicott Pre-Acquisition Environmental Site Assessment (Document 1, Appendix A); they developed a series of work plans to address existing hazards as identified in the 1996 report as well as in other documents (Documents 4 through 6, Appendix A). Current and future use scenarios have not been thoroughly evaluated in the past studies conducted at the site, resulting in uncertainty and data gaps for assessing human or ecological risks associated with the site. For example, the waste characterizations completed under past studies that were needed for disposal purposes under the Resource Conservation and Recovery Act (RCRA) do not constitute characterization of the nature and extent of contamination under CERCLA. Although toxicity characteristic leaching procedure (TCLP) limits may not have been exceeded in some areas, the TCLP method does not address potential health or ecological risks, and the total metals concentrations present at the site may warrant further study or action.

Table 4 summarizes available reports documenting the historical site investigations and remedial action activities conducted for the site. Table 5 summarizes where information regarding analytical samples can be found in the historical reports.

Asbestos

As described in the Kennicott Pre-Acquisition Environmental Site Assessment (Document 1, Appendix A):

> *"… the Site was surveyed August 15 through 21, 1991, by Asbestos General for asbestos containing material (ACM). The survey was performed by an EPA/AHERA accredited inspector and a state-certified asbestos worker. They surveyed all open buildings and structures in the mill town (some private buildings were locked and unavailable for survey). ACM was identified and quantified in 23 buildings and utilidors in the mill town (Figure 7). Asbestos General made cleanup recommendations for each site (Asbestos General 1991). Seventy samples of various materials were gathered and analyzed, 11 of which contained asbestos. All of the asbestos found was Chrysotile, and it was primarily located in pipe insulation (thermal system insulation-TSI), fiberboard, and around boiler tanks.*
>
> *During 1993 and 1994 the Kennecott Corporation hired INTERA Inc. to mitigate the asbestos hazards in the mill town. INTERA Inc. subcontracted the work to Technic Services Inc., and EMCON Alaska provided local assistance and air monitoring services during the removal process (INTERA 1995). ACM was removed from all buildings and accessible utilidors in the mill town, with the following exceptions (INTERA 1995):*
>
> *1) Utilidors with more than two feet of soil cover were not abated.*
>
> *2) The boilers in the power house and leaching plant were not dismantled for ACM removal. Instead, after abatement of exterior ACM, boilers were sealed by injecting with a solid foam and welding a steel plate across fuel injection port.*

3) *Due to inaccessibility, they were unable to clean below the boilers in the leaching Plant. Consequently, two feet of tails were deposited on the floor to bury it beneath the tanks.*

All work was conducted according to Alaska Construction Code 8ACCO5.045, and all areas had less than 0.01 fibers/cc [cubic centimeter] before the Site was declared abated, which exceeds OSHA standards for worker safety, and meets EPA standards for clearance in schools. All removed ACM was transported off Site and properly disposed of. Appendix 4 is a compilation of the buildings in which asbestos was found by Asbestos General and in which mitigation activities were carried out by Technic Services.

... Several of the private structures were not mitigated; however, it appears that all buildings and ruins that contained exposed asbestos and that are proposed for NPS acquisition have been mitigated. On our Site visit in July 1995 we examined the sites in the mill town that formerly contained ACM. All appeared to be mitigated. However, the mines were not remediated by INTERA."

No privately owned building were reported as abated. The current U.S. Environmental Protection Agency (EPA) standards for clearance in schools is 0.01 fibers per cubic centimeter of air (40 Code of Federal Regulations 763.91 [5]).

The 2017 site reconnaissance and interviews with NPS maintenance staff show that asbestos continues to be found in crawl spaces and in foundation and walls by NPS workers during active rehabilitation of the site. Asbestos abatement is performed on a small scale by maintenance staff as asbestos is discovered during building rehabilitation. Maintenance staff confirmed that some asbestos may have been placed beneath the false bottom floor in the leach plant or buried beneath tailings during asbestos mitigation in the 1990s, indicating that asbestos-containing material (ACM) may not have been appropriately disposed of. Thus, further investigation into the disposal of ACM removed during mitigation measures conducted in the early 1990s is warranted. In addition, the boilers that were filled with ACM and sealed appear to have some seals that are failing, as observed during the site reconnaissance.

Mill Tailings

The copper sulfide ore mined in the Kennicott area was enclosed in a limestone matrix. When mining and processing the ore, the limestone was removed to the extent possible, and the rest of the limestone that could not be separated was deposited with the mine tailings. The earliest tailings deposits were in the vicinity of the mill building, including the area where the leach plant was later constructed (Figure 4). After construction of the leach plant, tailings were deposited west of the leach plant, as well as in the area south of National Creek. In 1992, America North/EMCON, Inc., collected tailings samples and analyzed them for total metals, sulfide content, and leachable metals (Document 7, Appendix A). Leachable metals were analyzed, and concentrations were all below the RCRA allowable limits (Document 3, Appendix A). TCLP results below allowable limits mean that the mill tailings analyzed are considered non-hazardous for waste disposal purposes. However, these constituents are CERCLA hazardous substances that may pose unacceptable risk to human and ecological receptors if present at sufficiently high concentrations.

As discussed in the 1996 NPS Report (Document 1, Appendix A), total metals concentrations were highest for the samples located in the earliest deposits of tailings located adjacent to the mill building, due

to inefficiencies in copper ore recovery associated with the crushing and sorting process in the mill. Copper ore recovery efficiencies at the mill were improved in 1916 by implementing the ammonia leaching process and in 1926 by adding a flotation separation process. After addition of these processes, the tailings generated were over 95 percent limestone. A detailed morphological study of the tailings was conducted to investigate subsurface geological conditions for depth to bedrock, determine the thickness of tailings, and identify groundwater levels. The apparent depth to bedrock beneath the tailings piles was between 4 and 49 feet, and the apparent maximum thickness of tailings was approximately 12.6 feet (Document 1, Appendix A). The total volume of tailings was estimated to be approximately 600,000 cubic yards (Document 7, Appendix A). The 1996 NPS Report (Document 1, Appendix A) also notes that generation of acid by the tailings is unlikely due to the buffering capacity of the surrounding limestone host rock.

Table 6 summarizes the maximum concentrations of total metals detected in the tailings samples and compares the maximum concentrations to the NPS ecological screening values (ESVs) and EPA regional screening levels (RSLs) for soil. The locations of the tailings samples are shown on Figure 5 of Document 1 in Appendix A; Figure 4 of this report shows an approximate surface footprint of the tailings locations. Figure 4 is based on available information from historical sources; tailings are not solely confined to the areas shown on Figure 4, as they have been widely dispersed by other means, such as through use of tailings as general fill, for road surfacing, or other uses, as mentioned by maintenance staff during the site reconnaissance.

Current NPS ESVs (NPS, 2014) were used for preliminary assessment conceptual screening purposes. Where applicable, EPA RSLs were used based on residential site usage for conservative screening purposes. The ESVs and RSLs have been included as applicable in Tables 6 through 8. As shown in Table 6, several metals, including arsenic, cadmium, lead, and mercury, exceeded both the RSLs and ESVs by at least one order of magnitude. The screening criteria have not been compared to the entire set of available characterization data for the site as part of this Preliminary Assessment. Uncertainties in data usability resulting from analytical and sample collection methods must be resolved prior to rigorous use of the historical data. In general, this Preliminary Assessment compares the screening criteria to the maximum reported historical data. Additional evaluation may be necessary after the data gaps described in Section 4 have been resolved.

During the 2017 site reconnaissance, the maintenance supervisor mentioned that a portion of the bank of National Creek consists of tailings, that ore concentrates may be transported downstream during flood events, and that at one point green tailings could be observed all the way to the surface water ponding locations in National Creek south of the leach plant (surface water ponding location shown in Photos 34 and 62 in Appendix B).

Ore and Ore Concentrates

A 1990 study reported that nearly 3,000,000 pounds of ore had been mined but not fully processed; the majority of the unprocessed ore was reported to be located in and around the mill (Document 2, Appendix A). The Preliminary Assessment Report (Document 3, Appendix A) also reported the quantities of ore and ore concentrates in 1992. No other mention concerning how the ore and ore concentrates were disposed of could be found. During Amec Foster Wheeler's 2017 site reconnaissance, ore concentrates were observed on equipment in the leach plant and on the ground beneath the leach plant timber supports,

as evident by green soil staining. In addition, ore bins inside the mill building contained ore during operations and they may still contain ore residue. Ore has been reported to be present beneath the mill building, but it is uncertain how much ore remains and what potential is present for hazardous substance releases from the remaining ore and ore residue. Ore was visually observed during the site reconnaissance on the west side of the mill building, along the steep slope.

Boiler Ash

An estimated volume of 1,443 cubic feet (49,000 pounds) of boiler ash is located west of the power plant in the approximate location shown on Figure 4 (Document 3, Appendix A). As part of the 1992 America North/EMCON, Inc., investigation, three samples were taken from the boiler ash pile. Two samples were analyzed for total metals and found to have high levels of barium, cadmium, chromium, lead, and silver. All three samples exceeded the RCRA TCLP limit for lead of 5 milligrams per liter (mg/L), indicating that the boiler ash is a RCRA hazardous waste (Document 7, Appendix A).

The boiler ash pile was reported to have been remediated in 1994. Following remedial alternative screening, construction of a fiber-reinforced concrete cap was selected as the remedial approach to prevent infiltration through the boiler ash area. The remedial action consisted of an application of 2–4 feet of tailings to fill in voids in the scrap metal pile and the surrounding moraine; tailings were shaped to form a flat footing around the base of the ash pile to prepare a foundation for concrete. A geotextile fabric was placed over the ash pile and tailings to separate the underlying contaminants from the concrete cap; steel reinforcing mesh was placed on the steepest face of the pile, on top of the geotextile. Polypropylene fiber-reinforced concrete was pumped over the geotextile and spread by hand; a cap thickness between 4 inches (top of pile) and approximately 1 foot (base of pile) was reported. Following placement of the concrete, tailings were embedded into the concrete in order to give the final appearance of a small tailings pile (Document 8, Appendix A).

Based on locations shown in historical reports and the location observed during the site walk, the boiler ash cap was observed during the site walk (refer to Photo 24 of Appendix B). The observed concrete area had visible signs of deterioration, and the integrity of the underlying plastic liner is uncertain.

Ammonia Tanks

Five ASTs that were used as part of the ammonia leaching and floatation process are located in the leach plant. Three were reported to be empty, and two reportedly contain an ammonia solution. America North Inc. sampled the contents of the tanks and determined that the solutions were relatively dilute (0.1 and 0.06 molar), metal concentrations were all below allowable TCLP limits, and the pH was below 12.5 and above 2. Based on these results, the ammonia solution was not considered a hazardous waste (Document 7, Appendix A). The ammonia tanks were treated by adding sodium sulfide to the tanks to precipitate copper sulfide. Approximately 10,500 gallons of treated solution was passed through bag filters to filter total suspended solids; filtered liquid was discharged onto the glacial moraine. The precise disposal locations for the liquids were not reported. The dissolved copper concentration of the discharge was monitored hourly and did not exceed 0.5 mg/L, the threshold concentration specified by the Alaska Department of Environmental Conservation (ADEC) (Document 8, Appendix A). Other metals, including arsenic, were not monitored during discharge of the liquid. These two tanks reportedly had considerable quantities of hard, blue to colorless crystals on the bottom and a thin overlying layer of precipitated copper sulfide sludge. Approximate quantities of sludge were estimated as 2,079 gallons in one tank and

3,528 gallons in the other tank. Samples of the sludge were collected and analyzed using the TCLP; the sludge did not exceed RCRA TCLP allowable limits and was not classified as a hazardous waste. The material is still present in the tanks.

During the 2017 site reconnaissance, green staining was observed on the ammonia leaching tanks and the surrounding wood joists and support beams (Photo 32, Appendix B). Visual observation inside the tanks was not possible due to inaccessibility.

Fuel, Oil, and Grease

Site investigation activities conducted in the summers of 1991and 1992 identified three areas of hydrocarbon-impacted soil at the site: west of the power plant near three ASTs, a stained area on the north side of the mill building, and a reported used-oil disposal pit located next to a generator at the Guide Building (referred to as Cottage 24 by GeoEngineers; Document 9, Appendix A). Figure 4 shows the reported locations and the extent of soil staining described in the historical reports; the extent of soil staining was not reported for the Guide Building area. Table 5 summarizes where information regarding analytical samples can be found in the historical reports. In 2006, GeoEngineers provided a comprehensive summary of previously reported soil sample results for areas impacted by total petroleum hydrocarbons (Document 9, Appendix A). Their report summarized maximum observed soil concentrations from previous reports; that information is included in Table 6 for total petroleum hydrocarbons. Heavy fuel oil used at the site was believed to be Bunker C fuel, but the nature of the fuel oil cannot be confirmed from historical analytical data and reports.

Soil staining was reported within approximately 1 foot of the AST located upgradient of the power plant; this area is contained within a 3-foot-wide berm. An old utilidor connects this AST to the power plant, and occasional oil staining was reported along the length of the accessible utilidor, extending approximately 2 feet on either side. Soils in this area have been reported to be high in organic content and likely to have a high adsorptive capacity for the fuel (Document 3, Appendix A). This tank is located on private land, but was emptied and cleaned since it posed a potential threat to the adjacent property (Document 8, Appendix A). Oil staining was not observed during the 2017 site reconnaissance due to inaccessibility. During the 2017 site reconnaissance, olfactory evidence of oil was noted, and oil pooling was observed in the power plant, as shown on Photo 15 of Appendix B. The oil pooling is located in areas that are included on tours for visitors, representing a potential direct exposure pathway. In addition, old conveyance piping and a storage tank appeared to contain fuel oil residue during the site reconnaissance.

High levels of hydrocarbons have been detected in soils adjacent to the power plant and near three ASTs that appear to be the source of the historical releases. The tanks were used to supply the power plant and probably the locomotives running to Cordova. The total area of the surface staining was estimated to be approximately 79,000 square feet, and the estimated volume of soil contaminated by the oil is at least 1,000 cubic yards (Document 2, Appendix A). Surface oil staining was observed to extend approximately 125 feet downslope of the fuel tanks behind the power plant. A spring and two adjacent pools of oil about 1 foot deep were reported at the base of the slope, with water and oil seeping from the spring (Document 3, Appendix A). As summarized by GeoEngineers (Document 9, Appendix A):

> *"In 1994, it is also reported that remedial efforts were made to stabilize an area of pooled fuel oil/'Bunker C' by mixing sand and gravel into the pooled oil to make an asphalt cap. In the 1996 NPS Pre-Acquisition ESA, it was observed that the asphalt cap*

> *was cracked and a pool of fresh oil was observed. The pooled oil and seep were still present during a 2005 site visit conducted by Med-Tox Northwest. The continued activity of this seep suggests that the fuel oil/'Bunker C' is still migrating from an upgradient source."*

This area was visibly inspected during the 2017 site reconnaissance. Black staining was observed on the slope of the hillside behind the power plant. The oil seep and pooled oil/asphalt cap were inaccessible and not visible. An old wood stave sewer pipe was observed downslope from the power plant and appeared to have black staining in the sewer pipe and around the location where the sewer pipe opens. It is important to note that this area did not have controlled access at the time of the site reconnaissance.

A 50-square-yard stained soil area up the steep slope on the north side of the mill building was reported; America North/EMCON, Inc., collected four soil samples in 1992 that were submitted for analysis of total petroleum hydrocarbons. As stated in the 2006 GeoEngineers report (Document 9, Appendix A):

> *"Comparison to the current ADEC Method Two cleanup levels would suggest that all four sample locations were reported at concentrations greater than the applicable cleanup levels. The NPS Pre-Acquisition ESA states that due to the historic aspects of this spill location, mitigation of the spill would be controlled through controlling access to the spill by workers and visitors. The March 10, 1995, letter from ADEC 'Kennecott Mine, 1994 Remediation Activities Report, Review' stated that no further action was needed for the spill located at the mill building."*

This location was inaccessible during the 2017 site reconnaissance, due to the steep slope and presence of blasting caps.

GeoEngineers described the area adjacent to Cottage 24 (presently designated the Guide Building) that was used as a used oil disposal pit as follows (Document 9, Appendix A):

> *"The only evidence of previous investigation of the reported used oil disposal pit at Cottage 24 was found in the NPS Pre-Acquisition ESA as a soil sample collected in 1990, adjacent to Building 24. The soil sample was submitted for analysis of polychlorinated biphenyls (PCBs) and TPH. The two analyses exhibited concentrations less than the current ADEC Method Two cleanup levels. We did not find any further discussion regarding this reported used oil disposal pit at Cottage 24."*

Oil and grease found on site consisted mainly of lubricating and electrical oils, fuel oils, and lubricating grease. With the exception of the fuel oils and lubricating oil in some of the machinery in the mill, all oil and grease were consolidated in drums during the site assessment for shipment off-site to a facility in Palmer, Alaska, where the oil and grease were processed for re-use as boiler fuel or other purposes (Document 8, Appendix A).

GeoEngineers' 2006 historical document review (Document 9, Appendix A) summarizes the regulatory agency conclusions regarding hydrocarbon-impacted soils at the site:

> *"The 1996 NPS Pre-Acquisition ESA states that the Environmental Protection Agency (EPA) evaluated the site in regards to the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) National Priorities List (NPL) from 1994*

> *through 1995. Results of the EPA investigation concluded that the site did not warrant any further actions under the Federal Superfund Program. Jurisdiction of the site was transferred from EPA to the Alaska Department of Environmental Conservation (ADEC).*
>
> *… The March 10, 1995, letter from ADEC (Kennecott Mine, 1994 Remediation Activities Report, Review) addressed the department's comments regarding the site. The department in this letter indicated that no further investigation or cleanup was needed for either the pooled 'Bunker C' located west of the power plant or the spill located at the mill building.*
>
> *… ADEC listed remaining concerns with the following hydrocarbon impacted areas at the site: the miscellaneous oil spills at the Erie, Bonanza and Glacier mines, the spill north of the mill building and along the utilidor corridor for AST Tank 4' and 'It should be noted that the miscellaneous spills listed as remaining concerns were also listed as "no further action" items due to the type of contamination, apparent low risk to human exposure, access issues and the necessity to maintain the historical integrity of the site.'"*

The 1995 Site Inspection Report (Document 10, Appendix A) stated that during a site visit,

> *"In two roads cut though tailings pile below the leaching and floatation plant, layers of oil were seen as deep as 5 feet. The oil appeared to have migrated downward through the coarser grained tailings and had a strong hydrocarbon smell. Below the leaching and floatation plant, a seep flowed from beneath the tailings pile over bedrock. The seep had stained surrounding rock red."*

Lead and Arsenic Paint

Lead-based paint was used as the finish surface on several of the buildings and structures at the site. Based on the available data and analysis of paint samples, it appears that all the original paint used on site buildings has lead levels that exceed regulatory limits for lead in paint. The colors commonly used were red, white, and pale yellow. Lead concentrations measured in chipped paint samples range between 50 and 525,000 milligrams per kilogram (mg/kg). The approximate square footage of lead paint is listed in Table 3 based on the hazardous substance audit performed by Kay and Miller (Document 1, Appendix A). Lead levels were greatest in the white paint (mean 214,760 mg/kg) and lowest in the red (mean 59,716 mg/kg). The NPS collected two samples each of both the red and white paint and had them analyzed for lead using the TCLP. Both of the white and one of the two red paint samples exceeded the RCRA criteria for toxicity characteristic for waste disposal. The paint finish on the surfaces of the buildings has deteriorated, and most surfaces require repainting if the wood is to be preserved. The 1992 America North/EMCON, Inc., report (Document 7, Appendix A) estimated approximately 70,000 square feet of the surface area of the buildings consisted of badly deteriorated peeling paint.

A lead-paint mitigation program was developed for NPS in 1997, which consists of refinishing deteriorating building surfaces as buildings are rehabilitated. Lead-paint investigations were conducted by Hart Crowser in 2002 (Document 11, Appendix A) and Federal Occupational Health in 2003 and 2005 (Documents 12 and 13, Appendix A). Hart Crowser investigated painted surfaces using field-screening

methods with portable field x-ray fluorescence (XRF) spectrum analyzer. Their report (Document 11, Appendix) states:

> *"While the U.S. Environmental Protection Agency (EPA) considers painted surfaces with lead concentrations above 1.0 mg/cm^2 [milligrams per square centimeter] as lead-based paints in homes or facilities where children are living or routinely present, this standard may only apply to the West Bunkhouse and the Old Schoolhouse, where children may stay in the future. In the other buildings within the scope of our survey, children will not reside or spend long periods of time; hence, the EPA limits cited above would not apply. The results of our lead in paint measurements are presented in Tables 1 and 5. Paint samples are identified with an L prefix; paint sample locations are presented on Figures 3 through 32, as appropriate."*

Table 7 summarizes the lead-based paint surface cover as estimated for the NPS lead-based paint management program (Document 5, Appendix A). Results from the White Environmental 2015 field screening are not included in Table 7 due to uncertainty in reproducibility compared to lab results (Documents 18, Appendix A).

Dust has accumulated in the building on the floors and window sills, and the dust may contain lead from interior paint or lead brought into the building as dirt and debris from the areas surrounding the buildings, either via foot traffic or airborne particulates. Dust present on selected floor surfaces was field-screened for the presence of lead using a portable XRF spectrum analyzer during the 2002 Hart Crowser investigation. Their report (Document 11, Appendix A) stated that:

> *"Most samples contained lead concentrations greater than 40 µg/ft^2 [micrograms per square foot]. While the U.S. Environmental Protection Agency (EPA) considers lead concentrations in dust above 40 µg/ft^2 as lead contamination only in homes or facilities where children are living or routinely present, this standard may only apply to the West Bunkhouse and the Old Schoolhouse, where children may stay in the future. In the other buildings within the scope of our survey, children will not reside or spend long periods of time; hence, the EPA limits cited above would not apply. OSHA has an industrial lead in dust standard of 200 µg/ft^2. Except for one sample, the lead in dust measurements made by Hart Crowser exceeded 200 µg/ft^2."*

Dust sample results from the 2002 Hart Crowser investigation (Document 11, Appendix A) are included in Table 7. Since the number of children visiting and touring the site has increased, the EPA's screening value for children, 40 micrograms per square foot (µg/ft^2) for lead in dust on floors, should be used when assessing potential risks, as it is conservative and covers changes in user groups and site use patterns.

Soils in the vicinity of site buildings have been sampled historically, and analytical results indicate that the soils have elevated lead levels, likely a result of peeling paint becoming incorporated into the surface soil profile. According to the 1996 NPS Pre-Acquisition Environmental Site Assessment (Document 1, Appendix A):

> *"... soil lead levels were highly variable; values vary between buildings and decrease with distance from building and between field duplicates. Measured values ranged from 465 to 3,040 mg/kg. The sample with the highest lead content of 3,040 mg/kg (BPS06) is*

a field duplicate of sample BPS05, which had a lead concentration of 1,340 mg/kg (Table 3). Analysis of soil samples collected by NPS personnel using EPA method 1311 (TCLP) resulted in three out of four samples falling below regulatory levels of 5.0 mg/L for toxicity characteristic. One soil sample, collected from adjacent to the hospital (Figure 6), which is painted white, exceeded the RCRA toxicity characteristic at 5.12 mg/L."

In addition, the report states that:

"The variable levels of total and TCLP lead observed on the Site lead to questions about whether corrective action of lead-impacted soils is necessary, or would be necessary on the entire Site. The OSWER lead guidance, 'Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities' dated July 14, 1994, recommends a screening level of 400 mg/kg in residential soils, above which further action should be considered to achieve risk reduction. The Site is not a residential area, and children are present in the area for only portions of the summer. The industrial screening level for lead in soils is 1,000 mg/kg, above which further action should be considered to achieve risk reduction. In the Federal Register notice of September 11, 1995, 'Guidance on Identification of Lead-based Paint Hazards,' EPA uses the Biokenetic Uptake Model for lead in children to establish 400 mg/kg as a threshold of hazard when children are present. At this concentration and above, EPA recommends exposure reduction activities, including planting ground cover, restricting access through posting signs, and fencing. At concentrations of 2,000 mg/kg, EPA recommends that controls be instituted regardless of whether children are present. Abatement is appropriate whenever lead levels are >5,000 mg/kg. The lead-impacted soils remain on the ADEC list of contaminated sites with ongoing investigation and/or remediation required based upon the current data."

Soil sample results from the 2002 Hart Crowser investigation (Document 11, Appendix A) are included in Table 7. Several soil samples exceed 400 mg/kg and some exceed 2,000 mg/kg.

In 2002, Hart Crowser field-screened soils from selected exterior areas near existing structures for the presence of lead using a portable XRF spectrum analyzer. Their report (Document 11, Appendix A) summarizes the results as follows:

"Many samples contained lead concentrations greater than 1,000 mg/kg. For comparison purposes, ADEC considers total lead concentrations in soil at or above 1,000 mg/kg to exceed soil lead cleanup criteria for non-residential uses (18 AAC 75). According to Footnote 11 to that regulation, lead cleanup levels must be determined on a site-specific basis, based on land use (i.e., residential 400 mg/kg; industrial/ commercial 1,000 mg/kg). Cleanup levels are determined through a site-specific risk assessment (18 AAC 75.340)."

Debris piles located throughout the site originated from old mining and mill equipment and from old wood structures that have collapsed or been removed. The wood debris may contain high concentrations of lead-based paint. In 2002, Hart Crowser collected samples from debris piles and analyzed the samples for leachable lead using TCLP. Their report (Document 11, Appendix A) summarizes the results as follows:

> *"Debris Pile T1 contained a leachable lead concentration of 24.0 mg/L. For comparison purposes, wastes containing leachable lead concentrations above 5.0 mg/L are considered hazardous wastes and are not allowed to be either burned or disposed of in unpermitted landfills. The results of our TCLP measurements are presented in Table 4."*

As reported in the Statement of Services for the Kennecott Mill Site Preliminary Assessment (NPS, 2017a), a suspected worker exposure incident in 2015 was reported by NPS and is believed to have been caused by workers moving wood from wood debris piles adjacent to the mill building. According to the Statement of Services, one employee expressed concerns that health effects, such as skin rashes, blisters, metallic taste on lips, swollen lymph nodes, and coughing, occurred after working with soil and wood debris at the mill building. Mercury wipe samples and soil samples were collected and analyzed for the eight RCRA metals, and results were compared to the New Jersey Department of Health and Senior Services (NJ DHHS) guidance due to there not being guidance from ADEC or the Alaska Department of Health and Social Services. Several of the samples exceeded the NJ DHHS guidance.

During the 2017 site reconnaissance, Amec Foster Wheeler visited several buildings that had reportedly been covered with lead-based paint containing high lead levels. Amec Foster Wheeler observed signs of peeling paint, dust accumulation along guided tour pathways, and what appeared to be many buildings covered with old peeling paint that appeared to be consistent with historical description of lead-based paint. Several buildings were observed to have been scraped and painted. Table 2 summarizes buildings that have been reported to have been repainted. Appendix B includes photographs taken during the site reconnaissance showing newly painted surfaces (Photos 4, 9, and 28) and surfaces that contained peeling paint (Photos 23, 56, and 58) at the time of the site reconnaissance.

Considerably fewer historic data are available concerning the presence of arsenic throughout the site. As reported in the 2015 White Environmental Soil Sampling Report (Appendix A, Document 22),

> *"It is clear that there is an abundance of arsenic throughout Kennecott Mill Town, oftentimes at concentrations that far exceed State of Alaska cleanup levels. As arsenic was a byproduct of the mining process, it is not completely unexpected to find high levels of it in the soils and tailings around Mill Town. What is surprising, however, is the presence of it in gray paint in the Mill Building in concentrations around 17,000 ppm [parts per million], or 1.7%. It was also detected in high levels in many other paint colors around Mill Town, though not at the concentrations as those of the Mill Building.*
>
> *The samples of wood debris that were collected and analyzed for the wood preservative pentachlorophenol and arsenic showed levels of arsenic around 170 mg/kg. It is not possible to discern whether the presence of arsenic was due to the wood preservative copper chromated arsenate or if it was from arsenic dust that had settled on the wood. Regardless of its origin, workers must take precautions (see Worker Protection section below) when handling painted surfaces, soil, and wood debris in and around buildings in Mill Town, especially the Mill Building."*

Table 6 compares the maximum arsenic concentration found in soils at the site to the EPA RSLs – Generic Tables (updated November 2017). Table 8 shows that arsenic has been

measured in surface water at concentrations exceeding the EPA RSL. Further sampling is necessary to better understand the extent of arsenic contamination in soils at the site.

Garbage Dumps

Several garbage dumps have been reported throughout the site. The 1992 ADEC Preliminary Assessment Report for Kennicott Mine Site (Document 3, Appendix A) noted that:

> *"… there are several dump areas in the Kennicott area. These are shown in the map as D1 through D5. D1 is the domestic dump that is currently being used by Kennicott residence. It consists mainly of empty drums, food cans, glass, wood, paper and plastic. Other contents include a few refrigerators, 5 gallon gas cans, lead and zinc batteries. Dump D1A is mainly food cans, metal and wood scraps. All other dumps contain small amounts of asbestos along with scrap metal and wood and some 55 gallon oil drums (containing about 10 gallons of oily water), old tires and a few lead/acid batteries."*

NPS performed additional investigation of the dump sites, and the Kennicott Pre-Acquisition Environmental Site Assessment (Document 1, Appendix A) stated that:

> *"From water quality analysis of seeps downhill of the dumps, there is no indication that contaminants are leaching and contaminating groundwater or National Creek. Following EMCON's 1992 survey, the following mitigation was completed in the historic dumps:*
>
> - *All lead acid batteries were removed from the surface of the dumps and the site in 1992 and properly disposed of (EMCON 1995).*
> - *All ACM should have been removed during asbestos mitigation. While there is no record of the dumps being mitigated for ACM's in the INTERA report (1995), the team observed no signs of asbestos in the dumps; therefore, it can be assumed that the mitigation was completed as recommended in the EMCON report (1992).*
>
> *During our site visit we saw no signs of asbestos or batteries in the dumps. We did observe barrels with oily rags in D3, and found empty cans of Dutch Boy white lead, which although empty, contained caked, dry product residue. Recent garbage was scattered throughout D4 and D3, but concentrated in D1 and in the new dump on the Jumbo plat.*
>
> *ADEC and EMCON's most pressing concern about the dumps was the ongoing dumping by local residents, principally in the Dl area. This activity ceased during 1995, and D1 and DlA were closed per ADEC guidance (Kirkwood 1995); solid waste was consolidated and buried under gravel and soil and large rocks were placed on top to discourage future dumping. ADEC requested post-closure procedures of annual visual inspection for surface erosion and leachate for five years (which Mr. Kirkwood has agreed to do), but they did not anticipate any problems with the site (Kreiber 1995b). However, there is no indication that barrels with oil or oil/water mixture were transported off-site.*
>
> *ADEC has no ongoing concerns with the historic dumps on the site, other than to reduce human exposure to potential hazards through reduced access (Kreiber pers. comm.)."*

Figure 4 shows the approximate areal coverage of the dump sites at the site, based on figures presented in the Kennicott Pre-Acquisition Environmental Site Assessment (Document 1, Appendix A). During the 2017 site reconnaissance, several dump sites were observed from above the hillside that leads down to the glacial moraines. Dumped material appeared to primarily be historical equipment and materials for the site; however, closer inspection was not performed due to safety concerns with accessing the dump sites; the slope leading to the dumps sites is steep and littered with debris.

Blasting Caps

During the sorting processes conducted in the mill during active milling operations, unexploded blasting caps were removed from the ore. The blasting caps were primarily disposed of along the steep slope north of the mill building. After addition of the leach plant, unexploded blasting caps were also disposed of along the northwestern side of the leach plant. An investigation report for these areas was prepared by Mike Shields, an independent consultant, in 2011 (Document 14, Appendix A). The report summarizes the hazards associated with the blasting caps as follows:

> *"Blasting caps have been found in two debris scatters at Kennecott and represent a serious hazard to employees and the public. One cap was found in a relatively small scatter (approximately 50' by 50') of burned fuse and other refuse on the north side of the mill downslope from the door to the crushing level. A dozen caps have been found several years ago in a larger dump on the moraine immediately to west of the north end of the leach plant. The caps found so far are from the mining operations and are at least 70 years old. Both areas known to contain blasting caps are currently behind barrier tape and posted with signs warning of the hazard.*
>
> *The number of caps is an unknown. Some of the caps will be attached to some small pieces of burnt fuse and the area is literally littered with burnt fuse. Some may not be attached to anything. The area of potential discovery covers a rectangular area measuring at least 50 feet by 50 feet. The surface is steeply sloping (30º +/-) and partially covered with scrap lumber and other building materials. The scatter has depth as it was built up over time and caps are as likely to be found at some depth as exposed on the surface. Finally, the scatter is not homogeneous. It consists of decaying jute bags, scrap steel, wooden wedges, wire, and discarded work clothing. Siding from the upper mill has fallen over the area. Identifying the caps in the scatter is not a straight forward exercise."*

The slope along the northern side of the mill was visually inspected during the 2017 site reconnaissance, and some tape barriers appeared to be in place to deter people from the hazardous area. Tape barriers represent an administrative control; however, engineering controls are necessary to reduce the potential for exposure to these areas. Substantial debris is still scattered throughout the slope along the northern side of the mill (Photos 44 and 46, Appendix B). The location to the west of the leach plant is also covered in debris, as shown in Photos 34 and 36 (Appendix B). Waste blasting caps are considered a RCRA D003 Reactive Waste if removed and disposed of.

3. Exposure Pathways and Environmental Hazard Assessment

This section provides an evaluation of the potentially contaminated media and the associated exposure pathways and sensitive environments that are known and/or suspected at the site. An evaluation of the potential for a hazardous substance release to each medium is also presented.

The exposure pathway evaluation summarized in this section includes input from the interviews conducted as part of the 2017 site reconnaissance conducted by Amec Foster Wheeler. These exposure pathways are shown on Figure 5. Additional information presented in this section summarizes previous work and historical investigations conducted for the site. It is important to note that several potential worker exposure incidents have been reported at the Kennecott mill site, including the 2015 medical incident referenced in the Lead and Arsenic Paint section above. An employee of NPS also reported a November 2015 toxic heavy metals challenge urine test result with elevated lead and mercury levels. The urine test was conducted several months after the potential exposure event. Table 9 presents the known or suspected contaminants present at the mill site and the potential exposure pathways and target organs.

3.1. Groundwater

This section discusses the groundwater associated with the site and the potential pathways for migration of contaminants through the groundwater.

3.1.1. Local Geologic and Hydrogeologic Setting

The site geology is discussed in the 1992 Preliminary Assessment Report for Kennicott Mine Site (Document 3, Appendix A), which noted that *"the key geological formations in the Kennicott area are the mid to late Triassic Nikolai Greenstone and the late Triassic Chitistone Limestone. The Chitistone Limestone directly overlies the Nikolai Greenstone and copper mineralization occurs in the limestone near this contact."*

The 1995 Site Inspection Report (Document 10, Appendix A) presents a discussion of groundwater conditions at the site, based on reports from historical investigations:

> *"Groundwater has not been well-characterized in the area due to the difficulty of distinguishing groundwater from surface water along the exposed bedrock and beneath the glacier. The greenstone and limestone units are not considered productive aquifers, and the glacial moraine aquifer bordering the Kennicott Glacier is subject to high levels of dilution from glacial meltwater.*
>
> *Groundwater on Bonanza Ridge would be expected to flow along the bedrock layer and feed into the creeks draining the ridge or into the mix of surface water and glacial meltwater beneath the glacier. The majority of this mix is assumed to feed the Kennicott River. The spring which creates Clear Creek in McCarthy would also likely be fed, in part, by this mix."*

The Kennicott and Root Glaciers have receded substantially since 1995; the recession has left behind a moraine field. It is likely that the shallow groundwater/surface water now flows into National Creek and drains into the Kennicott River near the town of McCarthy. The Kennicott River is still fed by glacial meltwater and runoff that moves through the site from Bonanza Ridge. Figure 3 shows the topography and drainage courses of the Kennecott NHL.

3.1.2. Groundwater Use

At least 12 water supply wells are present in McCarthy, east of the Kennicott River and north of McCarthy Creek. The well nearest the site (ID 31843) is owned by the Kennicott Glacier Lodge and was installed in 2001. The well is upgradient from the site and is EPA classified as a Transient Non-Community well (formerly Class B). This well provides drinking water to lodge employees and guests. The Kennicott Glacier Lodge serves seasonal employees and tourists with 45 guest rooms. According to park personnel, at least 12 additional water supply wells are located within 4 miles of the site; however, only two of them could be identified using the Alaska Department of Natural Resources Mining, Land, & Water's Well Log Tracking system.[1] Figure 2 shows the wells that were identified using the Well Log Tracking system and the topography of the region. Two wells are privately owned and are located in the town of McCarthy (well IDs 29224 and 41659), downgradient of the site (Figure 2). Well ID 41659 provides potable water to a restaurant called The Roadside Potatohead, for use by employees and restaurant guests. Well ID 29224 is a privately owned well in McCarthy and is designated for domestic use.

According to NPS personnel, the NPS is pursuing funding to develop wells within the site in 2021 with the intention of providing drinking water to employees and the public. The NPS attempted to develop a well just south of the Mill Building, north of National Creek, in the past. Water was not found, and the well was abandoned.

3.1.3. Potential Hazardous Substance Release

The release of hazardous substances to groundwater from the site has not been documented, because groundwater has not been well characterized for the area. Groundwater flow paths and routes of groundwater flow through the areas downgradient of the site may have changed due to the receding Kennicott and Root Glaciers since site characterization information was collected in the 1990s. Historical records and observations have indicated that groundwater may be a potential contaminant migration pathway for seeps on the downgradient side of the site that were visibly impacted by fuel releases. Historical seep sample locations are shown on Figure 4. Seeps downstream of the leach plant may flow through mine tailings, ore concentrates, and ACM beneath the leach plant. Historical sample results have indicated that these seeps may be affected by hazardous substances at the site (Table 8); the majority of historical average seep sample results from previous site investigations have exceeded the NPS ESV screening criteria for arsenic, copper, mercury, and lead (Documents 2, 7, and 10, Appendix A).

A potential migration pathway is associated with leaching from the boiler ash piles. Although the ash piles were capped, infiltration of water through any cracks in the cap could result in release of contaminants into the groundwater. Cracks in the cap were observed during the 2017 site walk, and the effectiveness of the liner beneath the concrete cap is unknown. The degraded cap may present a potential pathway for release of hazardous substances from the ash. However, no seeps data is available from locations that are directly downgradient of the pile, so a potential migration pathway cannot be assessed at this time based on available information. Infiltration through fuel spill areas may present a complete pathway to groundwater, but limited analytical data for TPH are available for only one seep downgradient of a fuel spill location; the one seep sample had TPH below the RSLs for ingestion of tap water.

1. https://dnr.alaska.gov/welts/#show-welts-intro-template.

Lead originating from lead-based paint has a potential migration pathway to groundwater. Lead has been found at elevated levels surrounding many of the buildings. Runoff in these areas of elevated lead creates a potential migration pathway to the groundwater. Table 8 shows that seeps directly downgradient of buildings originally painted with lead-based paint exceed the NPS ESV for wildlife exposure to lead in surface water. However, it is uncertain whether these elevated lead levels are associated with lead-based paint or other known contaminants upgradient of the seeps.

Table 5 summarizes where information regarding analytical samples can be found in the historical reports. Figure 5 shows potential exposure pathways for hazardous substances present in site groundwater.

3.2. Surface Water

This section discusses the surface water associated with the site and the potential pathways for migration of contaminants into and through the surface water.

3.2.1. Local Hydrologic Setting

Figures 2 and 3 show the topography and surface water drainage courses for the site. Surface water bodies in the site vicinity have primarily been formed by glacial meltwater, groundwater discharges, and runoff. In certain areas, these components are difficult to distinguish, such as in the moraine field downgradient from the site. Runoff drains westerly from Bonanza Ridge toward the receding moraine field of the Kennicott Glacier; a series of creeks, including National, Bonanza, Jumbo, and Amazon creeks, facilitate the runoff. These creeks flow into the Kennicott Glacier valley and infiltrate the ground surface. These creeks flow southerly beneath the Kennicott Glacier moraine field and emerge as surface water that feeds into the Kennicott River.

National Creek runs through the center of the site and west to the glacial moraine deposit area. National Creek travels as shallow surface water along the southeastern edge of the glacial moraine deposit field, and is released into the Kennicott River near the town of McCarthy. During the 2017 site reconnaissance, seepage was observed from the tailings pile immediately to the south of the leach plant to National Creek.

In addition to the Kennicott River, several surface water bodies occur in the moraine field, including a group of springs and creeks collectively referred to as Clear Creek. As a result of the glacial moraine deposits in this area, the various surface water bodies may be hydraulically connected. McCarthy Creek, which originates from runoff along the ridge east of Bonanza Ridge, joins the Kennicott River approximately 1.5 miles south of McCarthy.

As described in the 1995 Site Inspection Report (Document 10, Appendix A), the 15-mile downstream stream distance for this site begins where the seepage from the tailings pile flows into National Creek, and includes:

- An approximately 0.5-mile length of National Creek prior to entering the Kennicott Glacier moraine field;
- A 3.5-mile length of approximate flow path between the Kennicott Glacier to a surface water lake prior to flowing into the Kennicott River;
- 5 miles along the Kennicott River until it flows into the Nizina River; and
- 6 miles along the Nizina River.

Clear Creek and McCarthy Creek, although not specifically identified within the 15-mile downstream distance from the site, may be hydraulically connected to the Kennicott River near McCarthy. A hydraulic connection may also occur between McCarthy Creek and the other surface water bodies near the moraine field (Document 10, Appendix A).

No known wetlands are associated with the site. The site is considered a sensitive environment, as it is a national park. No reported endangered species are associated with the surface waters in the vicinity of the site. During the 2017 site reconnaissance, National Creek was observed draining into what appeared to be a lake prior to reaching the Kennicott River. The lake is approximately 4,000 feet long and 1,000 feet wide at the widest location observed. Lakes or other areas of water ponding within the moraine field were not observed being used for recreation activities, but NPS staff have indicated that the lake is used for recreational purposes. As indicated by NPS staff, the lake is regularly used by recreational boaters for primarily canoes, kayaks, and pack rafts. Both private and commercially guided tours occur on the lake. In the winter, ice is also harvested from the lake; ice harvesting from this lake is a common and long-time practice for the area.

Guided and unguided tours occur in the vicinity of the lake, and, according to NPS staff, there have been proposals to construct a hiking trail between Kennecott and the town of McCarthy along the glacier edge, which would bring hikers close to this lake. There have also been proposals for a campground to be constructed near the glacier toe. The Kennicott River downstream of the lake offers tourist destinations and activities, such as rafting tours.

3.2.2. Drinking Water Intakes

The 1995 Site Inspection Report (Document 10, Appendix A) did not identify any drinking water intakes from the stream along the 15-mile flow path downstream of the site. Several potential drinking water intakes occur downstream of the site, based on registered drinking water wells, drinking water wells downstream of the site reported by NPS staff, and observations of residents and visitors using water form National Creek and surface water downstream from the site. The drinking water intake for the NPS is on top of the waterfall that drops into the valley that runs through the site. The NPS drinking water source serves seasonal NPS employees and a few employees that may stay throughout the year. The intake for the city of McCarthy is in Clear Creek, which may be connected hydraulically to the Kennicott River, approximately 4 miles from the site.

The Pre-Acquisition Environmental Site Assessment stated that there were no drinking water intakes in the lower portion of National Creek or any wells downgradient and that consequently there are no potential human receptors (Document 1, Appendix A). Two private wells are located in the town of McCarthy downgradient of the Mill Site, representing a potential exposure pathway. During the 2017 site reconnaissance, a person was observed filling a plastic tote with water from National Creek at a location downstream of the hospital and immediately upstream of the bridge that crosses National Creek, downstream of the waste deposit areas shown on Figure 4. In addition, it has been reported by NPS staff that summer drinking water sources are not useable during winter periods; therefore, during the winter, water for use by NPS personnel is obtained by dipping plastic buckets in National Creek upstream of the bridge and downstream of the historic structures located near National Creek. This represents a direct exposure pathway from potentially contaminated water.

Water and sediment samples in the upper reaches of the Kennicott River show no signs of contamination, and the waters of Clear Creek meet drinking water standards as reported in historical reports.

3.2.3. Local Fisheries

The migration of fish into National Creek is unlikely due to obstruction by the moraine field (Document 10, Appendix A). No fisheries harvest data are reported by the Alaska Department of Fish and Game for the Kennicott and Nizina Rivers. According to the 1995 Site Inspection Report (Document 10, Appendix A):

> *"…the Kennicott and Nizina rivers may support small coho salmon fisheries for fish spawning in McCarthy Creek. In addition to coho salmon, these rivers are migration routes for sockeye and king salmon. Migratory fish enter the basin at the mouth of the Copper River near Cordova, and may migrate to the Kennicott River by swimming up the Copper, Chitina, and Nizina Rivers."*

No fishing was observed in the Kennicott River or the Nizina River en route to the site during the 2017 site reconnaissance. Site personnel did not know of any fishing in the area. Available information does not suggest that fisheries have been affected by the site.

3.2.4. Sensitive Environments

The site is located within Wrangell-St. Elias National Park and Preserve, which is considered to be a sensitive environment and major recreational area. The NPS owns the site; therefore, the site and all the surrounding national park lands are considered to be sensitive environments. No known wetlands or endangered species are associated with the contaminated surface water located on the site.

3.2.5. Potential Hazardous Substance Release

Based on the topography of the site and historical reports of information and extents of contamination, the migration route for contaminants through the surface water is assumed to be either via groundwater flow or infiltration (from the tailings and beneath the leach plant for inorganics, and from the fuel spill locations identified on Figure 4). Surface water and seep samples collected from the site were discussed in the Kennicott Pre-Acquisition Environmental Site Assessment (Document 1, Appendix A), and the results are shown on Table 8, including background surface sample concentrations from a location in National Creek upgradient from the site (Location BG on Figure 4). Table 8 shows that concentrations of inorganics were elevated above upstream levels and also exceeded the preliminary NPS ESVs at several locations downgradient/downstream from the tailings piles and the leach plant for arsenic, cadmium, copper, mercury, lead, and zinc. Surface water samples collected from National Creek downstream from the site (Locations NC2 and NC3 on Figure 4) were elevated over upstream levels, and locations downstream of the tailings pile west of the west bunkhouse were elevated above ESVs for arsenic, cadmium, copper, mercury, lead, and zinc.

Data suggest that surface water has received hazardous substance releases from the site. The downstream extent of the potential releases is unknown based on available data, although it was reported that inorganics were not elevated in Kennicott River water and sediment samples. At the seep adjacent to the power plant (the only reported seep where water is flowing over an oil spill area), total petroleum hydrocarbons were 16.8 mg/L, and total petroleum hydrocarbons as diesel was 6.9 mg/L (Document 1, Appendix A). These values exceed the EPA's regional screening levels for residential ingestion of tap

water and the Alaska Department of Environmental Conservation's migration to groundwater cleanup level of 1.5 mg/L (18 Alaska Administrative Code 75, Table C).

Table 5 summarizes where information regarding analytical samples can be found in the historical reports. Figure 5 shows the potential surface water exposure pathways for hazardous substances at the site. Complete and potentially complete pathways exist for park service workers, site visitors, site residents, and McCarthy Residents.

3.3. Soil

Potential hazardous substances of concern for release to the soil are those associated with mill tailings, ore concentrate, boiler ash, oil spills, lead paint, and dump sites.

3.3.1. Potential Receptors

The site is remote, and few permanent residences live in the vicinity. Workers in this area are primarily NPS staff and potentially contractors supporting site rehabilitation activities. The property is fully accessible to the public and attractive for tourists due to the historical nature of the site, the presence of the Kennicott Glacier Lodge, and abundant outdoor recreational activities. A few NPS workers live at the site year-round, and a few other residents live at the site in private cottages. Seasonal workers at Kennicott Lodge also occupy buildings at the site. At the time of the site walk, it was reported that approximately 65 people work and 20 people live within 0.25 mile of the site in the summer months. Winter resident populations in this area were reported to vary from 5 to 8 in Kennecott. The number of residents varies both seasonally and from year to year. McCarthy has a population of approximately 30 people, although it has been reported by NPS staff that more than 100 people may reside in McCarthy during the summer months. No known schools or daycare facilities are located within 200 feet of the areas of known contamination. Although the NPS does not keep accurate count of visitors to Kennecott, it estimates that 73,000 to 87,000 people visit the park each year (NPS, 2017b).

Due to the remoteness and seasonal population variation at the site, it is difficult to estimate the surrounding residential population that would come into contact with contaminated soil. However, based on the site visit, permanent population was estimated as follows:

- Approximately 20 residents 0 to ¼ mile away during the summer months;
- Approximately 10 residents ½ to 1 mile away during the summer months; and
- Approximately 100 residents 3 to 4 miles away during the summer months.

The entire site is considered to be a cultural resource and is being preserved as such. There have been frequent sightings of brown bears in the site vicinity. Moose have also been observed. Other small rodents, such as ground squirrels, were observed during the 2017 site reconnaissance.

3.3.2. Sensitive Environments

The site is located within Wrangell-St. Elias National Park and Preserve, which is considered to be a sensitive environment and a major recreational area. The NPS has acquired the site; therefore, the site and all the surrounding national park lands are considered to be sensitive environments. No known wetlands or endangered species are associated with the contaminated soil located on the site.

3.3.3. Potential Hazardous Substance Release

Surface staining for fuels has been documented in several site characterization reports. Three primary fuel-stained areas have been identified for the site, as described in Section 2.3. These three areas consist of the location of the AST on the northern end of the site and the associated utilidor that conveyed fuel to the power plant, the area to the west of the power plant, and the area adjacent to the mill building on the north side (Figure 4). In addition, several buildings at the site are built on areas filled with tailings. Ore concentrates have been observed near the mill building and beneath the leach plant. A coal ash pile was documented on the southwest corner of the power plant (Document 3, Appendix A).

Table 5 summarizes where information regarding analytical samples can be found in the historical reports. Table 6 summarizes the reported maximum concentrations of metals from tailings samples and fuel-stained soil samples. Maximum analytical results from site soil samples are presented in Table 6 and are compared to EPA RSLs, NPS ESVs, and ADEC Direct Contact Human Health Risk Screening Levels. As shown in Table 6, analytical results for all metals except chromium exceed one or more screening criteria, including RSLs and ESVs. Table 7 summarizes lead concentrations in surface soil samples in the vicinity of the site buildings. Figure 4 shows the approximate extent and locations of affected areas based on the historical reports reviewed and referenced in this Preliminary Assessment. Analytical results for lead in surface soil samples collected in the vicinity of the West Bunkhouse were as high as 4,880 mg/kg, which is well above the highest screening criterion of 400 mg/kg.

3.4. Air

The contaminants of concern exposed to the air are primarily particulate dust associated with the mine tailings, ore concentrate, and lead paint.

3.4.1. Potential Receptors

As reported in the 1995 Site Inspection Report (Document 10, Appendix A), *"...particulate migration from sources (e.g. tailings pile) is a potential source of exposure. The potential sources are not covered and could be spread to downwind areas. Based on site observations, the predominant wind direction was assumed to be down the valley towards McCarthy."*

Due to the remote location, the number of receptors that could be affected by migration of contaminants via air is likely similar to the values presented in Section 3.3.1. Residences are located in the immediate vicinity of the mill building and leach plant, including a residence across the road from the maintenance building. The Kennicott Glacier Lodge is located approximately 1,200 feet from the mill and leach plant at a down-valley location that is assumed to be downwind of the mill building and the leach plant. There are seasonal variations in the number of visitors and residents located downwind of the site who may be exposed to downwind transport of dust or fine particulates from upgradient sources, which include tailings and lead-based paint on buildings and in soil.

3.4.2. Sensitive Environments

The site is located within Wrangell-St. Elias National Park and Preserve, which is considered to be a sensitive environment and major recreational area. The NPS has acquired the site; therefore, the site and all the surrounding national park lands are considered to be sensitive environments.

3.4.3. Potential Hazardous Substance Release

Potential sources for airborne hazardous substances include several uncovered tailings waste piles distributed across the site and lead and possibly arsenic paint that may have been deposited on soils in the vicinity of the buildings or that may still be peeling from buildings. Additional potential sources include several oil spill areas (areas of stained soil) and dump sites.

Previous soil sampling data are summarized in the 1995 EPA Site Inspection Report (Document 10, Appendix A) as follows:

> *"... the top foot of soil at two locations south and downwind of the main mill town, near Cottage 29A and near the dairy, were sampled at three intervals (0-1, 1-6, and 6-12 inches). The purpose of the sampling was to assess transport, mainly by wind, of tailings and contaminated soil to areas that were considered to be at a sufficient distance (roughly ¼ mile) from actual mining activities. Concentrations near the surface were compared to concentrations at depth in order to identify any trends that suggest surface deposition of particles from mill town sources. Analytical results are summarized in Table 4-9. Sample results for inorganic analyses performed on all downwind soil samples are presented in Appendix D. Data Validation Reports. Sample locations were presented in Figure 3-1.*
>
> *At the station near the dairy (SS010), six metals were elevated in the top 1 inch of soil from the two locations, including arsenic, barium, copper, lead, mercury, and zinc. All six of the metals exhibited a gradient with elevated concentrations at the surface attenuating to lower concentrations at 6 to 12 inches.*
>
> *At the station near the Cottage 29A (SS011), the same metals elevated near the dairy were also elevated at the surface interval, with the exception of arsenic. However, in this case the 12-inch interval was higher than at least one of the overlying intervals for arsenic, barium, copper, and lead."*

The 1995 Site Inspection Report (Document 10, Appendix A) summarizes previous air monitoring that has been conducted:

> *"Seven dust samples and one blank sample (to assess contamination of the glass wool sampling material) were collected at five locations in the mill town, at the McCarthy airport and at Ma Johnson's hotel in McCarthy. The samples were collected of a 10-square-centimeter surface area. Table 4-8 lists samples in a general north to south progression. This arrangement roughly corresponds to an upwind to downwind arrangement. Concentrations are expressed in µg/cm^2 [micrograms per square centimeter]. Sample results for priority pollutant metals analyses performed on all wipe samples are presented in Appendix D, Data Validation Reports. Sample locations were presented in Figure 3-1.*
>
> *Of the priority pollutant metals (excluding mercury) analyzed, arsenic, cadmium, copper, lead and silver were detected in at least one wipe sample (see Table 4-8). All other metals were either not detected or were found at concentrations less than 5 times the concentration detected in the blank sample (DU008; the 5-fold margin was used to*

ensure that concentrations detected represented site conditions rather than residual metals on the glass wool used to sample dust).

No strong trends were indicated by analytical results for cadmium, silver and lead. Levels of copper and arsenic gradually increased in the first three north-to-south wipe samples, with low concentrations in Cottage 39B (Station DU004) and 13F (station DU005) and maximum concentrations in the refrigeration plant (Building 48; Station DU003)"

As reported in the 1995 Site Inspection Report (Document 10, Appendix A),

"… soil samples collected from areas projected to be downwind of sources and mining activities may also indicate areas of observed contamination. Although the transport mechanism is presently undetermined, arsenic, barium, copper, lead, mercury, and zinc were detected in both source samples and in downwind area soil samples. The concentrations of arsenic and copper in the downwind area soil samples are lower than those detected in the boiler ash pile and oil spill area.

Of the six inorganics listed above, arsenic, copper and mercury were also detected in downwind area soil samples at concentrations below those found in the tailings pile samples. This suggests the potential for migration of mine tailings, although the transport mechanism is unknown."

The 1995 Site Inspection Report (Document 10, Appendix A) also discusses the potential transport of hazardous substances through the air:

"Particle-size analysis was performed on surface tailings samples collected near Cottage 24 (Station SS007) and at the western edge of the pile (Station SS008). The analysis was intended to characterize the size of the tailings particulate and determine whether suspendable and transportable particles were present. Although considerable discussion of the cut-off point for suspendable soil size exists, as a group, particles less than 100 µm [micrometers] in diameter encompass suspendable and transportable particles. Within this group, particles between 30 µm and 100 µm would be expected to settle within a few hundred feet from the source, while those less than 30 µm would be expected to be transported a considerable distance downwind (EPA, 1988).

Table 4-10 summarizes the results of the particle size analysis. Based on particle size results, 86 to 96 percent of the surface tailings particulate were greater than 1 mm in size. This corroborates field observations which identified the tailings as coarse, gravelly material. Only 1.6 to 4.0 percent of the surface tailings were less than 75 µm and would be expected to be suspendable and transportable. A fraction of this amount would be expected to be less than 30 µm, and transportable a larger distance.

Estimates of suspendable and transportable particle size are generalizations only. Actual estimates would depend on site-specific weather patterns such as wind speed, wind direction and presence of ice or snow over the tailings pile. It can be assumed, however, that a small fraction of the tailings pile particulate is small enough to become windborne, as was observed when the tailings was disturbed during the site visit.

Results for particle size analyses performed on two tailings samples are presented in Appendix D, Data Validation Reports. Sample locations were presented in Figure 3-1."

The 1995 EPA Site Investigation Report also states that (Document 10, Appendix A):

"the metals detected at elevated concentrations in downwind soil samples – arsenic, barium, copper, lead, mercury, and zinc – were also detected at similar concentrations in the samples collected from the tailings pile, with the exception of barium. The occurrence of these metals in areas projected to be downwind of mining activities suggests the potential for particulate migration from the tailings pile. However, results from particle size analyses on the tailings pile sample indicate that only a small fraction (1.6 to 4 percent) of the tailings would be amenable to air migration."

The above quotes from the 1995 EPA Site Investigation Report indicate that some detailed air exposure assessments were conducted previously. This report also indicates that air transport of hazardous substances is dependent upon both source location and particle size. Vehicular traffic and foot traffic have likely increased since the 1995 Site Investigation report due to the increased number of site visitors. This traffic likely reduces surface particle size and increases the likelihood for transport of dust and hazardous substances from the upper layer of tailings, especially during the summer months when the ground is dry and the park has more visitors. Based on the historical data presented for air and the increased vehicular and foot traffic at the site, there is a pathway from soil to air exposure for hazardous substances at the site. This potential exposure pathway is either complete or potentially complete for all park service workers, site visitors, and site residents, and is shown on Figure 5.

Wipe samples have also been collected historically but were not used in this Preliminary Assessment. Wipe samples are useful for determining the areal extent of contamination on nonporous surfaces but there are significant problems with using wipes on porous surfaces, and results may not be precise or accurate in those circumstances. While wipe samples can be directly compared with EPA/HUD standards for surface contamination by lead in child-occupied facilities and housing, those levels were set at values that were not predictive of actual risk of blood lead elevation, not an absence of risk. Because actual dose from exposure to surface loading of contaminants depends on many factors that have substantial uncertainty in actual ranges and appropriate defaults, there is no widely-adopted methodology to determine the presence or absence of risk from ingestion and inhalation of any contaminant from surface loadings. Bulk dust composition is a much more widely-used parameter to estimate potential risks for dermal and ingestion pathways, and for inhalation exposure in the absence of actual airborne concentration data.

4. Conclusions and Recommendations

The Kennecott Mines and the Kennecott Mill were developed and operated between 1906 and 1938 as a copper mine and copper milling town. The mill building and later the leach plant received and concentrated ore mined from the nearby mines. A power plant, machine shops, repair shops, housing, administrative offices, and material stores were located around the mill to support copper ore processing operations. The mines and milling facilities have been shut down since 1938. Today, the site primarily consists of historical buildings that were used to support copper ore processing operations. These historical buildings contained lead- and arsenic-based paint as well as asbestos for insulation. The site was

also constructed over areas filled with tailings from the milling operations. A local power plant used heavy fuel to generate heat and power. ASTs were used to store fuel, and utilidors were used to transfer fuel from the tanks to the power plant. The site is currently accessible to visitors to view the historic mining town and serves as a center for exploring the surrounding park. Visitors can view the mill town on guided and self-guided trips.

A conceptual site model (CSM) is provided as Figure 5. The CSM should be reviewed in conjunction with Figure 4 to assess the likely hazardous substance sources, exposure routes, and potential receptors. This section summarizes likely exposure pathways by hazardous substance and receptors based on the information provided in Section 2.3 and Section 3.

Asbestos

Asbestos was abated in the majority of the buildings and structures at the site. ACM was removed from all accessible buildings and most of the utilidors in the mill town, except for the boilers in the power plant and leach plant, and below the boilers in the leach plant where two feet of tailings were deposited beneath the floor to bury ACM beneath the tanks.

The site reconnaissance and interviews conducted in 2017 with NPS maintenance staff revealed that asbestos continues to be found by NPS workers in crawl spaces, foundations, and walls during active rehabilitation of the site. The likely exposure pathways for ACM include inhalation of fibers during construction and rehabilitation of buildings and potential migration of ACM from the leach plant to surface water in National Creek. The boilers inside the power plant that were used to encapsulate ACM appear to have seals that are failing and need further investigation and potential mitigation. As described in Section 2.3, ACM may also be located beneath the false floor in the leach plant. The method of the 1993 abatement project needs to be further investigated based on reports of inadequate abatement by NPS staff. Analytical samples for asbestos from runoff and the risk of release of ACM to National Creek have not been investigated, based on available information.

Mill Tailings and Ore

The earliest mill tailings deposits were in the vicinity of the mill building, including beneath the leach plant. After construction of the leach plant, tailings were deposited west of the leach plant building. Tailings were also deposited south of National Creek during later periods of facility operation. Tailings samples were collected in 1991 and 1992 by America North/EMCON, Inc., and analyzed for total metals. Concentrations were highest for the samples collected from the earliest tailings deposits located adjacent to the mill building, likely due to inefficiencies during early copper ore recovery operations. Unrefined ore was observed in small quantities near the mill building during the 2017 site reconnaissance. Ore concentrates were observed in the leach plant and beneath the leach plant foundation.

Surface deposits of tailings or ore present a potential dust/inhalation and ingestion hazard, as the tailings and ore deposits have not been stabilized and may be broken up by foot and/or vehicle traffic to form small particulates that could become respirable. The potential for exposure is higher in the summer months when the site has more visitors and the ground is dry. Thus, airborne dust represents either a complete or a potentially complete exposure pathway for park service workers, site visitors, and site residents. An investigation of the amount of dust generated and transported from the tailings deposits is

recommended because the site has become more popular over the years, with significantly more foot and vehicular traffic since the previous investigations in the 1990s.

There is also potential for transport to surface water due to runoff and erosion of the tailings and ore deposits. Surface water samples collected downstream of potential runoff locations showed concentrations elevated above background concentrations for National Creek, as shown on Table 8 and reported in the 1992 Preliminary Assessment (Document 3, Appendix A).

The deeper tailings deposits that are reported to have higher metals concentrations may be in contact with groundwater. Hazardous substances leaching from these deposits may be transported by groundwater to surface water, based on the locations of observed seeps (Figure 4), analytical results of seeps and surface water samples collected from National Creek (Table 8), and the reported groundwater and surface water flow pathways described in historical reports. Historical characterization samples summarized in the Pre-Acquisition Environmental Site Assessment (Document 1, Appendix A) indicate surface water samples from National Creek collected immediately downgradient of the tailings piles located behind the west bunkhouse (Location NC2 on Figure 4) had the highest surface water concentrations, with an average result of 69.0 micrograms per liter (µg/L) arsenic, 1,367 µg/L copper, and 22.3 µg/L lead for the three samples collected (Table 8). These concentrations are orders of magnitude higher than the NPS ESVs (NPS, 2014). Sample location NC3, downstream of the maximum surface water sample location, had an average reported value of 2.1 µg/L for arsenic, based on six samples collected and averaged (Document 1, Appendix A). Surface water and seep samples from National Creek indicate that metals are significantly elevated over upstream concentrations and, in some cases, are well above screening levels, indicating release and a potentially complete exposure pathway for dissolved and/or suspended heavy metals transport from the site.

Boiler Ash

The capped boiler ash pile is located near the power plant, at the approximate location shown on Figure 4. Samples were collected directly from the boiler ash pile for waste characterization prior to capping the pile. The boiler ash was characterized as a hazardous waste. No samples have been collected from soils downslope of the pile or from downgradient groundwater to characterize potential releases. The cap was visually inspected during the 2017 site reconnaissance and was observed to be cracked and deteriorating. The competence of the cap liner is unknown. However, there are no reported seeps immediately downgradient of the boiler ash pile, so the potential migration pathway to groundwater/surface water cannot be fully assessed at this time. The cap was covered in tailings so a complete pathway for soil ingestion/inhalation is unlikely. The boiler ash pile is a potential source for the release of hazardous constituents to soil and groundwater outside the pile.

Ammonia Tanks

The sludge remaining inside the emptied ammonia tanks is contained, and a complete exposure pathway is not expected at the time of this assessment. The two emptied tanks reportedly had considerable quantities of hard blue to colorless crystals on the bottom and a thin overlying layer of precipitated copper sulfide sludge. As the tanks deteriorate, a complete exposure pathway could develop for the waste materials inside the tanks.

Fuel, Oil and Grease

Site investigations identified three areas of hydrocarbon-impacted soil at the site: near the three ASTs west of the power plant, a stained area on the north side of the mill building, the AST and utilidor on the north side of the site, and a reported used-oil disposal pit located next to a generator at the present-day Guide Building. Figure 4 shows the reported locations and the approximate extent of soil staining based on the historical reports.

During the 2017 site reconnaissance, stained soil was observed behind the power plant, downslope from the AST on the northeast side of the site, and along the utilidor that runs between the power plant and the AST. High levels of hydrocarbons have been detected in soils adjacent to the power plant and near the three ASTs that appear to be the source of the historical releases. Surface oil staining was observed to extend approximately 125 feet downslope of the ASTs behind the power plant. Hydrocarbon-contaminated soil on the surface may pose a hazard for ingestion or inhalation if particulates become airborne. A spring was noted at the base of the slope with water and oil seeping from the subsurface (Document 7, Appendix A), indicating a complete pathway between soil contaminants and surface water. Oil pooling was observed near the power plant in areas that are included on tours for visitors, representing a direct exposure pathway. In addition, old conveyance piping and a storage tank appeared to contain fuel oil residue. It is currently unknown whether a complete pathway to groundwater and surface water in National Creek exists.

Lead and Arsenic Paint

Lead- and arsenic-based paint was used as the finish surface on several of the buildings and structures at the site. Dust has accumulated in the buildings on the floors and window sills, and may contain lead from interior paint or lead that is brought into the building as dirt and debris from the areas surrounding the buildings, either from foot traffic or airborne dust. Lead measurements in dust collected from several site buildings have exceeded the Occupational Safety and Health Administration industrial lead in dust standard of 200 micrograms per square foot. The paint finish on the surfaces of most of the buildings has deteriorated, and lead has been deposited on the soil surface adjacent to the buildings. Soils in the vicinity of buildings at the site have been sampled, and analytical results indicate that the soils have elevated lead levels; the soil sample with the highest lead content was 4,880 mg/kg (Table 6); well above the EPA guidance screening level of 400 mg/kg for lead in residential soils (EPA, 1996). This value is also well above the NPS ecological screening value for wildlife exposure to soil of 0.94 mg/kg. Debris piles located throughout the site from old mining and mill equipment and from old wood structures that have collapsed or been removed may also be coated in peeling lead paint.

During the 2017 site reconnaissance, several buildings were visited and many of the building contained what appeared to be lead-based painted surfaces (based on historical reports) with signs of peeling paint and dust accumulation along guided tour pathways. Several buildings were observed to have been scraped and painted.

Peeling lead paint poses a potential health hazard associated with dermal contact, inhalation, and ingestion of dust and particulate lead. Elevated lead in soil adjacent to buildings may pose an ingestion and inhalation hazard. Runoff from areas with elevated lead in soil may transport the lead from the surface soil to surface water and potentially into National Creek; results from soil samples collected adjacent to National Creek in the vicinity of the hospital and the National Creek Bunkhouse were among

the highest results reported, at over 4,000 mg/kg lead (Table 7). Lead may be ingested from National Creek downstream of the site buildings by both human and ecological receptors.

Arsenic has been measured in surface water and soil samples at levels exceeding the NPS ecological screening levels for wildlife exposure to surface water. The extent of arsenic contamination in soil, groundwater, and surface water at the site is unknown and the transport pathways for arsenic releases have not been investigated.

Garbage Dumps

Several garbage dumps have been reported at the site. The Pre-Acquisition Environmental Site Assessment (Document 1, Appendix A) stated that *"From water quality analysis of seeps downhill of the dumps, there is no indication that contaminants are leaching and contaminating groundwater or National Creek."* This statement is hard to assess based on the lack of recent information downgradient of dump sites located south of National Creek. The primary exposure pathway from the garbage dumps would likely be leaching of contaminants from waste that makes their way into groundwater/surface water.

Blasting Caps

Unexploded blasting caps removed from the ore processed in the mill were primarily disposed of along the steep slope north of the mill building and in the vicinity of the northwestern side of the leach plant. The primary hazard associated with the unexploded blasting caps is from physical hazards associated with setting off a blasting cap in proximity to workers or tourists. The chemical(s) used to manufacture the explosive could not be determined through visual observation. During the time of mine operations, fuse blasting caps were known to be composed of mercury fulminate, potassium chlorate, tetryl, lead azide, and lead styphnate (Document 14 Appendix A). Further analysis is needed to determine whether the aforementioned chemicals are present in the caps located at the mill site. Blasting caps are considered a RCRA D003 hazardous waste due to reactivity.

Historical Characterization Data

Historical sampling data have been collected in several studies performed from 1990 to 2015. Table 5 summarizes where information regarding analytical samples can be found in the historical reports, including sample locations, analytical methods, sampling methods, and detection limits, where available. Appendix C includes copies of specific relevant data tables and sample location figures from these historical reports. This Preliminary Assessment compares historical data to screening levels to assess the general status of the site concerning potential releases of hazardous substances to the environment and the potential need for future action to mitigate potential risks and protect receptors, both ecological and human. Historical data have not been reviewed in detail to assess the analytical methods and quality control. It has been assumed that the data presented in historical reports are useable for comparison to screening values.

Data Gaps

Several data gaps have been identified based on review of available historical information and from the 2017 site reconnaissance. A list of data gaps identified by this review follows:

- Site Characterization
  - Characterization of site hydrology and hydrogeology
  - Potential for transport of contaminants through groundwater/surface water and an in-depth analysis of groundwater flow paths which may have changed since previous investigations
  - Potential for future changes to site hydrology due to the ongoing glacial recession
  - The extent to which increased vehicular and foot traffic has affected the airborne transport of contaminants
  - Dust/air migration pathway, including correlations between wipe samples and respirable fractions of dust
  - The extent to which contaminants are being released in National Creek, and specific locations where contaminants are leaching
- Asbestos
  - The presence of ACM remaining from the 1993 abatement event and an in-depth evaluation of abatement practices
  - The quantity of ACM located underneath historic buildings, such as the leach plant
  - The potential for transport of ACM through runoff and potential release into National Creek
- Mill Tailings
  - Delineation of the extent of tailings, affected soil, and affected groundwater in the vicinity of the tailings
  - Updated historical tailings maps to include areas that have been filled through more recent construction and site development activities
  - The location and quantity of tailings beneath historic buildings
  - The potential for transport of metals from mill tailings, including particulates and dissolved transport
  - The potential for exposure to metals from dust in buildings and downwind of the site
- Ore Concentrates
  - The potential for transport of ore/ore concentrate deposits present at the site, including the locations of ore concentrates
  - The location of the large quantity of ore concentrates described in the 1990 Waste Audit
- Boiler Ash
  - The integrity of the boiler ash cap and liner system
  - The potential for transport of heavy metals from the capped boiler ash area
- Ammonia Tanks
  - The discharge location of the wastewater that was discharged on the glacial moraine field from the leach plant flotation tanks

  - Samples for additional potentially concentrated heavy metals and metalloids, such as cadmium, arsenic, and zinc, that may have been released to the moraine field

- Fuel, Oil, and Grease
  - The extent of fuel contamination in soil, groundwater, and surface water downgradient from the AST on the north side of the site, including the utilidor to the power plant and the spill area behind the power plant
  - Potential impacts to human and ecological receptors
  - Mapping of sources and deposits of hydrocarbons, including presence in power plant utilidors, piping, and tanks
- Lead/Arsenic Paint
  - A comprehensive delineation of lead-affected surface soils and potential routes of exposure associated with lead paint contamination
  - Further examination concerning the source of arsenic contamination of surface and groundwater
  - The full extent of the presence of arsenic in paints remaining on site buildings
- Garbage Dumps
  - Waste audit to determine if any ACM, lead acid batteries, old lead/arsenic-painted debris, or other wastes are present at the site and that may leach into the moraine field
- Blasting Caps
  - Further investigation concerning the presence of contaminants in the blasting caps at the site that may be leaching

It should also be noted that the data, assumptions, and conclusions presented in historical documents have been developed over a long period of time and under varying site conditions. The largest change in site conditions has been the receding of the Kennicott Glacier, which may have affected surface and subsurface flow pathways, and the increases in foot and vehicle traffic that have occurred at the site since previous studies were completed. The reduction of contaminants located at the mill site due to rehabilitating buildings (for example, repainting of building exteriors) is not reflected in historical data collected from surface soil samples or in some cases surface water samples.

Conclusions and Recommendations

The site has been designated a historical cultural resource. Any future efforts to address potential sources of contamination and the potential exposure pathways for contaminants must be compatible with the end use of the site as a cultural resource enjoyed by tourists. A comprehensive summary of historical data is included in this Preliminary Assessment. Further analysis is required after data gaps are resolved to refine the appropriate exposure pathways and screening levels for various site user groups. Figure 5 presents a preliminary conceptual site model to document the known and/or suspected potential exposure pathways. Figure 5 and Tables 6, 7, and 8, provide enough information to warrant further action to protect potential downgradient receptors from hazardous substance releases from the site.

Data presented in this report were collected primarily in the 1990s under site conditions that are different from current site conditions. Changed conditions include hydrological and hydrogeological changes due to the receding glacier and flood events, and site uses resulting from increased tourism. As a result of

these changes, much of the data in this PA provides only a preliminary overview of the potential for hazardous substance releases; the data need to be expanded to address these changed conditions and to address potential future changes.

It is recommended that a complete remedial investigation and a feasibility study be performed for the site. The process would include development of a Remedial Investigation Work Plan to resolve the data gaps noted in this Preliminary Assessment. After additional site investigation is completed, the remedial investigation would compile existing and new data into a useable and informative format, including comprehensive data summary figures to fully assess potential site risks. The remedial investigation would also more carefully evaluate current and future site user groups and support decision making for site-specific cleanup levels that would be used in the feasibility study to identify and evaluate feasible remediation technologies and alternatives to protect potential human and ecological receptors. The feasibility study would use information presented in the remedial investigation to identify a feasible, site-specific remedy that would both comprehensively address site risks and be compatible with the planned site uses. The feasibility study would identify and describe active remedial measures that can be implemented at the site, such as capping portions of the site and mitigating leachate sources that are high in metals. Remedial measures may also include institutional controls that could alter site uses.

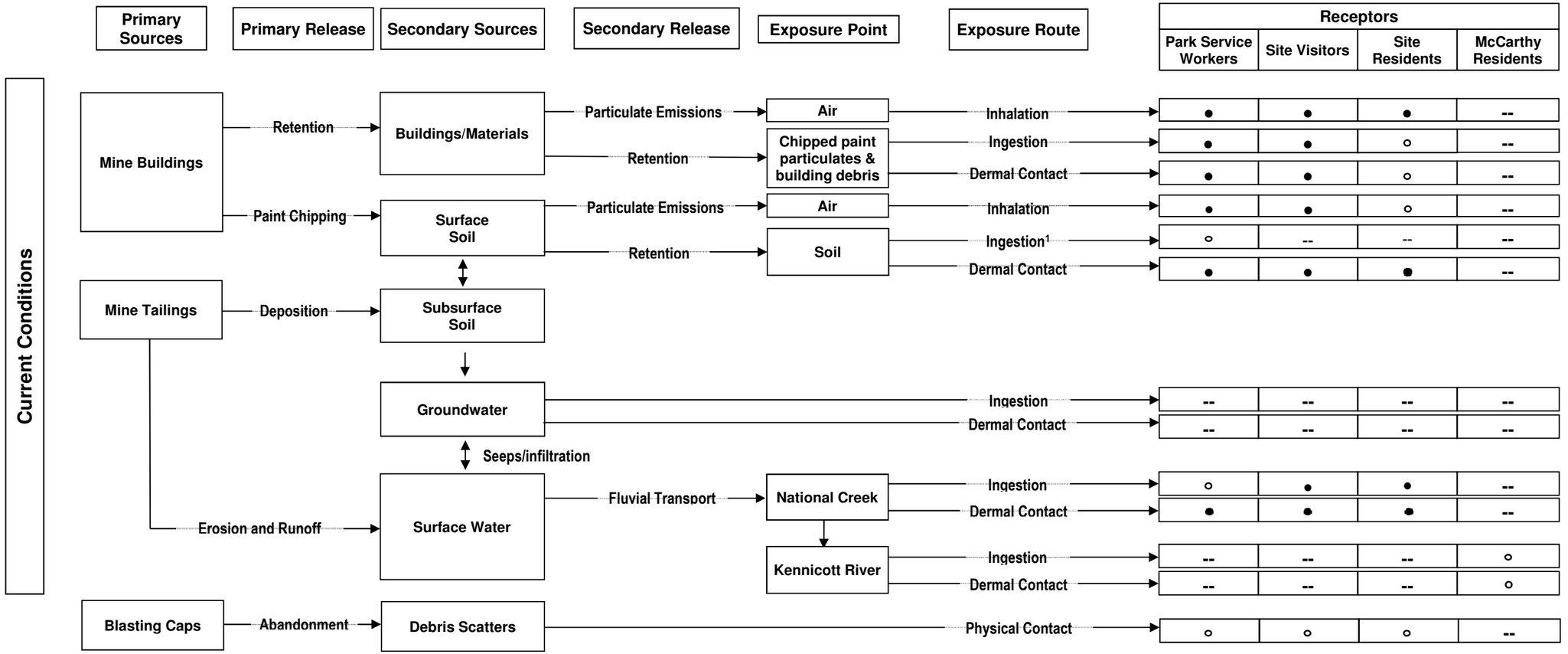
5. References

National Park Service (NPS). 2014. *NPS Protocol for the Selection and Use of Ecological Screening Values for Non-Radiological Analytes*. Revision 1. January 13.

NPS. 2017a. Statement of Services: Kennecott Mill Site Preliminary Assessment, Wrangell–St. Elias National Park and Preserve. May 8.

NPS. 2017b. Wrangell–St. Elias National Park and Preserve Park Statistics. Available at: https://www.nps.gov/wrst/learn/management/statistics.htm.

United States Environmental Protection Agency (EPA). 1994. Memorandum: OSWER Directive: Revised Interim Soil Lead Guidance for CERLA Sites and RCRA Correction Action Facilities. EPA OSWER Directive #9355.4-12. August.



→ Potential Transport or Exposure Pathway

-- Incomplete Exposure Pathway

○ Potentially Complete Exposure Pathway[2]

● Complete Exposure Pathway[3]

Notes:

1. Soil ingestion by Park Service Workers is only considered complete if the worker is performing excavation activities. The pathway is incomplete during all other activities; since excavation does not consistently occur at the site, the pathway was considered potentially complete.

2. A potentially complete exposure pathway exists when potential contamination exposure to an individual or population is considered possible but unlikely.

3. A complete exposure pathway exists when an individual or population is exposed or has the potential to be exposed to hazardous substances at or originating from the site.

CONCEPTUAL SITE MODEL- RECEPTORS
NPS Preliminary Site Assessment
Kennecott Mill Site

By: WMY	Date: 3/18/2018	Project No. 32106H037
Amec Foster Wheeler Environment & Infrastructure, Inc.		Figure 5

P:\National Park Service Kennecott\PA Report\Revised PA and response to comments\Figures\Figure 5 Conceptual Site Model Kennecott Mill Site.xlsx

TABLE 1

HISTORIC USE OF KENNECOTT MILL SITE
Wrangell-St. Elias National Park and Preserve
Kennecott Mill Site

Year	Event Description
1899	Nikolai Native Copper lode staked by Chittyna Company. Mother Lode claim staked by Clarence Warner and "Tarantula Jack" Smith.
1900	Bonanza Mine area staked by Warner and Smith on July 22.
1905	Alaska Copper and Coal Company wins ownership battle and is reformed as the Kennecott Mines Company.
1906–1911	Kennecott Mines Company spends $25 million to construct mine buildings and works. A 196-mile railroad carried ore from Kennecott to Cordova, and a steamship line shipped ore from Cordova to the American Smelting and Refining Company smelter in Tacoma, Washington.
1909	Bonanza tramway built.
1911	Railroad completed.
1915	Kennecott Mines Company reorganized into KCC. Jumbo ore body discovered. The 16,000-foot-long Jumbo tramway built.
1916	Ammonia leaching plant becomes operational. The 350-foot-long Erie tramway built. High grade ore struck in Mother Lode Mine.
1917	Mill and leaching plant enlarged (completed in 1918).
1918	Glacier Mine tramway built. KCC buys Mother Lode Mine.
1923	Flotation plant operational. Ore production peaks.
1930	Last year of full production.
1932	Mines temporarily close.
1935	Mines reopen.
1938	Mines closed in October. Railroad abandoned in November.
1938–1941	Site evaluated for preservation as the Kennecott National Monument. No action taken.
1954	KCC contracted Ray Trotuchau to demolish all buildings. The roof of the concentrator, two superintendent's houses, and staff house destroyed. The contractor defaults and no further work is done.
1964	Consolidated Wrangell Corporation, now owner of the surface rights, attempt some surface mining of ore residues.
1974	The USGS studies the geology of the Bonanza and Mother Lode Mines, both underground and on the surface.
1976–1977	Site re-evaluated. Kennecott nominated to the National Register of Historic Places.
1980	The Historic American Engineering Record branch of the National Park Service inventories and records the buildings and mill.
1986	Kennecott designated a National Historic Landmark as the best remaining example of an early 20th-century copper mine.
1987	Site owners (Great Kennicott Glacier Land Company and Consolidated Wrangell Mining Company) offer the site to the National Park Service.
1998	The National Park Service acquires the Kennecott National Historic Landmark, including 2,839 acres and several structures and begins rehabilitation of the historic mill town.
Present	The National Park continues to rehabilitate the mill town. The park is a popular tourist destination.

Abbreviations:
KCC = Kennecott Copper Corporation
USGS = United States Geological Survey

TABLE 2

GENERAL HAZARDS AND MITIGATION SUMMARY FOR BUILDINGS

Wrangell-St. Elias National Park and Preserve
Kennecott Mill Site

Building Name[1]	General Hazards	Mitigation Summary	Photo Identification[2]
Sleeping Cabana 1		None	None
Sleeping Cabana 2		None	None
Sleeping Cabana 3		None	None
Sleeping Cabana 4		None	None
Electrical Generator Building		None	None
Dairy Barn	Lead Paint	Interior and exterior painted in 2010	None
Support Building/Sleeping Cabins		None	None
Old School Outhouse		None	None
Old School House (Shaw)	Lead Paint	Interior and exterior painted in 2003	None
Recreation Hall	Asbestos Lead Paint	Interior and exterior painted in 2003 Asbestos abated in 1993	None
Firehose House	Asbestos	Asbestos abated in 1993	None
School House	Lead Paint	Interior and exterior painted in 2004	None
West Bunkhouse	Asbestos Lead Paint	Asbestos abated in 1993	56–59
Refrigeration Plant	Asbestos Lead Paint	Interior and exterior painted in 2006 Asbestos abated in 1993	54 and 55
Kennecott Generator Shed		None	None
South Tailings Hoist House	Asbestos	Asbestos abated in 1993	None
Kennecott Visitor Center	Lead Paint	Interior and exterior painted in 2006	None
Leach Plant	Asbestos Lead Paint	Exterior painted in 2012 and 2013 Asbestos abated in 1993 and 1994	28–36
North Tailings Hoist House		None	None
Machine Shop	Asbestos Lead Paint Boiler Ash	Exterior painted in 2012 Ash buried and capped in 1994	22–27
Machine Shop Shed		None	None

TABLE 2

GENERAL HAZARDS AND MITIGATION SUMMARY FOR BUILDINGS

Wrangell-St. Elias National Park and Preserve
Kennecott Mill Site

Building Name[1]	General Hazards	Mitigation Summary	Photo Identification[2]
Power Plant	Asbestos Asbestos in boilers Hydrocarbon Impacted Soil Hydrocarbon pooling Lead Paint	Asbestos was abated in 1994 The boilers were sealed in 1994 Exterior painted in 2014	3–18
Kirkwoods Cottage 29C	Asbestos	Asbestos abated in 1993	1 and 2
Silk Stocking Cottage 32D	Asbestos	Asbestos abated in 1993	None
Silk Stocking Cottage 32C	Asbestos	Asbestos abated in 1993	None
Railroad Depot/Station House	Lead Paint Asbestos	Interior and exterior painted in 2002 Asbestos abated in 1993	None
National Creek Bunkhouse	Asbestos Lead Paint	Asbestos abated in 1993	51 and 52
Assay Office	Lead Paint	Asbestos abated in 1993	52
East Bunkhouse	Asbestos	Exterior painted in 2016 Asbestos abated in 1993	None
Hospital	Asbestos	Asbestos abated in 1993	49, 50 and 52
General Managers Office	Asbestos Lead Paint	Interior and exterior painted in 2006 Asbestos abated in 1993	None
Tramway Turnhouse		None	37
Mill Building	Asbestos Lead Paint	Asbestos abated in 1993	37–48
Transformer House	Asbestos	None	19–21

Notes:

1. **Bold** indicates building was visited during the 2017 site reconnaissance.
2. Photos can be found in Appendix B.

TABLE 3

ESTIMATED WASTE QUANTITIES
Wrangell-St. Elias National Park and Preserve
Kennecott Mill Site

Type of Waste	Comment	Estimated Amount	Source of Data
Asbestos	Chrysotile-thermal insulation asbestos-containing material	28,728 pounds prior to abatement in 1993, current extent unknown	NPS, 1996 (Doc 1, App A)
Tailings	Leachable metals levels reported below RCRA MCLs	330,000 cubic yards	ADEC, 1992 (Doc 3, App A)
Boiler Ash	Leachable levels of lead reported above TCLP limits; Boiler Ash pile is capped	49,062 pounds	ADEC, 1992 (Doc 3, App A) NPS, 1996 (Doc 1, App A)
Ammonia tanks	Tanks reported to have been emptied, ammonia crystals remain at bottom of tanks	5,607 gallons of sludge	EMCON Alaska, Inc., 1995 (Doc 8, App A)
Oil and Grease Oil Spills	Oil reported to have been removed from tanks; soil staining remains	79,000 sf west of Power Plant; 450 sf north of Mill Building; Unknown amount near utilidor	GeoEngineers, 2006 (Doc 9, App A)
Paint-lead based	Red and white paints contained lead; grey paint contains arsenic	~98,000 sf total lead paint cover; 52,000 sf peeling paint	NPS, 1997 (Doc 5, App A)
Ore and ore concentrates	Reported to be nonhazardous; location where ore was disposed of is unknown	2,905,769 pounds	ADEC, 1992 (Doc 3, App A)
Blasting Caps	Located in dumps north of mill building and west of leach plant	Extent unknown	Shields, 2015 (Doc 21, App A)
Garbage dumps	Dumping continues	Volume unknown 21,800 sy	NPS, 1996 (Doc 1, App A)

Abbreviations:
MCLs = maximum contaminant levels
RCRA = Resource Conservation and Recovery Act
sf = square feet
sy= square yards
TCLP = toxicity characteristic leaching procedure

TABLE 4

SUMMARY OF HISTORICAL DOCUMENTS
Wrangell-St. Elias National Park and Preserve
Kennecott Mill Site

Investigation Dates	Author and Publication Date	Report Type/Title	Regulatory Agency	Scope of Document	Appendix A Document No.
1987–1990	Kay and Miller, 1990	Site Characterization: Kennecott – A Hazardous Waste Audit	ADEC	Waste audit for all hazardous waste. Looked at asbestos, oil and grease, ore concentrations, building paints, mine tailings, garbage dumps, power plant ash, oil leakage and water quality.	2
1991–1992	America North/EMCON, Inc., 1992	Site Characterization: Kennecott Mine Site Investigation Final Report	ADEC	Site investigation for potentially hazardous substances. Identified the following potentially hazardous substances: Asbestos, garbage dumps, water quality, tailings, oil spills, oil and grease, boiler ash, paint, ammonia tanks, ore concentrates and miscellaneous potentially hazardous substances.	7
1992	ADEC, 1992	Site Characterization: Preliminary Assessment Report for Kennecott Mine Site	ADEC/EPA	Preliminary assessment conducted by ADEC that summarized the reports of Kay and Miller (1990) and America North/EMCON, Inc. (1992). Identified the following areas of concern: Old mill building safety hazards, asbestos, boiler ash piles, ammonia solutions, oil spills, mine tailings and explosives.	3
1992–1994	EMCON Alaska, Inc., 1995	Remediation Activities: 1994 Remediation Activities Report, Kennecott Mine, Kennecott, Alaska	ADEC	Summary of remediation activities between 1992 and 1994. These activities consisted of packaging and removal of small quantities of hazardous substances located in the buildings, removal of friable asbestos-containing materials from all buildings capping of ash piles, treating and draining of two ammonia tanks, cleaning of two above ground fuel tanks, oil spill containment, and oil and grease drum removal.	8
1994–1995	Roy F. Weston, 1995	Site Characterization: Site Inspection Report, Kennecott Mine, Kennecott, Alaska	EPA	CERCLA site investigation that characterized potential source areas, determined contamination effects on surface water bodies, evaluated the potential for source migration via the air pathway and evaluated the potential for contaminants to impact human receptors.	10
1995–1996	NPS, 1996	Site Characterization: Kennicott Pre-Acquisition Environmental Site Assessment	USDOI	Summarized previous reports of site characterization and remediation activities. Focused on tailings, fuel releases, transformers, lubricant oils and greases, lead based paint, asbestos and solid waste. Weighed the benefits of the acquisition relative to the total cost of acquisition.	1

TABLE 4

SUMMARY OF HISTORICAL DOCUMENTS
Wrangell-St. Elias National Park and Preserve
Kennecott Mill Site

Investigation Dates	Author and Publication Date	Report Type/Title	Regulatory Agency	Scope of Document	Appendix A Document No.
1997	NPS, 1997	Statement of Work: Statement of Work and Schedule Actions to be taken by the National Park Service at the Kennecott National Historic Landmark, Mitigation of Hazardous Material Issues	USDOI	Statement of services addressing necessary actions to mitigate the hazards identified in the 1996 NPS Kennecott Pre-Acquisition Environmental Site Assessment. Outlined work needed to mitigate fuel releases, transformers, oils and greases, lead based paint, asbestos and solid waste.	4
1997	NPS, 1997	Remediation Activities: Kennecott National Historic Landmark: Integrated Emergency Stabilization and Lead-Based Management Program	USDOI	Action plan for mitigating the hazards associated with lead based paints identified in the 1996 Kennecott Pre-Acquisition Environmental Site Assessment. Plan outlines the removal of lead based paint from the buildings.	5
1999	NPS, 1999	Remediation Activities: Kennecott National Historic Landmark Hazardous Material Issues Work Plan	ADEC	Action plan for mitigating the seven hazards identified in the 1996 Kennecott Pre-Acquisition Environmental Site Assessment. Identifies lead based paint in soils, fuel releases and asbestos as hazards that require immediate attention.	6
2001–2002	Hart Crowser, 2002	Site Characterization: Limited Hazardous Materials Survey	USDOI	Hazardous materials survey of collected samples from paint, dust in buildings, soil surrounding buildings and some debris piles. Collected samples in several of the buildings and provided recommendations concerning remediation.	11
2003	US Public Health Service, Federal Occupational Health, 2003	Site Characterization: Lead and Arsenic Employee Exposure Assessment	FOH	Survey of lead and arsenic levels in soil, dust and debris for mine buildings. Make recommendations for employee health and safety plan.	12

TABLE 4

SUMMARY OF HISTORICAL DOCUMENTS
Wrangell-St. Elias National Park and Preserve
Kennecott Mill Site

Investigation Dates	Author and Publication Date	Report Type/Title	Regulatory Agency	Scope of Document	Appendix A Document No.
2003	Hart Crowser, 2003	Site Management Plan: Lead and Asbestos	OSHA	Identifies site activities that involve potential exposure to lead and asbestos. Utilizes data from 2002 Hart Crowser survey.	15
2005	Federal Occupational Health, 2005	Site Characterization - Lead and Asbestos in Soil Survey	FOH	Survey of lead and asbestos in several buildings at the site. Compared measured values with State of Alaska's contaminated site cleanup level.	13
2006	GeoEngineers, 2006	Site Characterization: Summary and Recommendations for Kennecott Mine Historical Hydrocarbon Releases	USDOI	Analysis of hydrocarbon release data from 1992 America North/EMCON, Inc. report and 1996 Kennecott Pre-Acquisition Environmental Site Assessment. Provided recommendations for additional site research.	9
2010	SGS North America, Inc., 2010	Site Characterization: Laboratory Analysis Report for Lead and Asbestos	USDOI	Measurement of lead and cadmium in dust in the east bunkhouse.	16
2011	Shields, 2011	Site Characterization: Blasting Caps	USDOI	Survey of blasting caps present in the debris piles on the site. Identifies chemicals used in fuse blasting caps and potential hazards.	14
2013	Shields, 2013	Site Characterization: Blasting Caps Diagram	USDOI	Identifies approximate extent of blasting caps in vicinity of the mill building.	17
2015	White, 2015	Site Management Plan: Hazardous Materials Management Plan	USDOI	Update of 2003 Hart Crowser site management plan.	18
2015	SH Alaska, 2015	Site Characterization: Report of Records and Data Preview	USDOI	Report in response to worker exposure incident and reports of symptoms similar to those caused by metals exposure. Analysis of heavy metals in air measured in areas where site employees work.	19

TABLE 4

SUMMARY OF HISTORICAL DOCUMENTS
Wrangell-St. Elias National Park and Preserve
Kennecott Mill Site

Investigation Dates	Author and Publication Date	Report Type/Title	Regulatory Agency	Scope of Document	Appendix A Document No.
2015	NPS, 2015	Site Characterization: Timeline for Lead Paint Mitigation and Asbestos Abatement	USDOI	Summary table of buildings and hazards (lead and/or asbestos) addressed. Covers some additional hazards like blasting caps in 2013 and power plant hydrocarbon area.	20
2015	Shields, 2015	Site Characterization and Remediation Activities: Blasting Caps	USDOI	Identify fuse and caps throughout debris slopes. Some of the found products were removed.	21
2015	White, 2015	Site Characterization: Soil Sampling Supplemental Services	USDOI	Measured concentrations of heavy metals and compared to the Alaska cleanup levels using XRF field screening methods. Provided recommendations for further analysis	22

Abbreviations:
ADEC = Alaska Department of Environmental Conservation
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act
EPA = Environmental Protection Agency
FOH = Federal Occupational Health
NPS = National Park Service
OSHA = Occupational Safety and Health Administration
USDOI = United States Department of the Interior

TABLE 5

SUMMARY OF LOCATION OF HISTORICAL DATA

Wrangell-St. Elias National Park and Preserve

Kennecott Mill Site

Author and Publication Date	Report Objectives	Sample Location Figures in Report	Sample Tables in Reports	Media Sampled	Location of Data In Appendix C
Kay and Miller, 1990	Site Characterization - Hazardous Waste Audit	Locations summarized in NPS 1996 report	Tables 2–10	Surface water, mine tailings, paint, asbestos, oil and grease, soil hydrocarbon, miscellaneous substances, paint, asbestos, groundwater	Appendix C-1
America North/EMCON, Inc., 1992	Site Characterization - Investigation Final Report	5, 6a, 6b, 13, 14, 15	Tables 1–38	Fuel oil, paint, soil, grease, fire brick, ammonia solution, tailings	Appendix C-2 (Unable to locate Figure 5)
Weston, 1995	Site Characterization - Inspection Report	Figures 3-1, 3-2	Tables 3-1, 3-2, 4-1, 4-2, 4-4, 4-5, 4-6, 4-7, 4-8, 4-9	Soil, sediment, surface water, dust	Appendix C-3
NPS, 1996	Site Characterization - Preacquisition Environmental Site Assessment	Figures 5, 6, 7, 8	Tables 2–5	Tailings, paint, paint impacted soils, water, sediment	Appendix C-4
Hart Crowser, 2002	Site Characterization - Hazardous Building Materials Survey	Figures 2–32	Tables 1–6	Paint, dust and soil for lead and asbestos	Appendix C-5 (Figures not included)
US Public Health Service, Federal Occupational Health, 2003	Site Characterization - Lead and Arsenic Employee Exposure Assessment	Figure 1	Tables 1–4	Soil, dust and debris	Appendix C-6
Federal Occupational Health, 2005	Site Characterization - Lead and Asbestos in Soil Survey	Appendix D	Table 1a, 3, 4, 5	Debris, dust, soil	Appendix C-7 (Unable to locate Appendix D)

TABLE 5

SUMMARY OF LOCATION OF HISTORICAL DATA
Wrangell-St. Elias National Park and Preserve
Kennecott Mill Site

Author and Publication Date	Report Objectives	Sample Location Figures in Report	Sample Tables in Reports	Media Sampled	Location of Data In Appendix C
SGS Laboratory, 2010	Site Characterization - Laboratory Analysis Report for Lead and Asbestos	NA	NA	Dust	Appendix C-8
Shields, 2013	Site Characterization Blasting Cap Diagram	2013 Mill Blasting Cap Diagram	NA	NA	Appendix C-9
SH Alaska, 2015	Site Characterization - Report of Records and Data Preview	Sampling Data Table	NA	Air (lead, arsenic, mercury, asbestos)	Appendix C-10
White, 2015	Site Characterication - Soil Sampling Supplemental Services		Tables 1–4	Soil (metals)	Appendix C-11

TABLE 6

SUMMARY OF HISTORICAL MAXIMUM SOIL DATA[1]

Wrangell-St. Elias National Park and Preserve

Kennecott Mill Site

Metal	Maximum Constituent Results		Regional Screening Level[2] (mg/kg)	NPS Screening Level[3] (mg/kg)	ADEC Direct Contact Human Health Risk Screening Level[4] (mg/kg)	Maximum Results Leachable Metals		TCLP Hazardous Waste Limit[5] (mg/L)
	EPA Method	Result (mg/kg)				EPA Method	Result (mg/L)	
Arsenic	7060	**3,500**	0.39	0.25	25	1312	ND	5.0
Barium	6010	162	15,000	17.2	20,300	1312	0.3	100
Cadmium	6010	**282**	7.1	0.27	79	1312	ND	1.0
Chromium	6010	19	230	28	304	1312	ND	5.0
Lead	6010	**4,880**	400	0.94	NA	1312	ND	5.0
Mercury	6010	**51.8**	1.1	0.013	30	1312	ND	0.2
Selenium	6010	3	390	0.331	510	1312	ND	1.0
Silver	6010	118	390	2.6	510	1312	ND	5.0
TPH - Power Plant	418.1	**110,000**	520	No ESV	No Screening Level	NA	NA	NA
TPH - Mill Building	418.1	**100,000**	520	No ESV	No Screening Level	NA	NA	NA
TPH - Utilidor	418.1	**320,000**	520	No ESV	No Screening Level	NA	NA	NA

Notes:

1. **Bold** values indicate RSL exceedances
2. RSL from EPA for residential ingestion of soil.
3. Screening level is NPS ecological screening value for wildlife exposure to soil.
4. ADEC Division of Spill Prevention and Response Contaminated Sites Program, Cumulative Risk Guidance.
5. Toxicity characteristic from 40 Code of Federal Regulations 261.24.

Abbreviations:

ADEC = Alaska Department of Environmental Conservation
EPA = U.S. Environmental Protection Agency
ESV = ecological screening value
mg/kg = milligrams per kilogram
mg/L = milligrams per liter
NA = not applicable
ND = not detected
NPS = National Park Service
TCLP = toxicity characteristic leaching procedure
TPH = total petroleum hydrocarbons

TABLE 7

LEAD CONCENTRATION MEASUREMENTS
Wrangell-St. Elias National Park and Preserve
Kennecott Mill Site

Location	1997 Lead Paint Estimations[1]		2002 Hazardous Materials Survey[2]	
	Total Cover (square feet)	Peeling (square feet)	Lead in Dust Samples[3] ($\mu g/ft^2$)	Lead in Soil Samples[4] (mg/kg)
Old School House (Shaw)			436–1,583	123–152
Recreation Hall	1,400	616	1,448–2,762	87–109
Firehose House				
School House	2,160	1,015	5,344–9,824	3,400
West Bunkhouse	8,138	2,997	2,139–17,920	4,480–4,880
Refrigeration Plant			1,420–1,550	6,218
Kennecott Visitor Center (Store and Warehouse)	3,920	2,320	Basement: 810 First floor: 1,283–5,773	1,500–2,989
Leach Plant	18,288	11,298	777	243–1,450
Machine Shop	4,536	1,242	1,188–1,495	101–224
Power Plant	9,360	1,502		
Railroad Depot/Station House	720	302	914	398
National Creek Bunkhouse	4,128	2,974	6,950–8,070	116
Assay Office	800	320	NM	NM
General Managers Office	3,916	1,955	Floor 1: 3,827 Floor 2: 6,118	2,200
Mill Building	41,661	26,037	131–1,298	
Totals:	**99,027**	**52,578**		

Notes:
1. NPS (1997b)
2. Hart Croswer (2002)
3. The EPA screening value for lead in dust is 40 $\mu g/ft^2$.
4. The NPS ESV screening value for wildlife exposure to soil for lead is 0.94 mg/kg.

Abbreviations:
$\mu g/ft^2$ = micrograms per square foot
ESV = ecological screening value
mg/kg = milligrams per kilogram
NM = not measured

TABLE 8

SEEP AND SURFACE WATER SAMPLING RESULTS[1]

Wrangell-St. Elias National Park and Preserve
Kennecott Mill Site

All concentrations are in parts per billion (ppb).

Location[2]	Figure ID	Number of Samples	Arsenic	Cadmium	Chromium	Copper	Mercury	Lead	Zinc
Screening Level[3]			3.1	0.07	None	0.23	0.026	0.92	30
Regional Screening Levels[4]			50[5]	9.2	4.4	80	6	15[6]	600
Background Location	BG	10	0.7	**0.1**	< 5	**0.9**	**0.1**	**1.4**	9
Seeps downgradient of power plant	SP1	3	**13.0**	**0.5**	2.7	**157.7**	**0.1**	**63.7**	**493.3**
Seep at south end of leach plant	SP2	3	**177.3**	**2.1**	< 5	**4,253.3**	**0.7**	**5.7**	<500
Seep downgradient of leach plant	SP3	1	**7.2**	< 0.5	< 5	**65.3**	0	<.5	<500
National Creek, west of assay office, prior to entering tailings	NC1	4	1.4	< 0.5	< 5	**21.3**	< 0.2	0	2
National Creek, west of west bunkhouse directly downstream of tailings	NC2	3	**69.0**	**3.3**	< 5	**1,366.7**	**1.0**	**22.3**	**2,366.7**
National Creek, west of Kennecott Glacier Lodge, above historic glacier influent	NC3	6	2.1	< 0.5	< 5	**38.3**	**0.1**	**1.4**	9

Notes:

1. **Bold** values exceed NPS ESV for wildlife exposure to surface water.
2. Specific locations are shown on Figure 4. Sampling data is from NPS (1996).
3. Screening value is the NPS ESV for wildlife exposure to surface water.
4. Regional Screening Levels from EPA for residential ingestion of tapwater.
5. EPA does not have a screening level; this screening value is recommended by the California Regional Water Quality Control Board.
6. EPA does not have a screening level as there is no consensus reference dose cancer slope factor.

However, they recommend 15 parts per billion, which is the EPA Action Level in water.

Abbreviations:

EPA = U.S. Environmental Protection Agency
ESV = ecological screening value
NPS = National Park Service
ppb = parts per billion

TABLE 9

HEALTH EFFECTS FOR CHEMICAL HAZARDS IDENTIFIED AT KENNECOTT MILL SITE

Wrangell-St. Elias National Park and Preserve

Kennecott Mill Site

CAS	Chemical	Exposure Route	Health Hazards
1332-21-4	Asbestos (fibers/cc)	Inhalation, Ingestion, Eye/Skin Contact	*RISE;* Asbestosis (chronic exposure): dyspnea (breathing difficulty), interstitial fibrosis, restricted pulmonary function, finger clubbing; eye irritation; potential occupational carcinogen
7439-92-1	Lead (inorganic) (mg/m3)	Inhalation, Ingestion, Eye/Skin Contact	*RISE;* Lassitude (weakness, exhaustion), insomnia; facial pallor; anorexia, weight loss, malnutrition; constipation, abdominal pain, colic; anemia; gingival lead line; tremor; paralysis wrist, ankles; encephalopathy; kidney disease; irritation eyes; hypotension
7664-41-7	Ammonia (ppm)	Inhalation, Ingestion, Eye/Skin Contact	*RISE;* Irritation eyes, nose, throat; dyspnea (breathing difficulty), wheezing, chest pain; pulmonary edema; pink frothy sputum; skin burns, vesiculation; liquid: frostbite
7440-38-2	Arsenic -- inorganic (mg/m3)	Inhalation, Ingestion, Absorbtion, Eye/Skin Contact	*RISE;* Ulceration of nasal septum, dermatitis, gastrointestinal disturbances, peripheral neuropathy, respiratory irritation, hyperpigmentation of skin [potential occupational carcinogen]
7440-39-3	Barium - soluble (mg/m3)	Inhalation, Ingestion, Eye/Skin Contact	*RISE* ; Eye, mucous memebrane, and skin irritation
7727-43-7	Barium sulfate (mg/m3)	Inhalation, Eye/Skin Contact	*RISE* ; Eye, nose, and upper respiratory irritation; pneumoconiosis
7440-43-9	Cadmium (mg/m3)	Inhalation, Ingestion	*RI* ; Pulmonary edema, dyspnea (breathing difficulty), cough, chest tightness, substernal (occurring beneath the sternum) pain; headache; chills, muscle aches; nausea, vomiting, diarrhea; anosmia (loss of the sense of smell), emphysema, proteinuria, mild anemia [potential occupational carcinogen]
Varies	Chromium(II) compounds (mg/m3)	Inhaltion, Ingestion, Eye/Skin Contact	*RISE* ; Irritation eyes; sensitization dermatitis
Varies	Chromium(III) compounds (mg/m3)	Inhaltion, Ingestion, Eye/Skin Contact	*RISE* ; Irritation eyes; sensitization dermatitis
7439-97-6	Mercury (inorganic) (mg/m3)	Inhaltion, Ingestion, Eye/Skin Contact	*RISE* ; SKIN; Irritation eyes, skin; cough, chest pain, dyspnea (breathing difficulty), bronchitis, pneumonitis; tremor, insomnia, irritability, indecision, headache, lassitude (weakness, exhaustion); stomatitis, salivation; gastrointestinal disturbance, anorexia, weight loss; proteinuria
7782-49-2	Selenium compounds (mg/m3)	Inhaltion, Ingestion, Eye/Skin Contact	*RISE* ; Irritation eyes, skin, nose, throat; visual disturbance; headache; chills, fever; dyspnea (breathing difficulty), bronchitis; metallic taste, garlic breath, gastrointestinal disturbance; dermatitis; eye, skin burns; in animals: anemia; liver necrosis, cirrhosis; kidney, spleen damage
7440-22-4	Silver, metal and soluble compounds (mg/m3)	Inhaltion, Ingestion, Eye/Skin Contact	*RISE* ; Blue-gray eyes, nasal septum, throat, skin; irritation, ulceration skin; gastrointestinal disturbance
1314-13-2	Zinc (zinc oxide -- total dust) (mg/m3)	Inhalation	*I* ; Metal fume fever: chills, muscle ache, nausea, fever, dry throat, cough; lassitude (weakness, exhaustion); metallic taste; headache; blurred vision; low back pain; vomiting; malaise (vague feeling of discomfort); chest tightness; dyspnea (breathing difficulty), rales, decreased pulmonary function

TABLE 9

HEALTH EFFECTS FOR CHEMICAL HAZARDS IDENTIFIED AT KENNECOTT MILL SITE

Wrangell-St. Elias National Park and Preserve

Kennecott Mill Site

CAS	Chemical	Exposure Route	Health Hazards
65996-93-2	Coal Tar Pitch Volatiles (Polycyclic Aromatic Hydrocarbons, PAH) (mg/m3)	Inhalation, Eye/Skin Contact	*RSE*; Dermatitis, bronchitis, [potential occupational carcinogen]
8006-61-9	Gasoline (ppm)	Inhalation, Absorbtion, Ingestion, Eye/Skin Contact	*RISE*; Irritation eyes, skin, mucous membrane; dermatitis; headache, lassitude (weakness, exhaustion), blurred vision, dizziness, slurred speech, confusion, convulsions; chemical pneumonitis (aspiration liquid); possible liver, kidney damage; [potential occupational carcinogen]
8012-95-1	Oil (mineral) mist, particulate (Bunker C)	Inhalation, Absorbtion, Ingestion, Eye/Skin Contact	*RISE;* Irritation eyes, skin, respiratory system
111-65-9	Octane	Inhalation, Ingestion, Eye/Skin Contact	*RISE;* Irritation eyes, nose; drowsiness; dermatitis; chemical pneumonia (if liquid aspirated); in animals: narcosis
8008-20-6	Kerosene (mg/m3)	Inhalation, Ingestion, Eye/Skin Contact	*RISE*; SKIN; Irritation eyes, skin, nose, throat; burning sensation in chest; headache, nausea, lassitude (weakness, exhaustion), restlessness, incoordination, confusion, drowsiness; vomiting, diarrhea; dermatitis; chemical pneumonitis (aspiration liquid)
7783-06-4	Hydrogen sulfide (ppm)	Inhalation, Eye/Skin Contact	*RISE*; Irritation eyes, respiratory system; apnea, coma, convulsions; conjunctivitis, eye pain, lacrimation (discharge of tears), photophobia (abnormal visual intolerance to light), corneal vesiculation; dizziness, headache, lassitude (weakness, exhaustion), irritability, insomnia; gastrointestinal disturbance; liquid: frostbite

Abbreviations

R	Respiratory
I	Irritant
S	Skin Hazard
E	Eye Hazard
SKIN	Recommends need for Personal Protective Equipment
cc	cubic centimeters
ppm	parts per million
mg/m^3	milligrams per cubic meter

Appendices

Appendix A – Previous Reports

Files provided separately on DVD.

Appendix B – Photographic Log

Photo 1 –Restored (foreground) and non-restored (background) areas in Kirkwood Cottage D. Orientation: west. Date: 8/22/2017. Time: 0939.

Photo 2 – Exterior of Kirkwood Cottage D. The building has been repainted. Orientation: west. Date: 8/22/2017. Time: 0939.

Photo 3 – Power Plant (left), Fuel Tank (center) and Storage Tank (right). Orientation: south. Date: 8/22/2017. Time: 0944.

Photo 4 – Power plant Exterior. Orientation: southwest. Date: 8/22/2017. Time: 0944.

Photo 11 – Sewer line and soil staining. Orientation: east.
Date: 8/22/2017. Time: 1018.

Photo 12 – Power house interior with peeling lead-based paint. Orientation: west.
Date: 8/22/2017. Time: 1022.

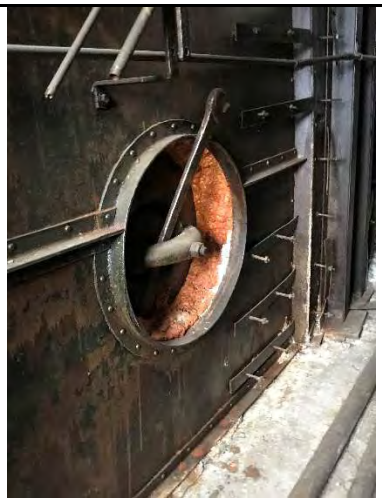


Photo 13 –The seal on a boiler containing asbestos in the Powerhouse. Orientation: south.
Date: 8/22/2017. Time: 1036.

Photo 14 – Cracking of a sealed boiler containing asbestos in the Powerhouse. Orientation: south.
Date: 8/22/2017. Time: 1037.

Photo 15 – Utilidor stained with Bunker C in the Powerhouse. Orientation: south.
Date: 8/22/2017. Time: 1030.

Photo 16 – Guided tour path through the Powerhouse. Note the boilers which contain asbestos on the left.
Orientation: south. Date: 8/22/2017. Time: 1031.

Photo 17 – Bunker C staining underneath the day tank in the powerhouse. Orientation: west.
Date: 8/22/2017. Time: 1026.

Photo 18 – Power house interior with peeling lead-based paint. Orientation: west.
Date: 8/22/2017. Time: 1040.

Photo 19 –Exterior of transformer house, painted with lead-based paint. Orientation: northeast.
Date: 8/22/2017. Time: 1049.

Photo 20 – Asbestos in wall of transformer house.
Orientation: north.
Date: 8/22/2017. Time: 1050.

Photo 21 – Lead battery in transformer house.
Orientation: north.
Date: 8/22/2017. Time: 1052.

Photo 22 – Debris next to the Machine Shop which represents a physical hazard.
Orientation: south. Date: 8/22/2017. Time: 0919.

Photo 23 – Peeling lead-based paint on Machine Shop. Orientation: east.
Date: 8/22/2017. Time: 1058.

Photo 24 – Boiler Ash cap (foreground), machine shop, and leach plant (right). Orientation: south.
Date: 8/22/2017. Time: 1007.

Photo 25 –Exterior of Machine Shop, which has been repainted. Orientation: south.
Date: 8/22/2017. Time: 1059.

Photo 26 – Peeling lead-based paint on ceiling of Machine Shop. Orientation: NA.
Date: 8/22/2017. Time: 1100.

Photo 27 – Equipment stored inside Machine Shop. Orientation: southwest. Date: 8/22/2017. Time: 1101.

Photo 28 – North end of Leach Plant showing repainted (left) and original lead-based paint (right). Orientation: south. Date: 8/22/2017. Time: 1105.

Photo 29 – Leach Plant interior with new ceiling and original lead-based paint. Orientation: southeast. Date: 8/22/2017. Time: 1105.

Photo 30 – Western end of the Leach Plant. Note the lack of railing (right) representing a physical hazard. Orientation: west. Date: 8/22/2017. Time: 1007.

Photo 31 – Interior of Leach Plant showing old ammonia tanks. Orientation: south.
Date: 8/22/2017. Time: 1118.

Photo 32 – Ammonia tanks in Leach Plant. Note green staining on ceiling beams. Orientation: northwest.
Date: 8/22/2017. Time: 1122.

Photo 33 – Exterior of Leach Plant. The collapsing structure is a physical hazard. The wall contains original lead-based paint. Orientation: south.
Date: 8/22/2017. Time: 1125.

Photo 34 – Debris by west end of Leach Plant (foreground) and unknown surface water feature (background) downgradient of the Mill Site.
Orientation: south. Date: 8/22/2017. Time: 11218.

Photo 35 – Slope west of Leach Plant. A seep (left) runs under the Leach Plant creating a collapse potential. Orientation: southeast. Date: 8/22/2017. Time: 1130.

Photo 36 – National Creek (center) and Leach Plant (right). Building debris is actively falling into the creek. Orientation: east. Date: 8/22/2017. Time: 1131.

Photo 37 – Tramway building and Mill Building. Field contains debris, and building exterior contains lead-based paint. Orientation: south. Date: 8/22/2017. Time: 1344.

Photo 38 – Field west of Mill Building. This was the location of recent NPS employee exposure incident. Orientation: south. Date: 8/22/2017. Time: 1122.

Photo 39 – Debris west of Mill Building that caused recent NPS employee exposure incident. Orientation: south. Date: 8/22/2017. Time: 1345.

Photo 40 – South side of Mill Building. The debris and collapse potential are physical hazards. Orientation: northwest. Date: 8/22/2017. Time: 1345.

Photo 41 – Start of guided tours in the Mill Building. The room has had historically high lead concentrations. Orientation: southwest. Date: 8/22/2017. Time: 1350.

Photo 42 – Collapsing deck of the Mill building, which represents a physical hazard. Orientation: south. Date: 8/22/2017. Time: 1352.

Photo 43 – Collapsing deck of the Mill Building, representing a physical hazard. Orientation: south. Date: 8/22/2017. Time: 1354.

Photo 44 – Debris by the Mill Building. Blasting caps, representing an explosive hazard, have been found in the debris.
Orientation: west. Date: 8/22/2017. Time: 1429.

Photo 45 – North side of Mill Building. Note the original lead-based paint. Orientation: south.
Date: 8/22/2017. Time: 1433.

Photo 46 – Debris field west of the Mill Building which contains blasting caps.
Orientation: northeast. Date: 8/22/2017. Time: 1447.

Photo 57 – Gray paint that contains arsenic on the floor of the West Bunkhouse. Orientation: north. Date: 8/22/2017. Time: 1149.

Photo 58 – Peeling white paint on ceiling and grey arsenic-containing paint on floor of the West Bunkhouse. Orientation: southwest. Date: 8/22/2017. Time: 1149.

Photo 59 – Basement of the West Bunkhouse. A historic fire caused the white paint to "boil." Orientation: NA. Date: 8/22/2017. Time: 1200.

Photo 60 – Dump site west of the Maintenance Building. Orientation: west. Date: 8/22/2017. Time: 0906.

Appendix C – Summary Data from Previous Reports

Appendix C-1 – Data from Kay, Simon and Robert E. Miller. 1990. Kennicott – A Hazardous Waste Audit.

TABLE 2. ASBESTOS ANALYSES

Sample #	Location	Amounts in % volume Type of asbestos:							
		Chrysotile	Amosite	Anthophyllite	Tremolite-Actinolite	Crocidolite	Other Asbestos	Other fibrous material	Other non-fibrous material
1987 survey:									
1	Powerhouse; boiler insulation	40 to 60	nd	nd	nd	nd		nd	plaster
2	Powerhouse; pipe insulation	20 to 30	nd	nd	nd	nd		nd	plaster
3	Behind powerhouse; pipe insulation	20 to 30	nd	nd	nd	nd		5 to 10% mineral wool	plaster
4	Recreation Hall; projector booth	80 to 90	nd	nd	nd	nd		nd	plaster
5	Bunkhouse (bldg #5 or 7?); basement water tank?	30 to 40	nd	nd	nd	nd		nd	plaster
6	Assay Office	5 to 10	30 to 50	nd	nd	nd		30 to 40% cellulose	nd
This survey:									
14	Mill; utilidor insulation	50	nd				5		45
15	Firehouse; utilidor insulation	45	nd				nd		55
28	Store; pipe insulation	45	nd				nd	3% cellulose	52
30	Powerhouse; firebrick	nd	nd				nd	2% glass	98
30	Powerhouse; mortar from firebrick	nd	nd				nd	nd	100
51	Hospital; fiberboard on walls	nd	nd				nd	99% cellulose	1

Notes: nd=not detected. The two surveys are not exactly comparable - the present survey analyses group anthophyllite, tremolite and other forms of asbestos under "other asbestos".

All samples contain asbestos except sample #51

TABLE 3. ASBESTOS VOLUMES AND WEIGHTS				
Location	Form	Sample #	Volume-cu.ft	Weight-lb
Mill town utilidors	Pipe insulation	14*, 15*, 1990	252	3402
General Manager's	Pipe insulation		3	41
House, bldg#1				
Mill, bldg#3	Pipe insulation		13	176
Bunkhouse, bldg#5	Tank insulation	5*, 1987 survey?	1	14
	Pipe insulation		1	14
Bunkhouse, bldg#7	Tank insulation		2	27
	Pipe insulation		17	230
Assay Office, bldg#8	Fireproofing	6*, 1987 survey	2	27
Powerhouse, bldg#9	Pipe insulation	2*,1987; 29, 1990	306	4131
	Boiler insulation	1*, 1987 survey	681	9194
Hospital, bldg#14	Pipe insulation		1	14
Leaching Plant, bldg	Pipe insulation		15	203
# 15	Evaporator insulation		720	9720
Recreation Hall, bldg	Wall fireproofing	4*, 1987 survey	2	27
#18				
Store, bldg#19	Pipe insulation	28*, 1990 survey	27	365
West Bunkhouse,	Pipe & Tank insulation		28	378
bldg #20				
Cottage, bldg#29c	Stove insulation		Minimal volume: 0.07	1
M/c Shop, bldg#36	Pipe insulation		29	392
Oil House, bldg#38;	Spare pipe insulation	3*, 1987 survey	41	554
Spare insulation store	Asbestos bricks		24	324
	Asbestos/plaster sacks		8	108
Bonanza Mine, tram	Cupboard lining		estimated 1	14
terminus				
TOTALS:			2128	28728
* Asterisk indicates that a sample was analyzed				
Note: measurement rounded to nearest 1.0 cu.ft. or 1.0 lb.				
Density 13.5 lb/cu.ft used to determine asbestos weight.				

TABLE 4. OIL AND GREASE ANALYSES - OIL BURNING SPECIFICATIONS									
			Concentrations - ppm:						
Location	Sample number	Type of oil or grease	As	Cd	Cr	Pb	Total halogens	PCBs	Flash point, deg. F
Power House	31	Fuel oil/water mix	1.4	<0.5	<1.0	9.9	119	<1.0	>160
Fuel tank	32	Fuel oil	<0.5	<0.5	1.2	9.7	<100	<1.0	>160
Mill	33	Grease/water mix	2.1	<0.5	<1.0	2.1	<100	<1.0	>160
Fuel tank	35	Fuel oil	0.8	<0.5	<1.0	9.7	<100	<1.0	>160
Mill	36	Transformer oil	<0.5	<0.5	<1.0	<1.0	<100	<1.0	>160
Mill	37	Black grease	11.7	<0.5	<1.0	4.5	<100	<1.0	>160
Mill	38	Yellow grease	2.4	<0.5	<1.0	8.6	<100	<1.0	>160
Mill, James table	40	Sump oil	<0.5	<0.5	<1.0	<1.0	<100	<1.0	>160
Leaching Plant	42	Switchgear oil	<0.5	<0.5	<1.0	<1.0	<100	<1.0	>160
Transformer House	48	Transformer oil	<0.5	<0.5	<1.0	<1.0	<100	<1.0	>160
Junction Station	50	Transformer oil	<0.5	<0.5	<1.0	<1.0	<100	<1.0	>160
RCRA used oil for fuel limits:			<5	<2	<10	<100	<1000	<50	>100

TABLE 5. OIL AND GREASE VOLUMES				
Location	Type of container	Type of oil or grease	Sample #	Volume gallons
Tramway terminus, bldg #2	50 gallon drum	Yellow grease & water	33*	21
Mill, bldg #3	Transformer	Transformer oil	36*	6
	Coffee cans, etc	Yellow or black grease	37*, 38*	estimated 50
	Plat-O table oil sumps	Light lube oil		21
	James table oil sumps	Light lube oil	40*	4
Powerhouse, bldg #9	Oil in floor troughs	Fuel oil and water mix	31*	793
	Oil tanks in SE corner	Fuel oil?		724
	Oil tank in rafters	Fuel oil?		133
Leaching Plant, bldg#15	Switchgear	Insulating oil	42*	14
	Leaching tanks	Fuel oil residues?		~3508
	2x50 gallon drums	Yellow grease		100
	25 lb tins	'Arctic Cup' grease		estimated 45
Store, bldg#19	2 recent oil drums	Diesel?-not opened		110?
	4 small cans- labelled	Inflammable mix of vaseline,		1
	battery vaseline	rosin & benzine (gasolene)		
West Bunkhouse, bldg #20	55 gallon drum	Chevron #1 heating oil,recent		estimated 5
Machine Shop, bldg#36	Small cans	Black grease		estimated 5
Transformer House, bldg#37	Transformers	Transformer oil	48*	160
Oil tank next bldg #38	Large oil tank	Fuel oil	35*	235
Tank #4 next to bldg #49	Large oil tank	Fuel oil	32*	26655
Junction Station	50 gallon drum	Grease		estimated 10
	Switchgear	Insulating oil		2
	Transformers	Transformer oil	50*	97
Bonanza Mine, tram terminus	Drum and cans	Black grease		estimated 135
Total				**32834**
* Asterisk indicates that a sample was analyzed				

TABLE 6. ORE CONCENTRATE ANALYSES

Sample #	Location	Inferred bulk composition	Metals, % by weight: Al	As	Ba	Ca	Co	Cu	Fe	Mg	Mn	Ni	P	Si	Zn
4	Leach plant	magnetite	nd	nd	0.13	0.34	nd	nd	74.2	nd	0.54	0.16	0.18	0.25	nd
6	Tailings	copper carbonate and limestone concretion	0.26	nd	nd	21.5	nd	23.4	5.9	4.7	nd	nd	nd	0.11	0.14
7	Flotation plant outfall pipe	limestone with minor copper carbonate	0.69	0.95	nd	33.1	nd	8.7	2.5	4.2	nd	nd	nd	0.25	nd
8	Mill bldg ore bins	copper sulphide	0.22	nd	nd	2.2	nd	48.9	1.4	0.2	nd	nd	nd	nd	0.22
10	Mill bldg high-grade ore bin	copper sulphide & limestone	0.2	0.4	nd	22.8	nd	25.2	1.8	4.7	nd	nd	nd	0.15	0.15

TABLE 7. ORE AND ORE CONCENTRATE VOLUMES AND WEIGHTS						
Building	Ore container type, location	Ore composition	Sample #	Volume, cu. ft	Density, lb/cu.ft	Weight, lb
Mill, bldg #3	Main ore bin, #5 on fig.7	Mixed ores and lime-stone	34	12872	86	1106992
	Dorr Thickener, #20 on fig.7	Mixed ores and lime-stone	39	13102	86	1126772
	Table concentrate/high grade ore circular tanks, #25 on fig.7	Chalcocite; Cu2S	41	125	66	8250
	Rectangular high-grade bin at north end of loading area, #25 on fig.7	Chalcocite; Cu2S	10*	est. 130	88	11440
Flotation Plant, bldg #15	Two rectangular bins in NE corner of building	Copper sulphide; CuS	46	213	94	20022
	Three Dorr Thickeners	Copper sulphide; CuS		est. 6190	94	581860
	Loading bay, 105 cardboard drums	Magnetite; Fe3O4	4*	263	191	50233
Store, bldg #19	Assay samples; paper bags	Copper carbonate or sulphide	13		53	est. 200
Totals				32895		2905769
*Asterisk indicates that a sample has been analyzed						

TABLE 8. PAINT ANALYSES					
Sample #	**Type**	**Location**	**Parameter tested**	**Result**	**Units**
2	White paint	Hospital	Lead	525	g/kg
9	Red paint	Leach Plant	Lead	8.2	g/kg
47	Red paint	Bldg #46	Lead	4.8	g/kg
	powder				
Federal limit of 2 mg Pb/sq. cm. of paint is approximately 20 g/kg.					

TABLE 9. EP TOXICITY FOR METALS

Sample #	Type	Location	Metals: concentration in mg/L:								pH	Flammability,		
			Ag	As	Ba	Cd	Cr	Hg	Pb	Se	corrosivity	deg. F	Reactivity	
1	Tailings	W of bldg #19	<0.05	0.14	0.2	0.18	<0.05	<0.0002	<0.05	<0.01				
53	Ash	W of bldg #9	<0.1	<0.01	<0.05	<0.1	<0.05	<0.002	<0.05	<0.010	7.1	>200	non-reactive	
39	Ore conc.	Bldg #3	<0.1	1.06	0.21	1.6	<0.05	0.004	<0.05	<0.010				
RCRA limits:			<5	<5	<100	<1	<5	<0.2	<5	<1	2 to 12.5	>140		

TABLE 10. MISCELLANEOUS SUBSTANCE VOLUMES AND WEIGHTS

Type	Composition	Location	Sample?	Volume-cu.ft.	Density-lb/cu.ft.	Weight-lb.	Amount-misc. units
Fiberboard interior	100% wood fiber	Bldg#19, Steward's		6.3			394 sq.ft.
wall covering		Office					
		Bldg#1		7.5			384 sq.ft.
		Bldg#5		19.2			974 sq.ft.
		Bldg#14	51*	127			7750 sq.ft.
Firebricks	Ceramic	Bldg#9	30*	5832	37.5	216700	
		Open store nr bldg#38	52	48	37.5	1800	
Plaster	Calcium sulphate	Bldg#19				estimated 4000	
White powder	Unknown	Bldg#19				estimated 170	
Carbide cans	CaC2/Ca(OH)2	Bldg#19	12	0.7	45	32	
Crates washing soda	Na2CO3.10H2O	Bldg#19	11	5.4	34	184	
Powder barrels	Unknown	Bldg#19		11			
Carbolic acid crystals	C6H5OH-Phenol	Bldg#19		0.6		estimated 65	
Gas mask canisters	CaO/Ca(OH)2	Bldg#19		0.04			
Sulphur powder	Sulphur	Bldg#19	3			estimated 50	
Grease sticks	Solid grease	Bldg#19				estimated 10	
Ammonia solution	(NH4)2CO3 aq.	Bldg#15	45				estimated 17220 gallons
White powder	Unknown	Bldg#36		3.4			
Boiler ash	Hydrocarbon residues	West of Bldg#9	53	1443	34	49062	
Assorted chemicals	Unknown	Bldg#8				estimated 10	
Assorted drugs	See text	Bldg#14				estimated 10	

* Asterisk by sample number indicates that an analysis exists

Appendix C-2 – Data from America North/EMCON, Inc. 1992. Kennicott Mine Site Investigation Final Report, Volumes 1 and 2.

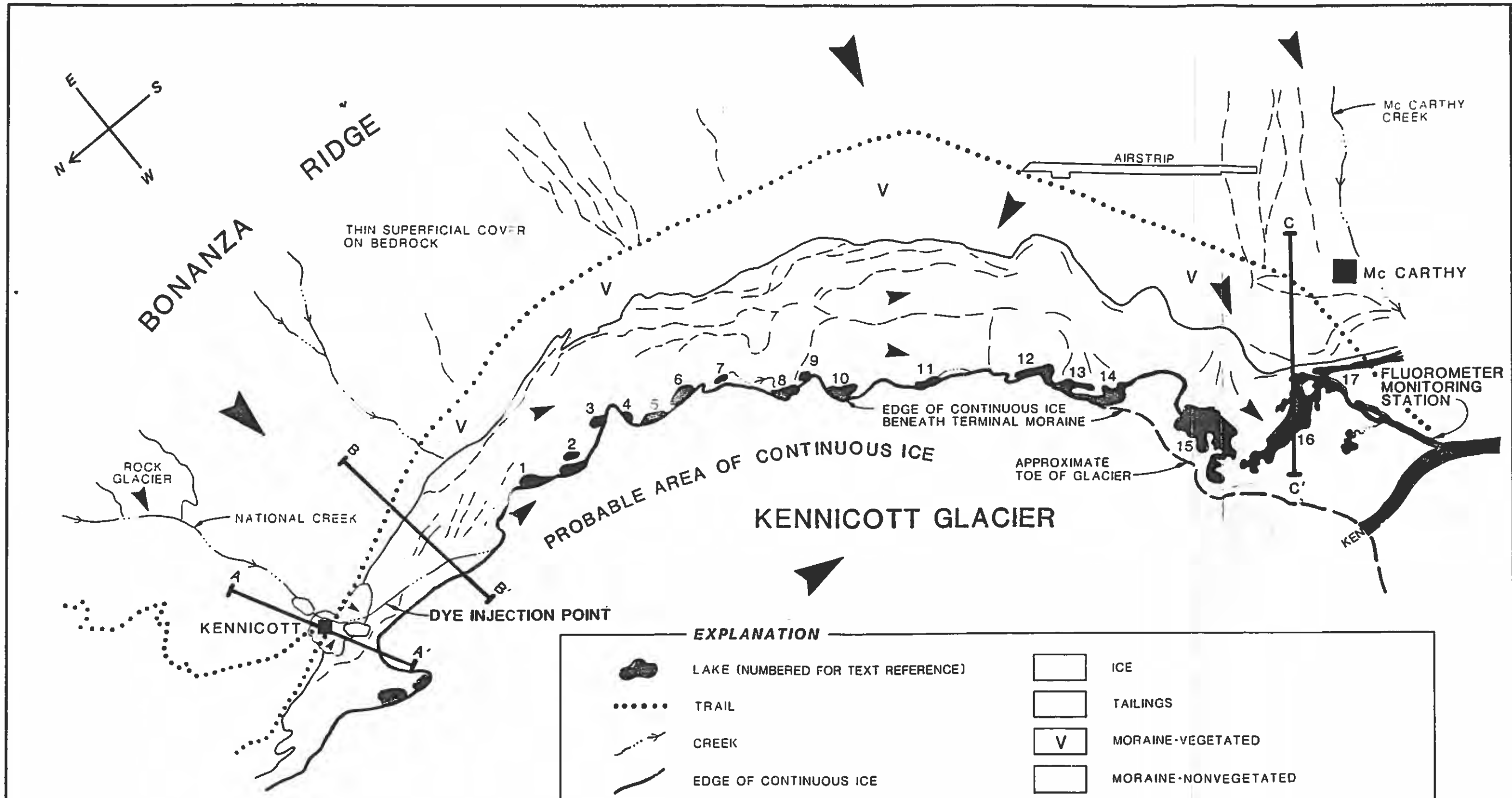
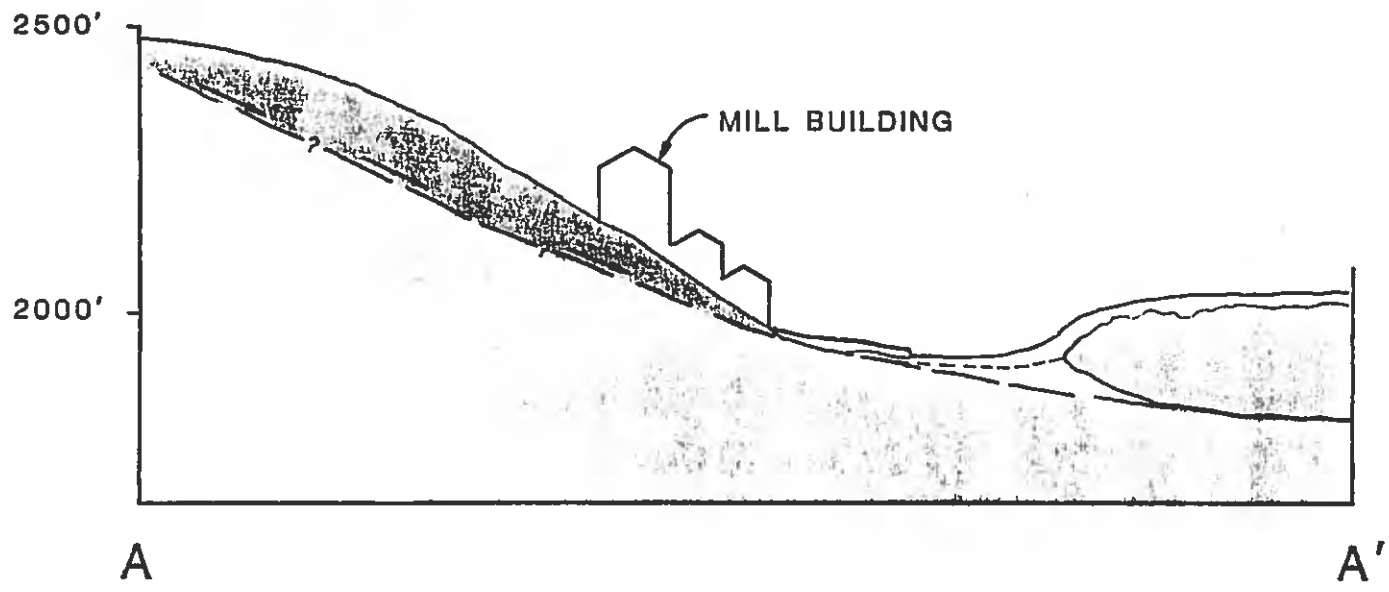


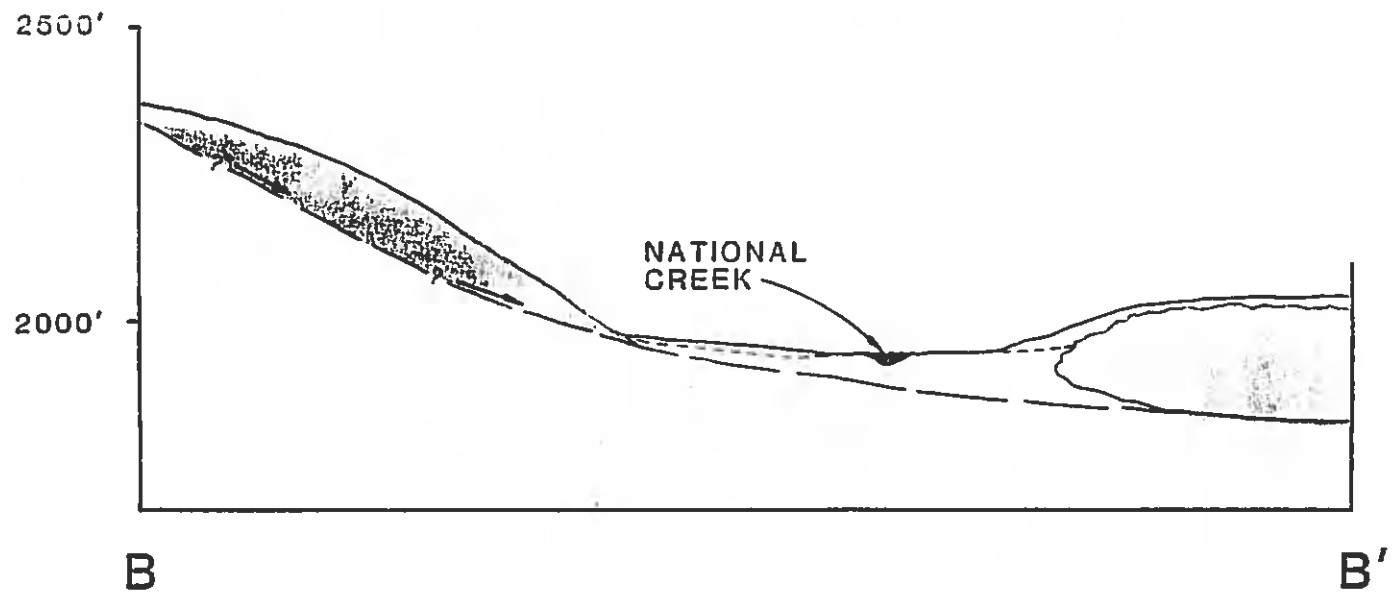
FIGURE 6A

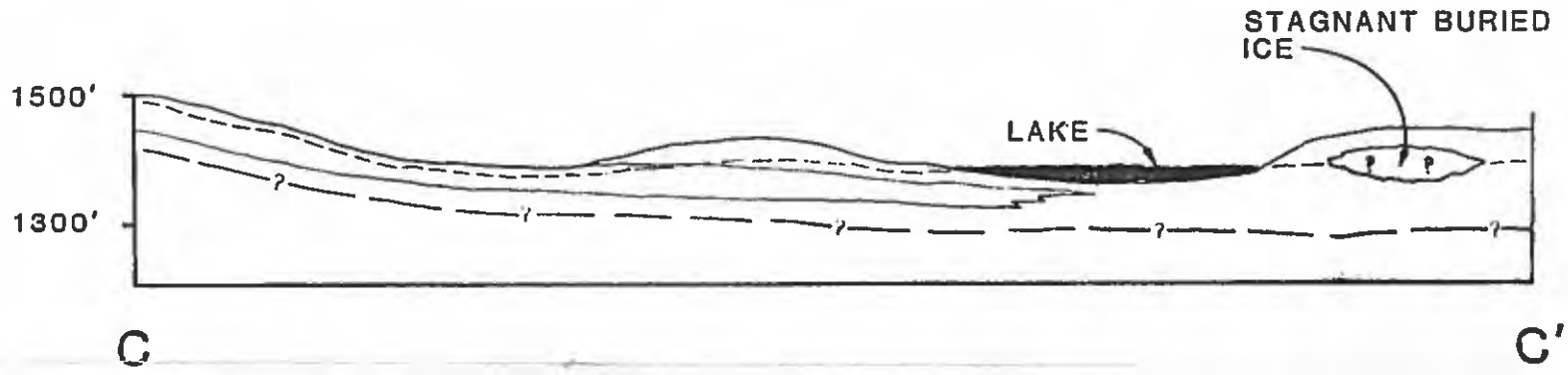
INTERPRETIVE MAP OF GROUND AND SURFACE WATER DRAINAGE, KENNICOTT / Mc CARTHY AREA

DATE DEC. 1991
DWN CDS91057
CKD S.K.
REV JULY 1992
PROJECT No. 11004.01

America North/ EMCON, Inc.







0 525' 1050'

SECTION HORIZONTAL SCALE

0 300' 600'

SECTION VERTICAL SCALE

SEE FIGURE 6A FOR KEY

America North/ EMCON, Inc.	DATE DEC. 1991 DWN. CDS CKD. S.K. REV. PROJECT No. 11004.01	SECTIONS TO ACCOMPANY FIGURE 6A	FIGURE 6B

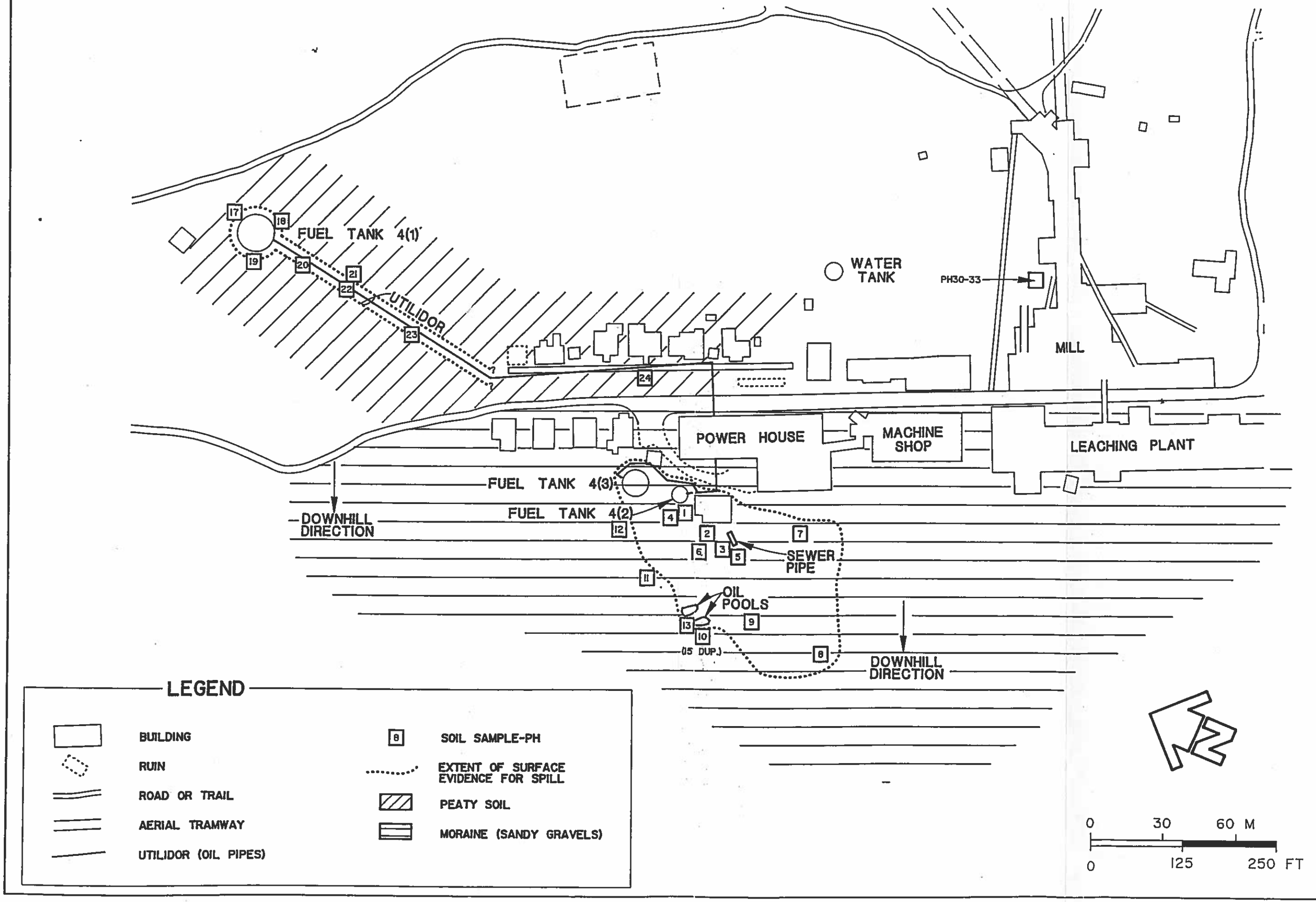


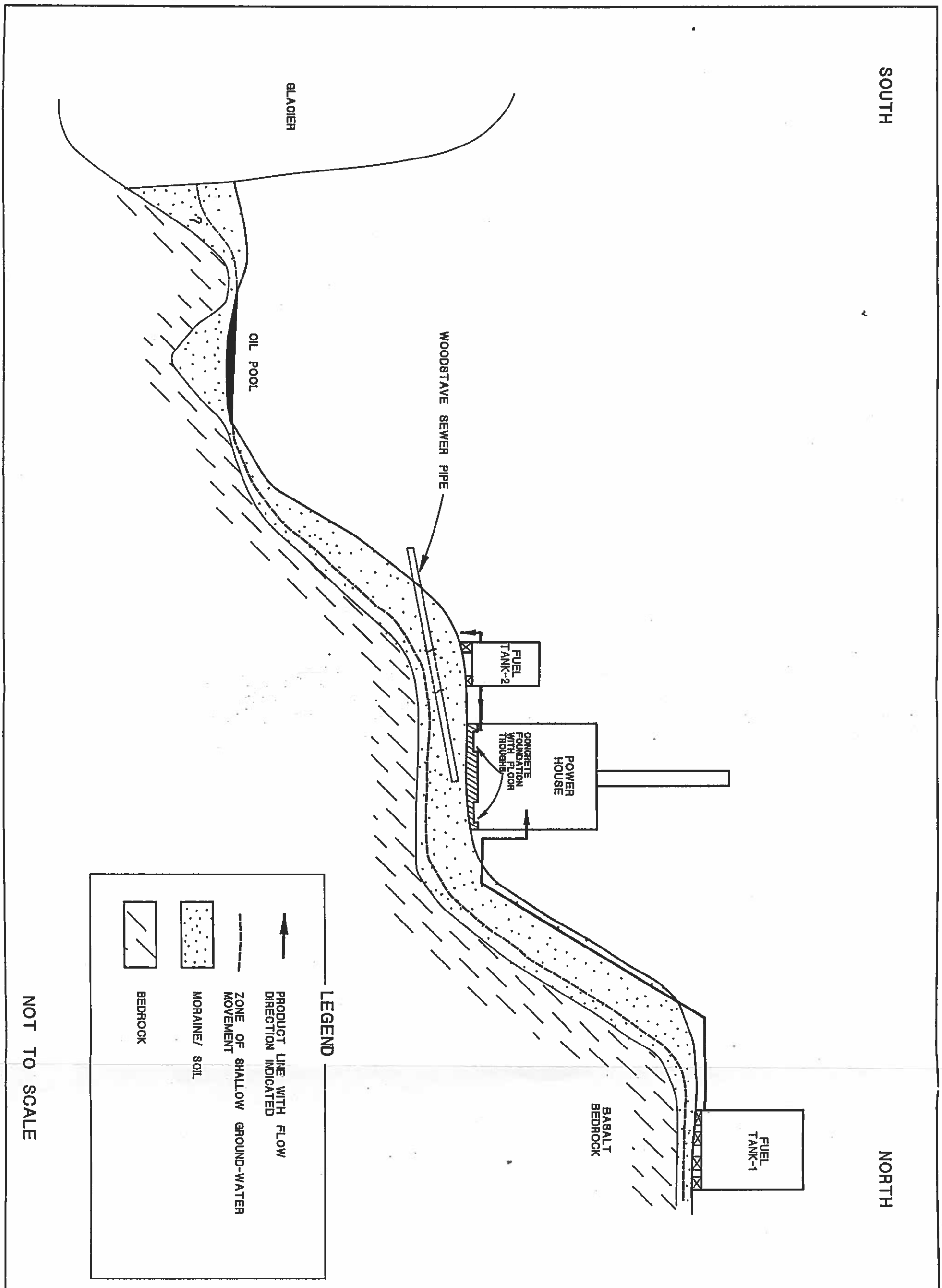
FIGURE 13

KENNECOTT CORPORATION
Kennicott, Alaska

EXTENT OF SURFACE OIL STAINING AND SAMPLE LOCATIONS

DATE AUG. 1991
DWN. CDS91057F8
CKD. S.K.
REV. JULY 1991
PROJECT No. 11004.01

America North/
EMCON, Inc.



America North/ EMCON, Inc.

DATE AUG. 1991
DWN. CDS-91057
CKD. S.K.
REV. JULY 1992
PROJECT No. 11004.01

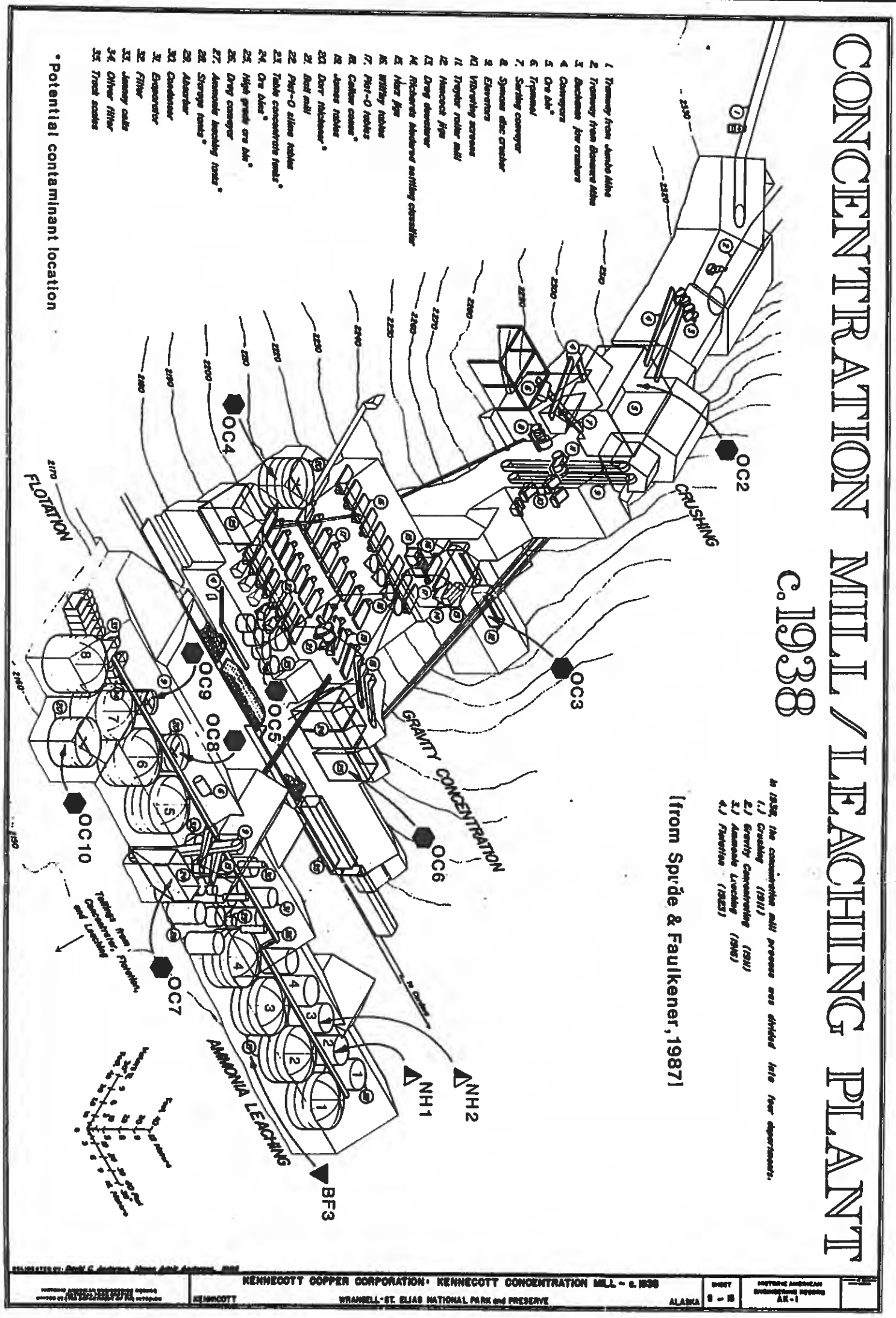
KENNECOTT CORPORATION
Kennicott, Alaska

SCHEMATIC CROSS-SECTION OF SITE HYDROLOGY AND OIL MIGRATION PATHWAYS

FIGURE
14

CONCENTRATION MILL / LEACHING PLANT
c. 1938

In 1938, the concentrator mill process was divided into four departments.
1.) Crushing (1911)
2.) Gravity Concentrating (1911)
3.) Ammonia Leaching (1916)
4.) Flotation (1923)



**Potential contaminant location*

[from Spude & Faulkener, 1987]

LEGEND

- OC — ORE CONCENTRATE
- NH — AMMONIA SOLUTION
- BF — FUEL OIL

KENNECOTT COPPER CORPORATION · KENNECOTT CONCENTRATION MILL ~ c. 1938
KENNICOTT — WRANGELL-ST. ELIAS NATIONAL PARK and PRESERVE — ALASKA

America North/ EMCON, Inc.

DATE OCT. 1991
DWN. CDS-91057
CKD. S.K.
REV. JULY 1992
PROJECT No. 11004.01

KENNECOTT CORPORATION
Kennicott, Alaska

CONCENTRATION MILL / LEACHING PLANT SAMPLE LOCATIONS

FIGURE 15

TABLE 1. LIST OF SAMPLES TAKEN, ANALYSES PERFORMED AND SAMPLE DESCRIPTIONS (continued)

Sample	Date Sampled	Sample Type	Analysis	Sampling Description
PH30	6/19/92	Soil	TPH, EPH	For location see Figure 7 and plate (referenced in text). Soil type: Olive (5Y 4/3) sandy gravel (GM). Gravel 35-45%, angular, max. 1cm; Sand 55-65%, very coarse to fine. Visible oil-staining and petroleum odor.
PH31	6/19/92	Soil	TPH, EPH	For location see Figure 7 and plate (referenced in text). Soil type: sandy gravel, as above. Visible oil-staining and petroleum odor.
PH32	6/19/92	Soil	TPH	For location see Figure 7 and plate (referenced in text). Soil type: sandy gravel, as above. Visible oil-staining and petroleum odor.
PH33	6/19/92	Soil	TPH	For location see Figure 7 and plate (referenced in text). Soil type: olive green sandy gravel (GP). Gravel 30-40%, angular, max. 1cm.; Sand 60-70%, very coarse to medium. Visible oil-staining but no odor.
TPS1	7/20/91	Tailings	Total metals; sulfide; synthetic precipitation leaching procedure (1312)	For location see map; Enclosure 3. Tailings type: Sandy, silty gravel (GM); Gravel 60%, angular, limestone composition, fine, with <2% azurite and malachite in gravel fraction; Sand 40%, very fine grained, grading to silt, moderately well graded; color 5Y 5/2 olive gray. In-place tailings are hard, compacted, with a silty sand matrix. Sampling technique: by hand auger, sample homogenized in a stainless steel bowl. Sampling depth 2"-10".

TABLE 1. LIST OF SAMPLES TAKEN, ANALYSES PERFORMED AND SAMPLE DESCRIPTIONS (continued)

Sample	Date Sampled	Sample Type	Analysis	Sampling Description
TPS2	7/20/91	Tailings	Total metals; sulfide; 1312	For location see map; Enclosure 3. Tailings type: Silty sand with gravel (SM); Gravel 50%, composition as above (a/a); Sand 50%, silty and very fine grained, non plastic; well graded; color 5Y 5/2 olive gray. In-place characteristics a/a. Sampling technique a/a. Sample depth 2"-12".
TPS3	7/20/91	Tailings	Total metals; sulfide; 1312	For location see map; Enclosure 3. Tailings type: Silty gravel (GM); Gravel 60-70%, angular, composition a/a; Sand 30-40%, very fine grained, grading to silt, non-plastic; well graded; color 5Y 6/2 light olive gray. In-place tailings are loose, easy auger penetration. Sampling technique: a/a. Sample depth 2"-14".
TPS4	7/20/91	Tailings	Total metals; sulfide; 1312	For location see map; Enclosure 3. Tailings type: Silty/sandy gravel (GM); Gravel 50%, a/a; very fine grained sand grading to silt 50%; well graded; color 5Y 5/2 olive gray. Tailings are loose, unconsolidated, moist. Sampling technique: a/a. Sample depth 2"-10".
TPS5	7/20/91	Tailings	Total metals; sulfide; 1312	For location see map; Enclosure 3. Tailings type: Silty/sandy gravel (GM) a/a. Color 5Y 4/2 olive gray. Sampling technique: a/a. Sample depth 2"-10".

TABLE 1. LIST OF SAMPLES TAKEN, ANALYSES PERFORMED AND SAMPLE DESCRIPTIONS (continued)

Sample	Date Sampled	Sample Type	Analysis	Sampling Description
TPS6	7/20/91	Tailings	Total metals; sulfide; 1312	For location see map; Enclosure 3. Tailings type: Silty sand with gravel (SM); 70-80% very fine grained sand and silt; 20-30% fine gravel, angular limestone clasts with ~5% azurite and malachite; moderate to poor grading; color 2.5Y 6/2 light brownish gray; very moist; sample taken below tailings cribbing - finer grain size may be due to coarser material being held back by cribbing. Hard-packed surface, difficult to auger. Sampling technique: a/a. Sample depth 2"-8".
TPS7	7/20/91	Tailings	Total metals; sulfide; 1312	For location see map; Enclosure 3. Tailings type: poorly graded silty sand (SM); very fine grained sand, grading to silt, 50-60%; gravel 40-50%, fine, angular with <1% azurite and malachite; color 2.5Y 5/4 light olive brown. Sampled from above cribbing, hard packed sand. Sampling technique: a/a. Sample depth 2"-10".
TPS8	7/20/91	Tailings	Total metals; sulfide; 1312	For location see map; Enclosure 3. Tailings type: Sandy/silty gravel (GW); gravel 70%, fine, angular, limestone composition with 2-5% azurite and malachite; silty very fine grained sand 30%; color 5Y 4/2 olive gray; well graded and loose gravel. Sampling technique: a/a. Sample depth 2"-16".
TPS9	7/21/91	Tailings	Total metals; sulfide; 1312	For location see map; Enclosure 3. Tailings type: gravelly silt (ML); 60-70% silt, slightly plastic; 30-40% fine angular gravel with <1% azurite and malachite; moist; color 5Y 6/3 pale olive; moderately well graded. Sampling technique: a/a. Sample depth 2"-12".

TABLE 1. LIST OF SAMPLES TAKEN, ANALYSES PERFORMED AND SAMPLE DESCRIPTIONS (continued)

Sample	Date Sampled	Sample Type	Analysis	Sampling Description
TPS10	7/21/91	Tailings	Total metals; sulfide; 1312	For location see map; Enclosure 3. Tailings type: Sandy, silty gravel (GW); fine, angular limestone gravel 60% with ~2% azurite and malachite; very fine sand and silt 40%; moist; moderately well graded; color 5Y 5/2 olive gray; loose to firm surface. Sampling technique a/a. Sample depth 2"-18".
TPS11	7/21/91	Tailings	Total metals; sulfide; 1312	For location see map; Enclosure 3. Tailings type: Gravelly sand (SW); fine grained sand 40-60%; gravel 30-40%, fine, angular, <1% copper minerals; silt 10-20%, low plasticity; color 2.5Y 5/4 light olive brown; slightly moist; well graded. Material is road fill by railway bridge. Sampling technique: a/a. Sample depth 4"-12".
TPS12	7/21/91	Tailings	Total metals; sulfide; 1312	For location see map; Enclosure 3. Tailings type: Clayey, gravelly silt (ML): Silt 60-70%, clayey, moderately plastic, moist; gravel 30-40%, coarse, angular, limestone composition with ~5% azurite and malachite; color 5Y 5/3 olive. Hard packed. Foundation material for Leaching Plant. Sampling technique: a/a. Sample depth 2"-6".
TPS13	7/21/91	Tailings	Total metals; sulfide; 1312	For location see map; Enclosure 3. Tailings type: Sandy gravel (GW); gravel 60-70%, fine with ~5% azurite and malachite; sand 30-40%, coarse; color 5Y 5/1 gray. Sampling technique: hand trowel. Sample depth 0-8".

TABLE 1. LIST OF SAMPLES TAKEN, ANALYSES PERFORMED AND SAMPLE DESCRIPTIONS (continued)

Sample	Date Sampled	Sample Type	Analysis	Sampling Description
TPS14	7/21/91	Tailings	Total metals; sulfide; 1312	For location see map; Enclosure 3. Tailings type: Gravelly sandy silt (ML); silt 85%, slightly plastic; gravel 15%, fine, angular, limestone composition; color 5Y 5/3 olive; poorly graded; compacted. Sampling technique: hand auger. Sample depth 2"-8".
TPS15	7/21/91	Tailings	Total metals; sulfide; 1312	For location see map; Enclosure 3. Tailings type: Silty sand with gravel (SM); sand 60-70%, fine to medium grained; silt 25-30%, low plasticity; gravel 10-15% with 5-8% copper minerals, fine, angular; color 5Y 5/4 olive; well compacted. Sampling technique: a/a. Sample depth 2"-8".
TPS16	7/21/91	Tailings	Total metals; sulfide; 1312	For location see map; Enclosure 3. Tailings type: Sandy gravel (GW); gravel 70%, fine, angular limestone clasts with ~1% azurite and malachite; silty sand 30%; moderate to well graded. Loose. Sampling technique: a/a. Sample depth 2"-7".
TPS17	7/21/91	Tailings	Total metals; sulfide; 1312	For location see map; Enclosure 3. Tailings type: Sandy gravel with silt (GW); gravel 50-60% with 8-10% azurite and malachite, fine; sand 30-40% fine; silt 10%, low plasticity; color 5Y 3/2 dark olive gray. Very hard surface. Sampling technique: a/a. Sample depth 2"-6".

TABLE 1. LIST OF SAMPLES TAKEN, ANALYSES PERFORMED AND SAMPLE DESCRIPTIONS (continued)

Sample	Date Sampled	Sample Type	Analysis	Sampling Description
TPS18	7/21/91	Tailings	Total metals; sulfide; 1312	For location see map; Enclosure 3. Tailings type: gravel with very fine sand and silt (GW); gravel 50%, coarse, angular, with about 5% azurite and malachite and occasional cobbles; silt and fine sand 50%; occasional wood fragments; color 2.5Y 4/2 dark grayish brown. Substrate is talus, rock waste from surface mining. Sampling technique: hand auger and hand scoop. Sample depth 2"-6".
TPS19	7/21/91	Tailings	Total metals; sulfide; 1312	For location see map; Enclosure 3. Tailings type: gravelly silt (ML); silt 80%, non plastic; gravel 20%, fine, occ. coarse, angular, occ. cobbles, with 5-10% azurite and malachite; occ. roots;color 5Y 5/3 olive; foundation for gravity concentrator, possibly a natural soil with allochthonous ore bin debris, hard substrate. Sampling technique: hand auger. Sample depth 2-6".
TPS20	7/21/91	Tailings	Total metals; sulfide; 1312	For location see map; Enclosure 3. Tailings type: gravelly, sandy silt (ML); slight plasticity; silt 85%; gravel 10%, fine with ~5% azurite and malachite; sand 5%; poorly graded; wood fragments; color 5Y 5/4 olive; foundation for gravity concentrator, may be natural soil, hard substrate. Sampling technique: a/a. Sample depth 2"-6".
TPS21	7/21/91	Tailings	Total metals; sulfide; 1312	For location see map; Enclosure 3. Tailings type: sandy silt with gravel (ML): silt 75-80%, low plasticity, slightly moist; gravel 10-20%, fine, subangular with ~5% azurite and malachite; sand 5-10%, very fine grained, angular; color 10YR 3/4 dark yellowish brown. Sampling technique: a/a. Sampling depth 2-8".

TABLE 1. LIST OF SAMPLES TAKEN, ANALYSES PERFORMED AND SAMPLE DESCRIPTIONS (continued)

Sample	Date Sampled	Sample Type	Analysis	Sampling Description
TPS22	7/21/91	Tailings	Total metals; sulfide; 1312	For location see map; Enclosure 3. Tailings type: angular limestone talus; cobbles 80%, 2-4 cm long axis, with 5-10% azurite and malachite; silt with roots 20%; color 2.5Y 4/4 olive brown. Location is a rock pile behind the Transformer House, rocks may be a natural scree slope, or at least not processed beyond a coarse crusher. Sampling technique: hand auger. Sample depth 2"-10".
TPS23	7/21/91	Tailings	Total metals; sulfide; 1312	For location see map; Enclosure 3. Tailings type: sandy gravel (GP); gravel 60-70%, very fine with 2-4% azurite and malachite, angular; poorly graded; sand 30-40%, medium to coarse, angular; color 5Y 5/2 olive gray. Loose substrate. Sampling technique: hand trowel.
TPS24	7/21/91	Tailings	Total metals; sulfide; 1312	Duplicate of TPS 10.
TPS25	7/21/91	Tailings	Total metals; sulfide; 1312	Duplicate of TPS20
TPS26	5/21/92	Tailings	Total metals	For location see map; Enclosure 3. Sample obtained west of Leaching Plant in a gully carrying water discharge from the plant. Tailings were stained green. Tailings type: well graded sandy gravel (GP); gravel 40-50%, angular max. 1 cm; sand 40-50%, coarse to fine, moist; very few fines; <1% azurite or malachite; dark olive gray (5Y 3/2). Sampling technique: hand auger. Sample depth 2"-10".

TABLE 1. LIST OF SAMPLES TAKEN, ANALYSES PERFORMED AND SAMPLE DESCRIPTIONS (continued)

Sample	Date Sampled	Sample Type	Analysis	Sampling Description
TPS27	5/21/92	Tailings	Total metals	For location see map; Enclosure 3. Sample obtained west of the Leaching Plant from the base of a well-stratified tailings sequence adjacent to National Creek. Tailings type: poor to medium graded gravelly sand (SP); gravel 15-20%, angular, max. 1 cm.; sand 80-85%, v. coarse to medium, dry to slightly moist; very few fines; 1% malachite; gray (5Y 5/1). Sampling technique as above.
TPS28	5/21/92	Tailings	Total metals	For location see map; Enclosure 3. Sample obtained beneath flume on south side of National Creek. Tailings type: well graded sandy gravel (GP); gravel 70-80%, angular, max. 5mm; sand 20-30%, v.coarse to medium, moist; very few fines; <1% azurite or malachite; olive gray (5Y 5/2). Sampling technique as above.
TPS29	5/21/92	Tailings	Total metals	For location see map; Enclosure 3. Tailings type: moderately graded sandy gravel (GP); gravel 85-95%, angular, max. 1 cm.; sand 5-15%, v.coarse to coarse, moist; very few fines; <1% azurite or malachite; olive gray (5Y 5/2).
TPS30	5/21/92	Tailings	Total metals	Duplicate sample of TPS29.

TABLE 2. ANALYTICAL RESULTS FOR AIRBORNE ASBESTOS SAMPLING

Sample Number	Location	Analytical Method	Result - Fibers/cc
ASB-01	Power Plant	NIOSH 7400	<0.01
ASB-02	R. Sweet, personal monitor	NIOSH 7400	<0.01
ASB-03	W. Willson, personal monitor	NIOSH 7400	0.02
ASB-04	Leaching Plant	NIOSH 7400	<0.01

TABLE 3. SUMMARY OF ANALYTICAL RESULTS FOR ASBESTOS SAMPLING

Sample Number (KEN prefix)	Material	Location	Asbestos Content
1	Ore chute insulation	Building 3	None
2	Electrical insulation	Building 3	None
3	Vapor barrier	Building 3	None
4	Roofing	Building 3	None
5	Electrical insulation	Building 3	None
6	Drive belt	Building 3	None
7	Shaker table covering	Building 3	None
8	Sorbent pads	Building 3	None
9	TSI debris	Building 2/3	35% Chrysotile
10	Wall covering	Building 3	None
11	Ceiling board	Building 2/3	70% Chrysotile
12	Wall board scrap	Building 9	None
13	Roofing	Building 9	None
14	Flexible hose	Outside Building 9	None
15	Floor debris	Building 13e	<1% Chrysotile
16	Wall board	Building 13e	None
17	Roofing	Building 13e	None
18	Sample blank		None
19	Vapor barrier	Building 15	None
20	Roofing	Building 15	None
21	Vapor barrier	Building 15	None
22	Roofing	Building 36	None
23	Canvas pump packing	Building 19	None
24	Woven gaskets	Building 19	70% Chrysotile
25	Wall board	Building 19	None
26	Westinghouse metal paper	Building 19	None
27	Electrical insulation	Building 19	None
28	Fuse box liner	Building 19	75% Chrysotile
29	Floor tile	Building 20	None
30	Wall covering	Building 20	None
31	Vapor barrier	Building 23	None
32	Fibrous dust	Building 23	None
33	Vapor barrier	Building 5	None
34	Wall board	Building 5	None
35	Electrical insulation	Building 5	None
36	Roofing	Building 5	None
37	Roofing	Building 14	None
38	Electrical insulation	Building 14	None
39	Vapor barrier	Building 39c	15% Chrysotile
40	Vapor barrier	Building 32c	None
41	Roofing	Building 32c	None
42	Floor covering	Building 30b	None
43	Stove heat shield	Building 30b	85% Chrysotile
44	Roofing	Building 1	None
45	Flooring	Building 13b	None

TABLE 3. SUMMARY OF ANALYTICAL RESULTS FOR ASBESTOS SAMPLING (continued)

Sample Number (KEN prefix)	Material	Location	Asbestos Content
46	Stove heat shield	Building 26	95% Chrysotile
47	Floor covering	Building 26	None
48	Floor covering	Building 26	None
49	Wall board	Building 26	None
50	Vapor barrier	Building 26	None
51	Tar paper	Building 26	None
52	Projection screen	Building 18	None
53	Wall board	Building 18	97% Chrysotile
54	Vapor barrier	Building 18	None
55	Chimney gasket	Building 18	97% Chrysotile
56	Vapor barrier	Building 3	None
57	Gunny sacks	Mill town	None
58	Roofing	Building 15	None
59	Plaster	Building 19	None
60	Rubber gaskets	Building 19	None
61	Stove wicks	Building 19	None
62	Vapor barrier	Building 15	None
63	Pipe insulation	Building 9	None
64	Extractor hood board	Building 8	95% Chrysotile
65	Wall covering	Building 8	90% Chrysotile
66	Sample blank		None
67	Roofing	Building 29a	None
68	Vapor barrier	Building 29a	None
69	Vapor barrier	Building 19	None
70	Electrical insulation	Building 19	None
ASB2-61692	Roofing	Building 2/3	10% Chrysotile

TABLE 4. LIST OF WATER SAMPLES TAKEN, ANALYSES PERFORMED AND SAMPLING DESCRIPTIONS

Sample	Date Sampled	Time Sampled	Analysis	Sampling Description
SP1	7/23/91	20:40	Primary and Secondary Water Quality Standards (WQS), 65 Toxics	For location see Enclosure 3. Seep near Power House. Water seeping from the hill immediately downslope from the two fuel tanks near the Power House.
	5/20/92	16:15	WQS, Gross alpha, Total uranium ion, Total Petroleum Hydrocarbons (418.1), Extractable Petroleum Hydrocarbons (8100M), Aromatic Volatile Organics (8020)	Sample collected in 1992 approximately 10 yards downslope of 1991 location. Steady trickle of water from base of moraine. Water is clear but has a patchy visible sheen and hydrocarbon odor.
SP2	7/25/91	10:30	WQS	For location see Enclosure 1. Mother Lode mine seep. Water seeping from one of the mine portals.
SP3	7/27/91	14:15	WQS, 65 Toxics, Polynuclear Aromatic Hydrocarbons	For location see Enclosure 3. Water seeping from the tailings/bedrock contact immediately downslope from the Leaching Plant.
	9/23/91	11:00	WQS	
	5/20/92	12:15	WQS, Gross alpha, Total uranium ion	

TABLE 4. LIST OF WATER SAMPLES TAKEN, ANALYSIS PERFORMED AND SAMPLING DESCRIPTIONS (continued)

Sample	Date Sampled	Time Sampled	Analysis	Sampling Description
SP4	7/27/91	14:25	WQS, 65 Toxics, Polynuclear Aromatic Hydrocarbons	For location see Enclosure 3.
				Water seeping from beneath flume wreckage near the Leaching Plant.
	9/23/91	11:15	WQS	
	5/20/92	12:45	WQS, Gross alpha, Total uranium ion	
SP5	9/23/91	10:00	WQS	Water lying over oil in a pool downslope of the July 1991 sampling location for SP1.
SWB	7/24/91	11:55	WQS	For location see Figure 5.
	9/21/91	17:00	WQS	Bonanza Creek. Water sampled from a riffle area immediately upstream from the trail.
	5/22/92	09:20	WQS	
SWBK	7/23/91	16:00	WQS	Distilled water blank.
SWBK1	9/21/91	20:40	WQS	VWR Scientific deionized water.
SWBK2	9/21/91	20:40	WQS	VWR Scientific deionized water.
SWBK3	5/21/92	10:00	WQS, Gross alpha, Total uranium ion	Deionized water provided by Chemical & Geological Labs.
SWJ	7/24/91	11:30	WQS	For location see Figure 5.
	9/21/91	16:30	WQS	Jumbo Creek. Water sampled upstream from the trail in a pool at the base of a series of waterfalls.
	5/22/92	12:00	WQS	

TABLE 4. LIST OF WATER SAMPLES TAKEN, ANALYSIS PERFORMED AND SAMPLING DESCRIPTIONS (continued)

Sample	Date Sampled	Time Sampled	Analysis	Sampling Description
SWK1	7/24/91	10:15	WQS	For location see Figure 5. Kennicott Creek is defined as the intermittent drainage paralleling the Root and Kennicott Glaciers.
	9/21/91	16:00	WQS	Kennicott Creek below Amazon Creek. Amazon Creek was dry and the Root Glacier is adjacent to the ridge so that Kennicott Creek, if present, flows beneath the ice of the glacier or beneath the lateral moraine. Water seeping from the hillside adjacent to the glacier and slightly down gradient from Amazon Creek was sampled.
	5/22/92	11:15	WQS	Above location was dry. Sampled approx. 300 yards further south of previous location. Water is predominantly glacier meltwater.
				Same location as for 9/21/91.
SWK2	7/24/91	20:40	WQS, 65 Toxics	For location see Figure 5.
	9/22/91	18:45	WQS	Kennicott Creek below National Creek. Water taken from a riffle area downstream from a solid waste disposal area (drums and assorted debris). Surface flow at this point was from National Creek.
	5/20/92	17:45	WQS, Gross alpha, Total Uranium ion	
SWK3	7/24/91	18:00	WQS, 65 Toxics	For location see Figure 5.
	9/22/91	11:20	WQS	Clear Creek. A survey of the area between McCarthy and the moraine of Kennicott Glacier indicated that there was no surface flow in Kennicott Creek. Consequently, Clear Creek was sampled in a pool upstream from McCarthy near the museum.
	5/21/92	14:30	WQS	

TABLE 4. LIST OF WATER SAMPLES TAKEN, ANALYSIS PERFORMED AND SAMPLING DESCRIPTIONS (continued)

Sample	Date Sampled	Time Sampled	Analysis	Sampling Description
SWK4	7/25/91	11:25	WQS	For location see Figure 5.
	9/22/91	13:30	WQS	Kennicott River below McCarthy Creek. Kennicott River was sampled downstream of the confluence with McCarthy Creek.
	5/21/92	14:00	WQS	
SWK5	7/24/91	20:40	WQS	Duplicate of SWK2.
	9/22/91	15:30	WQS	Duplicate of SWN1.
SWM1	7/25/91	10:30	WQS	For location see Figure 5.
				McCarthy Creek downstream of Lubbe Creek. Water sampled in a riffle area equidistant from Lubbe Creek and Dimond Creek.
SWM2	7/25/91	11:00	WQS	For location see Figure 5.
				McCarthy Creek downstream of Dimond Creek. Water sampled from a riffle area downstream of the Green Butte mine.
SWM3	7/25/91	11:15	WQS	For location see Figure 5.
				McCarthy Creek southeast of mill town. Water sampled from a riffle area approx. 1/4 mile downstream of the last tributary entering McCarthy Creek from the east.
SWM4	7/24/91	16:10	WQS	For location see Figure 5.
	9/22/91	10:15	WQS	McCarthy Creek above McCarthy. Water sampled from a riffle area upstream from the foot bridge and directly across the creek from the stables.
	5/21/92	13:00	WQS	

TABLE 4. LIST OF WATER SAMPLES TAKEN, ANALYSIS PERFORMED AND SAMPLING DESCRIPTIONS (continued)

Sample	Date Sampled	Time Sampled	Analysis	Sampling Description
SWN1	7/24/91	14:40	WQS	For location see Figure 5.
	9/22/91	16:30	WQS	National Creek above Mill Town. Water sampled from a riffle area approx. 100 yards upstream from the remains of a dam.
	5/20/92	09:30	WQS, Gross alpha, Total uranium ion	
SWN2	7/24/91	21:10	WQS, 65 Toxics	For location see Figure 5.
	9/22/91	18:30	WQS	National Creek below Mill Town. Water sampled from a riffle area approx. 300 yards downstream of the bridge in the Mill Town at a point where the creek bends from flowing west to flowing south.
	5/19/92	18:00	WQS, Gross alpha, Total uranium ion	
SWN3	5/20/92	09:45	WQS, Gross alpha, Total uranium ion	Duplicate sample of SWN1
WP3	7/23/91	17:45	WQS, 65 Toxics	For location see Figure 5.
	9/23/91	08:45	WQS	Well point. The well point is located adjacent to Kennicott Creek near the old School House.
	5/20/92	17:00	WQS	

TABLE 5. WATER QUALITY - PRIMARY STANDARDS - JULY 1991 SAMPLING EVENT

Sample	Date Sampled	Location	Arsenic mg/L	Barium mg/L	Cadmium mg/L	Chromium mg/L	Fluoride mg/L	Lead mg/L	Mercury mg/L	Nitrate-N mg/L	Selenium mg/L	Silver mg/L	Turbidity NTU	Fecal Coliform col/100mL
SP1 - unfiltered	7/23/91	Seep west of Power Hse.	ND	0.031	0.0006	ND	0.2	0.011	ND	1.4	ND	ND	1.2*	5
SP2 - unfiltered	7/25/91	Mother Lode mine	0.046	0.130	ND	ND	ND	ND	ND	ND	ND	ND	0.5	NA
SP3 - unfiltered	7/27/91	Tailings	0.007	0.034	ND	ND	ND	ND	ND	2	ND	ND	0.1*	0
SP3 - filtered			0.008	0.034	0.0012	ND	NA	0.012	ND	NA	ND	ND	NA	NA
SP4 - unfiltered	7/27/91	Tailings	0.5	0.040	0.0050	ND	0.2	0.017	0.0017	2.4	ND	0.001	0.5*	0
SP4 - filtered			0.046	0.033	ND	ND	NA	0.061	ND	NA	ND	ND	NA	NA
SWB - unfiltered	7/24/91	Bonanza Creek	0.001	0.027	ND	ND	ND	ND	ND	0.2	ND	ND	0.3	0
SWB - filtered			0.001	0.024	ND	ND	NA	0.006	ND	NA	ND	ND	NA	NA
SWBK - unfiltered	7/23/91	Blank	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	<0.1*	0
SWBK - filtered			ND	ND	ND	ND	NA	ND	ND	NA	ND	ND	NA	NA
SWJ - unfiltered	7/24/91	Jumbo Creek	0.002	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.2	0
SWJ - filtered			0.002	ND	ND	ND	NA	ND	ND	NA	ND	ND	NA	NA
SWK1- unfiltered	7/24/91	Kennicott Ck.,	0.002	0.031	ND	ND	ND	ND	ND	0.7	ND	ND	0.2	0
SWK1 - filtered		south of Amazon Ck.	0.002	0.023	ND	ND	ND	0.012	ND	NA	ND	ND	NA	NA
SWK2 - unfiltered	7/24/91	Kennicott Ck.,	0.001	0.028	ND	ND	ND	ND	ND	0.2	ND	ND	0.8	0
SWK2 - filtered		south of National Ck.	ND	0.026	ND	ND	NA	0.009	ND	NA	ND	ND	NA	NA
SWK5 - unfiltered		Duplicate sample of SWK2	0.001	0.027	ND	ND	ND	ND	ND	0.2	ND	ND	0.4*	0
SWK3 - unfiltered	7/24/91	Kennicott Ck.,	ND	0.022	ND	ND	ND	ND	ND	0.4	ND	ND	0.4	0
SWK3 - filtered		above McCarthy Ck.	ND	0.022	ND	ND	NA	ND	ND	NA	ND	ND	NA	NA
SWK4 - unfiltered	7/25/91	Kennicott Ck.,	ND	0.040	ND	ND	ND	ND	ND	0.2	0.001	ND	23	NA
SWK4 - filtered		below McCarthy Ck.	ND	0.025	ND	ND	NA	ND	ND	NA	ND	ND	NA	0
SWM1- unfiltered	7/25/91	McCarthy Ck.,	ND	0.026	ND	ND	ND	ND	ND	ND	ND	ND	29	0
SWM1 - filtered		below Luss Ck.	ND	0.014	ND	ND	NA	0.007	ND	ND	ND	ND	NA	NA
SWM2 - unfiltered	7/25/91	McCarthy Ck.,	ND	0.034	ND	ND	ND	ND	ND	ND	ND	ND	26	1
SWM2 - filtered		below Green Butte Mine	ND	0.017	ND	ND	NA	ND	ND	NA	ND	ND	NA	NA
SWM3 - unfiltered	7/25/91	McCarthy Ck.,	ND	0.040	ND	0.005	ND	ND	ND	0.2	0.001	ND	22	1
SWM3 - filtered		south of Bonanza Ridge	ND	0.026	ND	ND	NA	ND	ND	NA	ND	ND	NA	NA
SWM4 - unfiltered	7/24/91	McCarthy Ck.,	ND	0.041	ND	ND	ND	0.006	ND	0.2	0.002	ND	30	0
SWM4 - filtered		above McCarthy	ND	0.025	ND	ND	NA	ND	ND	NA	ND	ND	NA	NA
SWN1- unfiltered	7/24/91	National Ck.,	ND	0.027	ND	ND	ND	ND	ND	0.1	ND	ND	0.8	0
SWN1 - filtered		above Mill Town	ND	0.024	ND	ND	NA	ND	ND	NA	ND	ND	NA	NA
SWN2 - unfiltered	7/24/91	National Ck.,	ND	0.028	ND	ND	ND	ND	ND	0.2	ND	ND	2.2	0
SWN2 - filtered		below Mill Town	ND	0.026	ND	ND	NA	ND	ND	NA	ND	ND	NA	NA
WP3 - unfiltered	7/23/91	Adjacent Kennicott Ck.,	0.091	0.120	0.0015	ND	ND	0.013	0.0021	0.6	ND	ND	46*	0
WP3 - filtered		nr. School House	0.004	0.029	0.0005	ND	NA	0.019	ND	NA	ND	ND	NA	NA
MCL			0.05	1	0.0100	0.05	4	0.05	0.002	10	0.01	0.05	1	0
Method			ASTM D2972	EPA 200.7	EPA 213.2	EPA 218.2	EPA 340.3	EPA 239.2	SM14 301AVI	EPA 353.2	ASTM D3859	EPA 272.2	EPA 180.1	Membrane filter
Method Reporting Limit			0.001	0.013	0.0005	0.005	0.1	0.005	0.0002	0.1	0.001	0.001	0.1	0

Abbreviations: MCL - Maximum contaminant concentration levels
ND - Not detected at Method Reporting Limit
NA - Not analyzed
NTU - Nephelometric turbidity units

* Lab measured value, other turbidity measurements are field values.

TABLE 6. WATER QUALITY - SECONDARY STANDARDS - JULY 1991 SAMPLING EVENT

Sample	Date Sampled	Location	Chloride mg/L	Color PCU	Copper mg/L	Corrosivity: L.I. @ 40 F units	L.I. @ 140F units	Foaming Agent MBAS mg/L	Iron mg/L	Manganese mg/L	Odor TON	pH units	Sodium mg/L	Sulfate mg/L	TDS mg/L	Zinc mg/L
SP1- unfiltered	7/23/91	Seep W. of Mother Lode	0.6	<5	0.023	0	1.08	ND	0.240	0.013	No odor	7.66*	2.4	8.2	270	ND
SP2 - unfiltered	7/25/91	Mother Lode	0.3	<5	0.033	-0.53	0.55	ND	0.042	ND	No odor	7.6	ND	5.6	83	ND
SP3 - unfiltered	7/27/91	Tailings	0.8	5	0.068	0.47	1.55	ND	0.022	ND	1	8.19*	1.4	13.6	261	ND
SP3 - filtered			NA	NA	0.078	NA	NA	NA	0.060	ND	NA	NA	1.4	NA	NA	0.049
SP4 - unfiltered	7/27/91	Tailings	0.4	5	10.0	0.66	1.74	ND	0.840	0.018	No odor	8.32*	2.3	10.1	280	ND
SP4 - filtered			NA	NA	0.47	NA	NA	NA	0.110	ND	NA	NA	2.8	NA	NA	0.08
SWB - unfiltered	7/24/91	Bonanza Ck	ND	<5	ND	-0.58	0.5	ND	0.066	ND	No odor	7.7	3.1	6.6	95	ND
SWB - filtered			NA	NA	ND	NA	NA	NA	0.015	ND	NA	NA	2.8	NA	NA	0.013
SWBK - unfiltered	7/23/91	Blank	0.3	<5	ND	-5.81	-4.73	ND	0.120	ND	No odor	6.04*	0.32	<1	<5	0.021
SWBK - filtered			NA	NA	ND	NA	NA	NA	ND	ND	NA	NA	0.27	NA	NA	ND
SWJ - unfiltered	7/24/91	Jumbo Ck	0.9	<25	ND	-0.54	0.54	ND	0.034	ND	No odor	8.0	1.5	10.8	121	ND
SWJ - filtered			NA	NA	ND	NA	NA	NA	0.045	ND	NA	NA	1.5	NA	NA	ND
SWK1 - unfiltered	7/24/91	Kennicott Ck	0.7	<5	ND	0.14	1.22	ND	0.610	0.042	No odor	8.0	2.5	11.5	131	ND
SWK1 - filtered		S. of Amazon Ck	NA	NA	ND	NA	NA	NA	0.019	ND	NA	NA	2.4	NA	NA	ND
SWK2 - unfiltered	7/24/91	Kennicott Ck.	ND	<5	0.019	-0.8	0.28	ND	0.062	ND	No odor	8.0	3.8	8.2	80	ND
SWK2 - filtered		S. of National Ck	NA	NA	ND	NA	NA	NA	0.027	ND	NA	NA	3.9	NA	NA	ND
SWK5 - unfiltered	7/24/91	Dup. of SWK2	0.1	<5	0.014	-0.79	0.29	ND	0.064	ND	No odor	8.04	4	6.2	80	0.015
SWK3 - unfiltered	7/24/91	Kennicott Ck	0.8	<5	ND	0.19	1.27	ND	0.041	ND	No odor	7.9	3.7	19.1	215	ND
SWK3 - filtered		abv McCarthy Ck	NA	NA	ND	NA	NA	NA	0.030	ND	NA	NA	3.6	NA	NA	ND
SWK4 - unfiltered	7/25/91	Kennicott Ck	0.4	<5	ND	-0.76	0.32	ND	1.70	0.025	No odor	7.6	3.4	62.3	194	ND
SWK4 - filtered		blw McCarty Ck	NA	NA	ND	NA	NA	NA	0.033	ND	NA	NA	3.1	NA	NA	ND
SWM1 - unfiltered	7/25/91	McCarthy Ck	0.6	<5	ND	0.78	0.3	ND	1.60	0.032	No odor	7.7	2.1	30.8	118	0.013
SWM1 - filtered		blw Russ Ck	NA	NA	ND	NA	NA	NA	0.042	ND	NA	NA	1.9	NA	NA	0.016
SWM2 - unfiltered	7/25/91	McCarthy Ck	0.8	<5	ND	-0.66	0.42	ND	2.40	0.039	No odor	7.7	2.3	54.1	169	ND
SWM2 - filtered		blw Green Butte	NA	NA	ND	NA	NA	NA	0.048	ND	NA	NA	2	NA	NA	ND
SWM3 - unfiltered	7/25/91	McCarthy Ck	0.5	<5	ND	-0.98	0.1	ND	1.70	0.027	No odor	7.7	3.2	62.2	191	ND
SWM3 - filtered		S. of Bonanza Ridge	NA	NA	ND	NA	NA	NA	0.034	ND	NA	NA	3.1	NA	NA	ND
SWM4 - unfiltered	7/24/91	McCarthy Ck.	0.6	<5	ND	-0.12	0.96	ND	1.80	0.030	No odor	8.0	3.3	54.4	172	0.015
SWM4- filtered		abv McCarthy Ck	NA	NA	ND	NA	NA	NA	0.021	ND	NA	NA	3	NA	NA	NA
SWN1- unfiltered	7/24/91	National Ck	0.2	<5	ND	-0.81	0.27	ND	0.053	ND	No odor	7.9	4	5.6	74	ND
SWN1 - filtered		abv Mill Town	NA	NA	ND	NA	NA	NA	0.025	ND	NA	NA	3.8	NA	NA	ND
SWN2 - unfiltered	7/24/91	National Ck	ND	<5	ND	-0.77	0.31	ND	ND	ND	No odor	7.9	3.9	6.6	83	ND
SWN2 - filtered		blw Mill Town	NA	NA	ND	NA	NA	NA	0.024	ND	NA	NA	3.9	NA	NA	ND
WP3 - unfiltered	7/23/91	adj Kennicott Ck	ND	<5	1.60	-0.4	0.68	ND	5.60	0.310	No odor	7.99*	4.4	7.1	100	3.70
WP3 - filtered		nr School House	NA	NA	0.035	NA	NA	NA	0.071	ND	NA	NA	4	NA	NA	1.10
MCL (18 AAC 80.070)			250	15	1	>0		0.5	0.3	0.05	3	6.5-8.5	250	250	500	5
Method			SM16ED407A	SM16ED204A	EPA 200.7A	SM14ED203		SM16ED512B	EPA 200.7A	EPA 200.7A	SM16ED207	EPA 150.1	EPA 200.7A	EPA 375.4	EPA 160.1	EPA 200.7A
Method Reporting Limit			0.1	<5	0.013			0.05	0.013	0.013	0		0.013	1	5	0.013

Abbreviations:
L.I. - Langelier Index
MBAS - Methylene-blue active substances (detergents)
MCL - Maximum contaminant concentration levels
MRL - Method Reporting Limit
NA - Not analyzed
ND - Not detected at MRL
PCU - Platinum Color Units
TDS - Total dissolved solids
TON - Threshold odor number

* Lab value, all other pH readings taken in field.

TABLE 7. WATER QUALITY - FIELD AND MISCELLANEOUS PARAMETERS - JULY 1991 SAMPLING EVENT

		Field Analyses							Miscellaneous Parameters					
Sample	Date Sampled	Temperature C	Dissolved Oxygen mg/L	Percent Saturation	Conductivity umhos/cm @ 25C	Turbidity NTU	pH units	Oxidation Reduction Potential mV	Calcium mg/L	Magnesium mg/L	Potassium mg/L	Sulfide mg/L	Chemical Oxygen Demand mg/L	Ammonia-N mg/L
SP1	7/23/91	NA	NA	NA	NA	NA	NA	NA	80	12	ND	ND	67	ND
SP2	7/25/91	NA	NA	NA	29	0.5	7.6	340	20	7.5	ND	ND	ND	0.20
SP3	7/27/91	NA	NA	NA	NA	NA	NA	NA	76	11.0	ND	<0.2	3.3	0.13
SP4	7/27/91	NA	NA	NA	NA	NA	NA	NA	91	14.0	ND	ND	10.0	0.41
SWB	7/24/91	5.1	11.4	97	500	0.3	7.7	354	21	5.4	ND	ND	ND	ND
SWBK	7/23/91	NA	NA	NA	NA	NA	NA	NA	0.04	ND	ND	ND	ND	ND
SWJ	7/24/91	4.5	12.6	105	500	0.2	8.0	351	21	4.8	ND	ND	ND	ND
SWK1	7/24/91	2.6	12.2	96	500	0.2	8.0	354	57	8.5	ND	ND	ND	ND
SWK2	7/24/91	6.1	11.4	99	540	0.8	8.0	370	16	5.1	ND	ND	16.3	ND
SWK2 duplicate	7/24/91	NA	NA	NA	NA	NA	NA	NA	16	5.1	ND	ND	13.1	ND
SWK3	7/24/91	4.6	10.8	88	530	0.4	7.9	384	61	9.1	ND	ND	ND	ND
SWK4	7/25/91	6.4	12.5	95	27	23.0	7.6	327	49	7.5	ND	ND	ND	ND
SWK5	duplicate of SWK2 - see above													
SWM1	7/25/91	4.8	12.6	96	26	29.0	7.7	321	28	3.1	ND	ND	6.7	ND
SWM2	7/25/91	5.1	12.7	96	26	26.0	7.7	355	44	5.3	ND	ND	10.0	0.25
SWM3	7/25/91	5.5	12.8	96	29	22.0	7.7	336	47	7.2	ND	ND	6.7	ND
SWM4	7/24/91	7.0	11.1	96	500	30.0	8.0	360	47	7.1	ND	ND	9.8	ND
SWN1	7/24/91	5.7	11.9	103	500	0.8	7.9	359	15	5.0	ND	ND	ND	ND
SWN2	7/24/91	5.8	11.3	97	590	2.2	7.9	354	15	4.9	ND	ND	9.8	0.20
WP3	7/23/91	5.7	NA	NA	134	NA	7.3	NA	40	11.0	ND	ND	13.0	ND
Method		ASTM mercury thermometer							EPA 200.7 ICP	EPA 200.7 ICP	EPA 258.1 AA	EPA 376.2	EPA 410	EPA 350.1
Method Reporting Limit									0.03	0.03	1.25	0.10	0.10	0.20

Abbreviations: NTU - Nephelometric turbidity units
NA - Not analyzed
ND - Not detected at MRL

All samples were unfiltered

TABLE 8. WATER QUALITY - SUMMARIZED 65 TOXICS ANALYTICAL RESULTS - JULY 1991

		Analyte Group						Total Unfiltered Metals:											
Sample	Date Sampled	Asbestos	Cyanide mg/L	Organochlorine Pesticides and PCBs ug/L	Volatile Organic Compounds ug/L	Semivolatile Organic Compounds ug/L	Dioxins ng/L	As mg/L	Cd mg/L	Cr mg/L	Cu mg/L	Pb mg/L	Hg mg/L	Ni mg/L	Se mg/L	Ag mg/L	Th mg/L	Zn mg/L	PAH ug/L
SP1	7/23/91	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.01	0	ND	ND	ND	ND	ND	ND	NA
SP3	7/27/91	ND	ND	NA	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND
SP4	7/27/91	ND	ND	NA	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND
SWK2	7/24/91	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.02	0	ND	ND	ND	ND	ND	ND	NA
SWK3	7/24/91	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA
SWN2	7/24/91	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA
WP3	7/23/91	ND	ND	ND	ND	10 of Bis(2-ethylhexyl) Phthalate	ND	0.03	ND	0.01	0.7	0.02	ND	ND	ND	ND	ND	2.38	NA
Method		PLM/ Dispersion Staining	335.2	3510/8080	8240	3510/8270	8280	7060	6010	6010	6010	7421	7470	6010	7740	6010	7841	6010	3510/8310
Method Reporting Limit			0.01	between 0.04 and 0.5	between 1 and 20	between 5 and 50	between 0.04 and 0.079	0.01	0.003	0.01	0.01	0.002	0.001	0.02	0.01	0.01	0.01	0.01	between 0.05 and 1.0

Abbreviations:

NA - Not Analyzed
ND - Not Detected at MRL
PAH - Polynuclear Aromatic Hydrocarbons
PCB - Polychlorinated Biphenyls
PLM - Polarized Light Microscopy

TABLE 9. WATER QUALITY - PRIMARY STANDARDS - SEPTEMBER 1991 SAMPLING EVENT

Sample	Date Sampled	Location	Arsenic mg/L	Barium mg/L	Cadmium mg/L	Chromium mg/L	Fluoride mg/L	Lead mg/L	Mercury mg/L	Nitrate-N mg/L	Selenium mg/L	Silver mg/L	Turbidity NTU	Fecal Coliform col/100mL
SP3 - unfiltered	9/23/91	Tailings	0.0074	0.033	ND	ND	ND	ND	ND	1.8	0.0008	ND	0.07*	0
SP3 - filtered			0.008	0.034	ND	ND	NA	ND	ND	NA	0.001	ND	NA	NA
SP4 - unfiltered	9/23/91	Tailings	0.019	0.026	ND	ND	ND	ND	ND	2.4	ND	ND	0.08*	0
SP4 - filtered			0.022	0.025	ND	0.008	NA	ND	ND	NA	ND	ND	NA	NA
SP5 - unfiltered	9/23/91	Seep west of Power Hse.	0.039	0.13	0.0009	0.008	ND	0.18	0.0002	ND	0.0047	0.001	76*	>0
SWB - unfiltered	9/21/91	Bonanza Creek	0.0013	0.025	ND	ND	ND	ND	ND	0.23	0.0006	ND	0.47	0
SWB - filtered			0.0013	0.026	ND	ND	NA	ND	ND	NA	0.0007	ND	NA	NA
WBK1 - unfiltere	9/21/91	Blank	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.06*	NA
SWBK1 - filtered			ND	ND	ND	ND	NA	ND	ND	NA	ND	ND	NA	NA
WBK2 - unfiltere	9/21/91	Blank	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.16*	NA
SWBK2 - filtered			ND	ND	ND	ND	NA	ND	ND	NA	ND	ND	NA	NA
SWJ - unfiltered	9/21/91	Jumbo Creek	0.0022	0.012	ND	ND	ND	ND	ND	0.25	ND	ND	0.4	0
SWJ - filtered			0.0022	0.012	ND	ND	NA	ND	ND	NA	ND	ND	NA	NA
SWK1- unfiltered	9/21/91	Kennicott Ck.,	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	16.5	0
SWK1 - filtered		south of Amazon Ck.	ND	ND	ND	ND	ND	ND	ND	NA	ND	ND	NA	NA
SWK2 - unfiltered	9/22/91	Kennicott Ck.,	0.0006	0.029	ND	ND	ND	ND	ND	0.22	ND	ND	4.1	0
SWK2 - filtered		south of National Ck.	ND	0.028	ND	ND	NA	ND	ND	NA	ND	ND	NA	NA
SWK3 - unfiltered	9/22/91	Kennicott Ck.,	0.0006	0.022	ND	ND	ND	ND	ND	0.54	0.0007	ND	0.21	0
SWK3 - filtered		above McCarthy Ck.	0.0006	0.023	ND	ND	NA	ND	ND	NA	ND	ND	NA	NA
SWK4 - unfiltered	9/22/91	Kennicott Ck.,	0.0072	0.042	ND	ND	ND	ND	ND	0.26	0.0011	ND	90	0
SWK4 - filtered		below McCarthy Ck.	0.0035	0.031	ND	ND	NA	ND	ND	NA	0.0012	ND	NA	NA
SWK5 - unfiltered	9/22/91	Duplicate of SWN1 - see below												0
SWK5 - filtered														NA
SWM4 - unfiltere	9/22/91	McCarthy Ck.,	0.0005	0.042	ND	ND	ND	ND	ND	0.33	0.0019	ND	23.5	0
SWM4 - filtered		above McCarthy	0.0005	0.039	ND	ND	NA	ND	ND	NA	0.0012	ND	NA	NA
SWN1- unfiltered	9/22/91	National Ck.,	ND	0.031	ND	ND	ND	ND	ND	0.19	ND	ND	1.7	0
SWN1 - unfiltered	duplicate	above Mill Town	ND	0.031	ND	ND	ND	0.01	ND	0.17	ND	ND	1.7	NA
SWN1 - filtered			ND	0.029	ND	ND	NA	ND	ND	NA	ND	ND	NA	NA
SWN1 - filtered	duplicate		ND	0.028	ND	ND	NA	0.008	ND	NA	ND	ND	NA	NA
SWN2 - unfiltered	9/22/91	National Ck.,	0.0012	0.030	ND	ND	ND	ND	ND	0.21	ND	ND	2.2	>0
SWN2 - filtered		below Mill Town	ND	0.028	ND	ND	NA	ND	ND	NA	ND	ND	NA	NA
WP3 - unfiltered	9/23/91	Adjacent Kennicott Ck.,	0.022	0.160	0.0033	ND	ND	0.032	0.001	0.52	ND	ND	380*	0
WP3 - filtered		near School House	0.0011	0.028	ND	ND	NA	ND	ND	NA	ND	ND	NA	NA
MCL (18 AAC 80.070)			0.05	1	0.0100	0.05	4	0.05	0.002	10	0.01	0.05	1	0
Method			ASTM D2972	EPA 200.7	EPA 213.2	EPA 218.2	EPA 340.3	EPA 239.2	SM14 301AVI	EPA 353.2	ASTM D3859	EPA 272.2	EPA 180.1	Membrane filter
Method Reporting Limit (MRL)			0.001	0.013	0.0005	0.005	0.1	0.005	0.0002	0.1	0.001	0.001	0.1	0

Abbreviations: MCL - Maximum contaminant concentration levels NA - Not analyzed ND - Not detected at MRL NTU - Nephelometric turbidity units

* Lab measured value, other turbidity measurements are field values.

TABLE 10. WATER QUALITY - SECONDARY STANDARDS - SEPTEMBER 1991 SAMPLING EVENT

Sample	Date Sampled	Location	Chloride mg/L	Color PCU	Copper mg/L	Corrosivity: L.I. @ 40 F units	L.I. @ 140F units	Foaming Agent MBAS mg/L	Iron mg/L	Manganese mg/L	Odor TON	pH units	Sodium mg/L	Sulfate mg/L	TDS mg/L	Zinc mg/L
SP3 - unfiltered	9/23/91	Tailings	0.6	5	0.064	0.53	1.61	ND	ND	ND	No odor	8.11	2.8	17	245	ND
SP3 - filtered			NA	NA	0.068	NA	NA	NA	ND	ND	NA	NA	2.7	NA	NA	ND
SP4 - unfiltered	9/23/91	Tailings	0.8	5	0.16	0.54	1.62	ND	ND	ND	No odor	8.11	4.4	14	236	ND
SP4 - filtered			NA	NA	0.16	NA	NA	NA	ND	ND	NA	NA	4.3	NA	NA	ND
SP5- unfiltered	9/23/91	Seep west of Power Hse.	0.8	120	0.45	-0.76	0.32	0.81	30.000	0.58	16	7.37	3.9	13	263	0.67
SWB - unfiltered	9/21/91	Bonanza Ck.	0.6	<5	ND	-0.91	0.17	ND	ND	ND	No odor	8.05	3	8.4	87	ND
SWB - filtered			NA	NA	ND	NA	NA	NA	ND	ND	NA	NA	3.1	NA	NA	ND
SWBK1 - unfiltered	9/21/91	Blank	ND	<5	ND	-6.06	-4.98	ND	ND	ND	No odor	5.49*	0.22	0.4	1	ND
SWBK1 - filtered			NA	NA	ND	NA	NA	NA	ND	ND	NA	NA	0.24	NA	NA	ND
SWBK2 - unfiltered	9/21/91	Blank	ND	<5	ND	-6.01	-4.93	ND	ND	ND	No odor	5.47	0.24	1	1.4	ND
SWBK2 - filtered			NA	NA	ND	NA	NA	NA	ND	ND	NA	NA	0.25	NA	NA	ND
SWJ - unfiltered	9/21/91	Jumbo Ck.	1	<5	ND	-0.58	0.5	ND	ND	ND	No odor	8.1	2	13	98	ND
SWJ - filtered			NA	NA	ND	NA	NA	NA	ND	ND	NA	NA	1.9	NA	NA	ND
SWK1- unfiltered	9/21/91	Kennicott Ck.	ND	5	ND	-3.4	-2.36	ND	0.480	ND	No odor	7.3	0.23	ND	7	ND
SWK1 - filtered		south of Amazon Ck.	NA	NA	ND	NA	NA	NA	ND	ND	NA	NA	0.22	NA	NA	ND
SWK2 - unfiltered	9/22/91	Kennicott Ck.	ND	5	ND	-0.57	0.51	ND	ND	ND	No odor	8.0	5.4	7.6	84	ND
SWK2 - filtered		south of National Ck.	NA	NA	ND	NA	NA	NA	ND	ND	NA	NA	5.4	NA	NA	ND
SWK3 - unfiltered	9/22/91	Kennicott Ck.	0.8	<5	ND	0.03	-1.11	ND	ND	ND	No odor	7.63	3.6	17	211	ND
SWK3 - filtered		above McCarthy Ck.	NA	NA	ND	NA	NA	NA	ND	ND	NA	NA	4	NA	NA	ND
SWK4 - unfiltered	9/22/91	Kennicott Ck.	4.2	10	ND	0.28	1.36	ND	0.74	0.038	No odor	7.63	5.2	63	208	ND
SWK4 - filtered		below McCarthy Ck.	NA	NA	ND	NA	NA	NA	0.05	ND	NA	NA	5.1	NA	NA	ND
SWK5 - unfiltered	9/22/91	duplicate of SWN1 - see below													80	0.015
SWK5 - filtered		duplicate of SWN1 - see below														
SWM4 - unfiltered	9/22/91	McCarthy Ck.	0.5	5	ND	-0.02	1.06	ND	0.56	ND	No odor	8.2	4.2	108	274	ND
SWM4- filtered		above McCarthy	NA	NA	ND	NA	NA	NA	ND	ND	NA	NA	4.9	NA	NA	ND
SWN1- unfiltered	9/22/91	National Ck.	0.4	5	ND	-0.56	0.52	ND	ND	ND	No odor	7.84	5.5	7.2	80	ND
SWN1 - unfiltered	duplicate	above Mill Town	0.4	5	ND	-0.53	0.55	ND	ND	ND	No odor	7.84	5.3	7.2	85	ND
SWN1- filtered			ND	NA	ND	NA	NA	NA	0.06	ND	NA	NA	5.6	NA	NA	ND
SWN1 - filtered	duplicate		NA	NA	ND	NA	NA	NA	ND	ND	NA	NA	5.4	NA	NA	ND
SWN2 - unfiltered	9/22/91	National Ck.	0.2	5	ND	-0.51	0.57	ND	ND	ND	No odor	7.99	6.1	7.2	86	ND
SWN2 - filtered		below Mill Town	NA	NA	ND	NA	NA	NA	ND	ND	NA	NA	5.6	NA	NA	ND
WP3 - unfiltered	9/23/91	Adjacent Kennicott Ck.	0.6	10	1.00	-0.53	0.55	ND	10.00	0.230	No odor	7.85	5.8	8.4	105	2.20
WP3 - filtered		near School House	NA	NA	ND	NA	NA	NA	ND	0.021	NA	NA	5.6	NA	NA	ND
MCL (18 AAC 80.070)			250	15	1	>0		0.5	0.3	0.05	3	6.5-8.5	250	250	500	5
Method			SM16ED407A	SM16ED204A	EPA 200.7A	SM14ED203		SM16ED512B	EPA 200.7A	EPA 200.7A	SM16ED207	EPA 150.1	EPA 200.7A	EPA 375.4	EPA 160.1	EPA 200.7A
Method Reporting Limit (MRL)			0.1	<5	0.013			0.05	0.013	0.013	0		0.013	1	5	0.013

Abbreviations:

L.I. - Langelier Index
MBAS - Methylene-blue active substances (detergents)
MCL - Maximum contaminant concentration levels
NA - Not analyzed
ND - Not detected at MRL
PCU - Platinum Color Units
TDS - Total dissolved solids
TON - Threshold odor number

* Lab value, all other pH readings taken in field.

TABLE 11. WATER QUALITY - FIELD AND MISCELLANEOUS PARAMETERS - SEPTEMBER 1991 SAMPLING EVENT

		Field Analyses							Miscellaneous Parameters						
Sample	Date Sampled	Temperature C	Dissolved Oxygen mg/L	Percent Saturation	Conductivity umhos/cm @ 25C	Turbidity NTU	pH units	Oxidation Reduction Potential mV	Calcium mg/L	Magnesium mg/L	Potassium mg/L	Sulfide mg/L	Chemical Oxygen Demand mg/L	Biochemical Oxygen Demand mg/L	Ammonia-N mg/L
SP3	9/23/91	NA	NA	NA	409	NA	8.1	537	67	9.8	ND	ND	3.6	ND	ND
SP4	9/23/91	NA	NA	NA	394	NA	8.1	590	68	9.9	ND	ND	3.6	ND	ND
SP5	9/23/91	NA	NA	NA	270	NA	7.37	521	57	13	2.8	ND	945	47	6.7
SWB	9/21/91	4.2	12.1	98	192	0.5	8.1	353	18	5.0	ND	ND	2.7	1.1	ND
SWBK1	9/21/91	NA	NA	NA	NA	0.08*	5.49*	NA	0.20	0.0	ND	NA	ND	ND	ND
SWBK2	9/21/91	NA	NA	NA	NA	0.16*	5.47*	NA	0.20	0.0	ND	NA	0.7	ND	ND
SWJ	9/21/91	4.0	11.8	96	217	0.4	8.1	390	23	5.7	ND	ND	0.7	ND	ND
SWK1	9/21/91	0.3	12.6	93	26.8	16.5	7.3	360	03	0.3	ND	ND	2.2	1.5	ND
SWK2	9/22/91	3.0	11.4	91	152	4.1	8.0	350	15	5.7	ND	ND	ND	<1.0	ND
SWK3	9/22/91	2.8	11.4	89	446	0.2	7.8	370	65	9.8	ND	ND	1.4	1.0	ND
SWK4	9/22/91	2.9	14.2	110	394	90.0	8.2	365	58	7.8	ND	ND	1.0	ND	ND
SWK5	duplicate of SWN1 - see below														
SWM4	9/22/91	2.4	13.8	104	522	23.5	8.2	388	71	11.0	ND	ND	1.4	ND	ND
SWN1	9/22/91	3.0	13.4	107	NA	1.7	NA	NA	14	5.7	ND	ND	ND	<1.0	ND
SWN1	duplicate	3.0	13.4	107	165	1.7	7.8	359	14	5.6	ND	ND	1.0	<1.0	ND
SWN2	9/22/91	3.0	12.2	97	144	2.2	8.0	329	17	5.8	ND	ND	2.2	ND	ND
WP3	9/23/91	NA	NA	NA	181	NA	7.9	534.00	16	5.3	ND	ND	14.3	ND	ND
Method		ASTM mercury thermometer							EPA 200. ICP	EPA 200.7 ICP	EPA 258.1 AA	PA 376.	EPA 410	EPA 405.1	EPA 350.1
Method Reporting Limit (MRL)									0.03	0.03	1.25	0.10	0.10	1.00	0.20

Abbreviations: NTU - Nephelometric turbidity units
NA - Not analyzed
ND - Not detected at MRL

* Asterisk indicates lab based analysis of pH or turbidity

All samples were unfiltered

TABLE 12. WATER QUALITY - PETROLEUM HYDROCARBON CONTENT - SEPTEMBER 1991

Sample	Date Sampled	Total Recoverable Petroleum Hydrocarbons mg/L	Diesel ppm
SP5	9/23/91	16.8	6.9
Method		418.1	3510/3550/8100

TABLE 13. WATER QUALITY - PRIMARY STANDARDS - MAY 1992 SAMPLING EVENT

Sample	Date Sampled	Location	Arsenic mg/L	Barium mg/L	Cadmium mg/L	Chromium mg/L	Fluoride mg/L	Lead mg/L	Mercur mg/L	Nitrate-N mg/L	Selenium mg/L	Silver mg/L	Turbidity NTU	Fecal Coliform col/100mL
SP1 - unfiltered	5/20/92	Seep west of Power Hse.	ND	ND	ND	ND	ND	ND	ND	0.14	ND	ND	1.5	0
SP1 - filtered	5/20/92		ND	ND	ND	ND	NA	ND	ND	NA	ND	ND	NA	NA
SP3 - unfiltered	5/20/92	Tailings	0.0073	ND	ND	ND	0.051	ND	ND	1.4	ND	ND	1.3	0
SP3 - filtered			0.0063	ND	ND	ND	NA	ND	ND	NA	ND	ND	NA	NA
SP4 - unfiltered	5/20/92	Tailings	0.013	ND	0.0014	ND	ND	ND	6E-04	1.9	ND	ND	4.1	0
SP4 - filtered			0.011	ND	ND	ND	NA	ND	ND	NA	ND	ND	NA	NA
SWB - unfiltered	5/22/92	Bonanza Creek	0.0011	ND	ND	ND	ND	ND	ND	1.5	ND	ND	0.89	0
SWB - filtered			ND	ND	ND	ND	NA	ND	ND	NA	ND	ND	NA	NA
SWBK3 - unfiltered	5/21/92	Blank	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	0
SWBK3 - filtered			ND	ND	ND	ND	NA	ND	ND	NA	ND	ND	NA	NA
SWJ - unfiltered	5/22/92	Jumbo Creek	0.0018	ND	ND	ND	ND	ND	ND	0.85	ND	ND	6.2	0
SWJ - filtered			0.0015	ND	ND	ND	NA	ND	ND	NA	ND	ND	NA	NA
SWK1- unfiltered	5/22/92	KC, south of Amazon Ck.	0.0022	0.053	ND	0.0066	ND	0.008	ND	0.16	ND	ND	NA	0
SWK1 - filtered			ND	ND	ND	ND	ND	ND	ND	NA	ND	ND	NA	NA
SWK2 - unfiltered	5/20/92	KC, south of National Ck.	0.0071	ND	ND	ND	0.058	ND	ND	1.4	ND	ND	5.3	0
SWK2 - filtered			0.0018	ND	ND	ND	NA	ND	ND	NA	ND	ND	NA	NA
SWK3 - unfiltered	5/21/92	KC, above McCarthy Ck.	0.0011	ND	ND	ND	0.065	ND	ND	0.73	ND	ND	0.26	0
SWK3 - filtered			0.0011	ND	ND	ND	NA	ND	ND	NA	ND	ND	NA	NA
SWK4 - unfiltered	5/21/92	KC, below McCarthy Ck.	0.0016	ND	ND	ND	0.051	ND	ND	0.79	ND	ND	14	0
SWK4 - filtered			ND	ND	ND	ND	NA	ND	ND	NA	ND	ND	NA	NA
SWM4 - unfiltered	5/21/92	McCarthy Ck., above McCarthy	0.0016	ND	ND	ND	0.065	ND	ND	0.68	0.0013	ND	11	0
SWM4 - filtered			ND	ND	ND	ND	NA	ND	ND	NA	ND	ND	NA	NA
SWN1- unfiltered	5/20/92	National Ck., above Mill Town	ND	ND	ND	ND	ND	ND	ND	1.6	ND	ND	0.9	0
SWN1 - filtered			ND	ND	ND	ND	NA	ND	ND	NA	ND	ND	NA	NA
SWN2 - unfiltered	5/19/92	National Ck., below Mill Town	0.0036	ND	ND	ND	ND	ND	ND	1.4	ND	ND	2.8	0
SWN2 - filtered			0.0013	ND	ND	ND	NA	0.007	ND	NA	ND	ND	NA	NA
SWN3 - unfiltered	5/20/92	Duplicate of SWN1	ND	ND	ND	ND	ND	ND	0.001	1.6	ND	ND	0.9	0
SWN3 - filtered			ND	ND	ND	ND	NA	ND	ND	NA	ND	ND	NA	NA
WP3 - unfiltered	5/20/92	Adj to KC, nr School House	0.094	0.130	0.0051	ND	ND	0.022	ND	1.5	ND	ND	NA	0
WP3 - filtered			0.0025	ND	ND	ND	NA	ND	ND	NA	ND	ND	NA	NA
MCL (18 AAC 80.070)			0.05	1	0.0100	0.05	4	0.05	0.002	10	0.01	0.05	1	0
Method			ASTM D2972	EPA 200.7	EPA 213.2	EPA 218.2	SM16 413	EPA 239.2	EPA 245.1	EPA 353.2	ASTM D3859	EPA 272.2		Membrane filter
Method Reporting Limit (MRL)			0.001	0.05	0.0005	0.005	0.1	0.005	2E-04	0.1	0.001	0.001	0.1	0

Abbreviations:
KC - Kennicott Creek
MCL - Maximum Contaminant Levels
ND - Not detected at MRL
NA - Not analyzed
NTU - Nephelometric turbidity units

TABLE 14. WATER QUALITY - SECONDARY STANDARDS - MAY 1992 SAMPLING EVENT

Sample	Date Sampled	Location	Chloride mg/L	Color PCU	Copper mg/L	Corrosivity: L.I. @ 20C units	Foaming Agent MBAS mg/L	Iron mg/L	Manganese mg/L	Odor TON	pH units	Sodium mg/L	Sulfate mg/L	TDS mg/L	Zinc mg/L
SP1- unfiltered	5/20/92	Seep west of Power Hse.	ND	<5	ND	-0.53	ND	ND	ND	5	7.6	1	7	108	0.61
SP1 - filtered			NA	NA	NA	NA	NA	ND	ND	NA	NA	NA	NA	NA	ND
SP3 - unfiltered	5/20/92	Tailings	NA	<5	0.066	0.34	ND	ND	ND	No odor	8.05	1.6	16	197	ND
SP3 - filtered			NA	NA	0.055	NA	NA	ND	ND	NA	NA	NA	NA	NA	ND
SP4 - unfiltered	5/20/92	Tailings	0.8	<5	2.6	0.44	ND	ND	ND	No odor	7.96*	2.1	7	199	ND
SP4 - filtered			NA	NA	0.15	NA	NA	ND	ND	NA	NA	NA	NA	NA	ND
SWB - unfiltered	5/22/92	Bonanza Ck.	ND	<5	ND	-0.29	ND	ND	ND	No odor	8.25	3.1	8	107	ND
SWB - filtered			NA	NA	ND	NA	NA	ND	ND	NA	NA	NA	NA	NA	ND
SWBK3 - unfiltered	5/21/92	Blank	ND	<5	ND	-6.07	ND	ND	ND	No odor	NA	ND	ND	44	ND
SWBK3 - filtered			NA	NA	ND	NA	NA	ND	ND	NA	NA	NA	NA	NA	ND
SWJ - unfiltered	5/22/92	Jumbo Ck.	ND	<5	ND	-0.14	ND	ND	ND	No odor	8.5	2.3	9	122	ND
SWJ - filtered			NA	NA	ND	NA	NA	ND	ND	NA	NA	NA	NA	NA	ND
SWK1- unfiltered	5/22/92	KC south of Amazon Ck.	ND	10	ND	0.38	ND	5.400	0.092	No odor	8.9	1.1	14	100	ND
SWK1 - filtered			NA	NA	ND	NA	NA	ND	ND	NA	NA	NA	NA	NA	ND
SWK2 - unfiltered	5/20/92	KC south of National Ck.	ND	<5	0.11	-0.47	ND	0.11	ND	No odor	8.1	3.6	10	107	ND
SWK2 - filtered			NA	NA	ND	NA	NA	ND	ND	NA	NA	NA	NA	NA	ND
SWK3 - unfiltered	5/21/92	KC above McCarthy Ck.	2.6	<5	ND	0.14	ND	ND	ND	No odor	8.02	6.4	2.1	187	ND
SWK3 - filtered			NA	NA	ND	NA	NA	ND	ND	NA	NA	NA	NA	NA	ND
SWK4 - unfiltered	5/21/92	KC below McCarthy Ck.	23	<5	ND	0.19	ND	0.39	ND	No odor	8.25	3.9	78	323	ND
SWK4 - filtered			NA	NA	ND	NA	NA	ND	ND	NA	NA	NA	NA	NA	ND
SWM4 - unfiltered	5/21/92	McCarthy Ck. above McCarthy	ND	<5	ND	0.16	ND	0.22	ND	No odor	8.2	3.7	44	179	ND
SWM4- filtered			NA	NA	ND	NA	NA	ND	ND	NA	NA	NA	NA	NA	ND
SWN1- unfiltered	5/20/92	National Ck. above Mill Town	ND	<5	ND	-0.61	ND	ND	ND	No odor	8.28	3.7	10	117	ND
SWN1- filtered			ND	NA	ND	NA	NA	ND	ND	NA	NA	NA	NA	NA	ND
SWN2 - unfiltered	5/19/92	National Creek below Mill Town	ND	<5	0.054	-0.42	ND	ND	ND	No odor	8.69	3.9	10	105	ND
SWN2 - filtered			NA	NA	ND	NA	NA	ND	ND	NA	NA	NA	NA	NA	ND
SWN3 - unfiltered	5/20/92	Duplicate of SWN1	ND	<5	ND	-0.57	ND	ND	ND	No odor	8.2	3.6	11	108	ND
SWN3 - filtered			NA	NA	ND	NA	NA	ND	ND	NA	NA	NA	NA	NA	ND
WP3 - unfiltered	5/20/92	Adjacent KC nr School House	ND	<5	1.50	-0.23	ND	19.00	ND	No odor	7.85	4.2	10	136	1.20
WP3 - filtered			NA	NA	ND	NA	NA	ND	ND	NA	NA	NA	NA	NA	ND
Method			SM16ED 407A	EPA 110.2	EPA 200.7A	SM14ED20 3	EPA 425.1	EPA 200.7A	EPA 200.7A	SM207	EPA 150.1	EPA 200.7A	EPA 375.4	SM20 9C	EPA 200.7A
Method Reporting Limit (MRL)			1	<5	0.05		0.1	0.1	0.05	0		0.25	1	5	0.5
MCL (18 AAC 80.070)			250	15	1	>0	0.5	0.3	0.05	3	6.5-8.5	250	250	500	5

Abbreviations:

KC - Kennicott Creek
L.I. - Langelier Index
MBAS - Methylene-blue active substances (detergents)
MCL - Maximum contaminant concentration levels
TON - Threshold odor number

NA - Not analyzed
ND - Not detected at MRL
PCU - Platinum Color Units
TDS - Total dissolved solids
* Lab value, all other pH readings taken in field.

TABLE 15. WATER QUALITY - FIELD AND MISCELLANEOUS PARAMETERS - MAY 1992 SAMPLING EVENT

Sample	Date Sampled	Field Analyses							Miscellaneous Parameters						
		Temperature C	Dissolved Oxygen mg/L	Percent Saturation	Conductivity umhos/cm @ 25C	Turbidity NTU	pH units	Oxidation Reduction Potential mV	Calcium mg/L	Magnesium mg/L	Potassium mg/L	Sulfide mg/L	Chemical Oxygen Demand mg/L	Biochemical Oxygen Demand mg/L	Ammonia-N mg/L
SP1	5/20/92	1	12.9	90.8	247	0.9	8.3	255	27	4.4	ND	ND	18	3.5	ND
SP3	5/20/92	2.5	12.2	90.7	413	1.3	8.1	265.9	52	8.1	ND	ND	ND	2.1	ND
SP4	5/20/92	2	11.4	82.5	462	4.1	8.1	216	59	9.7	ND	ND	ND	2.6	ND
SWB	5/22/92	1	13.4	91.8	189	0.9	8.3	332.6	24	6.5	ND	ND	ND	2.2	ND
SWBK3	5/21/92	NA	NA	NA	NA	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND
SWJ	5/22/92	0.0	12.6	86.3	190	6.2	8.5	340.6	27	6.4	ND	ND	ND	6.1	0.20
SWK1	5/22/92	0.0	13.2	90.4	65	NA	8.9	292.7	26	3.9	ND	ND	ND	8.0	ND
SWK2	5/20/92	2.0	11.6	84	193	5.3	8.1	198.7	20	6.3	ND	ND	ND	21.1	ND
SWK3	5/21/92	6.0	10.2	82	301	0.3	8.0	230	39	7.1	ND	ND	ND	9.6	0.31
SWK4	5/21/92	7.0	11.4	94	342	14.0	8.3	250	46	7.9	ND	ND	13.0	34.0	ND
SWM4	5/21/92	6.0	11.0	88	334	11.0	8.2	250	46	7.8	ND	ND	ND	4.1	0.41
SWN1	5/20/92	1.0	12.9	90.8	247	0.9	8.3	255	20	6.8	ND	ND	ND	10.2	ND
SWN2	5/19/92	1.4	12.5	88	610	2.8	8.7	215	21	6.7	ND	ND	ND	2.3	ND
SWN3	5/20/92	1.0	NA	NA	150	NA	7.8*	NA	19	6.7	ND	ND	ND	11.4	ND
WP3	5/20/92	NA	NA	NA	205	NA	7.9	267.00	37	11.0	ND	ND	14.3	42.0	ND
Method		ASTM mercury thermometer							EPA 200.7 ICP	EPA 200.7 ICP	EPA 258.1 AA	EPA 376.2	EPA 410	EPA 405.1	EPA 350.1
Method Reporting Limit									0.03	0.03	1.25	0.10	0.10	1.00	0.20

Abbreviation NTU - Nephelometric turbidity units
NA - Not analyzed
ND - Not detected at MRL

*Lab value, all other pH readings taken in field.

All samples were unfiltered

TABLE 16. WATER QUALITY-TOTAL URANIUM AND GROSS ALPHA CONTENT - MAY 1992 SAMPLING EVENT

Sample	Date Sampled	Location	Total Uranium mg/L	Gross Alpha pCi/L
SP1	5/20/92	Seep west of Power House	0.00006	<2
SP3	5/20/92	Tailings	0.00024	<2
SP4	5/20/92	Tailings	0.00207	4+/-3
SWBK3	5/21/92	Blank	ND	<2
SWK2	5/20/92	Kennicott Creek, south of National Creek	0.00024	<2
SWN1	5/20/92	National Ck., above mill town	0.00023	<2
SWN2	5/19/92	National Ck., below mill town	0.00028	<2
SWN3	5/20/92	Duplicate of SWN1	0.00022	<2
WP3	5/20/92	Adjacent Kennicott Ck., nr School House	0.00038	<2
MCL			None	15
Method			200.8	900.0
Method Reporting Limit			0.00001	2

ND - None Detected

MCL - Maximum Contaminant Level (18 AAC 080)

TABLE 17. WATER QUALITY-PETROLEUM HYDROCARBONS CONTENT OF SAMPLE SP1 - MAY 1992 SAMPLING EVENT

Parameter	Concentration	Units	EPA Method	MRL	MCL
Benzene	ND	mg/L	8020	0.001	0.005
Toluene	ND	mg/L	8020	0.001	
Ethylbenzene	ND	mg/L	8020	0.001	
p & m Xylene	ND	mg/L	8020	0.001	
o-Xylene	ND	mg/L	8020	0.001	
1,4-Dichlorobenzene	ND	mg/L	8020	0.001	0.075
1,3-Dichlorobenzene	ND	mg/L	8020	0.001	
1,2-Dichlorobenzene	ND	mg/L	8020	0.001	
Diesel-range Hydrocarbons	ND	mg/L	8100M	1	
Total Petroleum Hydrocarbons	0.33	mg/L	418.1	0.1	

MRL - Method Reporting Limit
MCL - Maximum Allowable Contaminant Concentration Level (18 AAC 80.070)
ND - None Detected

TABLE 18. TAILING SURFACE SOIL SAMPLES - TOTAL METALS CONTENT

Sample	Date Sampled	Sample Depth	Soil Type	Arsenic mg/kg	Barium mg/kg	Cadmium mg/kg	Chromium mg/kg	Lead mg/kg	Mercury mg/kg	Selenium mg/kg	Silver mg/kg
TPS1	7/20/91	2"-10"	GM	353	13	7	3	ND	2.6	ND	12
TPS2	7/20/91	2"-12"	SM	456	12	27	ND	49	7.1	ND	20
TPS3	7/20/91	2"-14"	GM	283	9	11	ND	21	6.9	ND	11
TPS4	7/20/91	2"-10"	GM	244	9	30	ND	ND	5.1	ND	5
TPS5	7/20/91	2"-10"	GM	594	8	9	ND	ND	5.1	ND	4
TPS6	7/20/91	2"-8"	SM	961	14	14	ND	27	4.4	ND	5
TPS7	7/20/91	2"-10"	SM	596	23	19	ND	27	11.5	ND	11
TPS8	7/20/91	2"-16"	GW	591	14	28	ND	41	7.5	ND	12
TPS9	7/21/91	2"-12"	ML	670	12	26	ND	32	7.5	ND	15
TPS10	7/21/91	2"-18"	GW	336	13	10	ND	38	3.9	ND	10
TPS10	duplicate			339	9	5	ND	ND	2.6	ND	5
TPS11	7/21/91	4"-12"	SW	427	22	10	3	22	9.7	ND	14
TPS12	7/21/91	2"-6"	ML	1770	51	26	4	107	13	1	15
TPS13	7/21/91	0-8"	GW	250	6	29	ND	ND	15.3	ND	8
TPS14	7/21/91	2"-8"	ML	1230	34	66	ND	120	8.3	ND	16
TPS15	7/21/91	2"-8"	SM	1270	28	48	ND	58	14.1	ND	18
TPS16	7/21/91	2"-7"	GW	207	7	12	ND	ND	3.6	ND	5
TPS17	7/21/91	2"-6"	GW	1350	29	5	14	28	6.3	1	33
TPS18	7/21/91	2"-6"	GW	205	31	5	19	ND	2.2	ND	20
TPS19	7/21/91	2"-6"	ML	3500	162	65	7	251	51.8	2	118
TPS20	7/21/91	0-6"	ML	1690	95	26	11	336	30.9	1	31
TPS20	duplicate			1610	109	22	9	94	15.4	3	70
TPS21	7/21/91	2"-8"	ML	263	74	7	14	37	7.3	ND	6
TPS22	7/21/91	2"-6"	Cobbles	3530	20	2	ND	25	27.3	2	6
TPS23	7/21/91	NR	GP	639	9	5	ND	ND	6.7	ND	5
TPS24	7/21/91	duplicate of TPS10 - see above									
TPS25	7/21/91	duplicate of TPS20 - see above									
TPS26	5/21/92	2"-10"	GP	619	18	20	ND	36	5.1	ND	5
TPS27	5/21/92	2"-10"	SP	3981	50	37	ND	58	5.7	ND	33
TPS28	5/21/92	2"-10"	GP	557	23	15	8	25	2.8	ND	6
TPS29	5/21/92	2"-10"	GP	880	19	70	ND	82	9.9	ND	14
TPS29	duplicate			942	20	198	ND	70	7.4	ND	9
TPS30	5/21/92	duplicate of TPS29 - see above									
Method				7060	6010	6010	6010	6010	7471	7740	6010
Method Reporting Limit				1	1	1	2	20	0.2	1	2

Abbreviations: ND - not detected at the MRL
NR - not recorded

TABLE 19. TAILINGS SURFACE SOIL SAMPLES - TOTAL SULFIDE AND SYNTHETIC PRECIPITATION LEACHATE PROCEDURE, LEACHABLE METALS

Sample	Total Sulfide mg/kg	Leachable Metals (mg/l) Ag	As	Ba	Cd	Cr	Hg	Pb	Se
TPS1	ND	ND	ND	ND	ND	ND	ND	ND	ND
TPS2	ND	ND	ND	ND	ND	ND	ND	ND	ND
TPS3	ND	ND	ND	0.2	ND	ND	ND	ND	ND
TPS4	ND	ND	ND	0.2	ND	ND	ND	ND	ND
TPS5	ND	ND	ND	0.3	ND	ND	ND	ND	ND
TPS6	ND	ND	ND	0.3	ND	ND	ND	ND	ND
TPS7	ND	ND	ND	0.2	ND	ND	ND	ND	ND
TPS8	ND	ND	ND	0.1	ND	ND	ND	ND	ND
TPS9	ND	ND	ND	ND	ND	ND	ND	ND	ND
TPS10	ND	ND	ND	ND	ND	ND	ND	ND	ND
TPS10 duplicate	ND	ND	ND	ND	ND	ND	ND	ND	ND
TPS11	ND	ND	ND	ND	ND	ND	ND	ND	ND
TPS12	ND	ND	ND	ND	ND	ND	ND	ND	ND
TPS13	ND	ND	ND	ND	ND	ND	ND	ND	ND
TPS14	ND	ND	ND	ND	ND	ND	ND	ND	ND
TPS15	ND	ND	ND	ND	ND	ND	ND	ND	ND
TPS16	ND	ND	ND	ND	ND	ND	ND	ND	ND
TPS17	ND	ND	ND	ND	ND	ND	ND	ND	ND
TPS18	ND	ND	ND	ND	ND	ND	ND	ND	ND
TPS19	ND	ND	ND	ND	ND	ND	ND	ND	ND
TPS20	ND	ND	ND	ND	ND	ND	0	ND	ND
TPS20 - duplicate	ND	ND	ND	ND	ND	ND	ND	ND	ND
TPS21	ND	ND	ND	ND	ND	ND	ND	ND	ND
TPS22	ND	ND	ND	ND	ND	ND	ND	ND	ND
TPS23	ND	ND	ND	ND	ND	ND	ND	ND	ND
TPS24	duplicate of TPS10								
TPS25	duplicate of TPS 20								
TPS26	NA	ND	ND	ND	ND	ND	ND	ND	ND
TPS27	NA	ND	ND	ND	ND	ND	ND	ND	ND
TPS28	NA	ND	ND	ND	ND	ND	ND	ND	ND
TPS29	NA	ND	ND	ND	ND	ND	ND	ND	ND
TPS29 - duplicate	NA	ND	ND	ND	ND	ND	ND	ND	ND
TPS30	duplicate of TPS29								
Method	9030	1312	1312	1312	1312	1312	1312	1312	1312
MRL	25	0.01	0.1	0.1	0.1	0.01	0	0.05	0.1
RCRA MCL		5	5	100	1	5	0.2	5	1

Abbreviations:
MCL - Maximum Contaminant Level
MRL - Method Reporting Limit
NA - Not Analyzed
ND - Not Detected at MRL

TABLE 20. TAILINGS GEOPHYSICAL SURVEY SUMMARIZED RESULTS

Location	Surface Elevation (ft. a.m.s.l.)	Tailings Thickness (ft.)	Top of Till Elevation (ft. a.m.s.l.)	Till Thickness (ft.)	Top of Basalt Bedrock Elevation (ft. a.m.s.l.)
VES - 1	2,185.4	12.6	2,172.8	36.0	2,136.8
VES - 2	2,167.0	5.5	2,161.5	12.3	2,149.2
VES - 3	2,172.7	8.7	2,164.0	18.0	2,146.0
VES - 4	2,177.1	6.2	2,170.9	14.0	2,156.9
VES - 5	2,168.6	8.5	2,160.1	20.7	2,139.4
VES - 6	2,140.5	6.0	2,134.5	11.7	2,122.8
VES - 8	2,128.7	8.2	2,120.5	17.2	2,103.3
VES - 9	2,170.9	6.2	2,164.7	10.6	2,154.1
VES - 12	2,189.7	7.0	2,182.7	13.6	2,169.1
VES - 13	2,166.6	8.7	2,157.9	21.0	2,136.9
VES - 14	2,147.1	9.9	2,137.2	25.1	2,112.1
VES - 15	2,137.2	4.5	2,132.7	7.3	2,125.4
VES - 16	2,116.2	5.4*	Tailings overlie basalt	0	2,110.8
VES - 17	2,106.0	3.9*	Tailings overlie basalt	0	2,102.1
VES - 18	2,102.1	7.2	2,094.9	14.4	2,080.5
VES - 19	2,060.8	7.7*	2,053.1	11.4	2,041.7
VES - 20	2,081.4	4.8*	Tailings overlie basalt	0	2,076.6

* Tailings reworked by National Creek.

TABLE 22. LEACHING PLANT FUEL TANKS - RESIDUAL OIL VOLUMES

Tank	Depth of Oil (inches)	Volume of Oil (gallons)
1	1	445
2	2	890
3	1/2	220
4	1/2	220

(The cross-sectional area of the tanks is approximately 713 square feet. For these estimates, it is assumed that the tank bottoms are flat and level.)

TABLE 23. OIL BURNING SPECIFICATIONS AND CALORIFIC VALUES

Sample	Date Sampled	Type	Location	Arsenic mg/kg	Cadmium mg/kg	Chromium mg/kg	Lead mg/kg	PCBs mg/kg	Total Halogens mg/kg	Flash Point F	Calorific Value BTU/lb
BF1	7/27/91	Fuel oil	Fuel tank-4(2)	ND	1.1	ND	10.2	ND	ND	>160	16,400
BF2	7/27/91	Fuel oil	Fuel tank-4(1)	ND	1.3	ND	9.1	ND	166	>160	17,600
BF3	8/17/91	Fuel oil	Leaching Plant	3.3	ND	ND	40	ND	2,000	>160	13,800
CG1	7/26/91	Black grease	Bonanza	11.4	ND	ND	1.7	ND	ND	>160	16,500
CG2	8/17/91	Black grease	Mill town	9.8	4.3	ND	22.8	ND	368	>160	14,800
CG3	8/17/91	Yellow grease	Mill town	ND	ND	ND	ND	ND	139	>160	17,200
CG4	8/17/91	Yellow grease	Mill town	ND	1.9	ND	ND	ND	ND	>160	17,200
CG5	8/17/91	Black grease	Mill town	ND	2.5	ND	1	ND	315	>160	15,400
CO1	7/30/91	Transformer oil	Angle Station	4.1	ND	1.7	13.5	ND	130	>160	NA
CO2	8/17/91	Shaking table oil	Mill building	ND	ND	ND	ND	ND	ND	>160	18,500
CO3	8/17/91	Transformer oil	Mill town	ND	ND	ND	ND	ND	105	>160	18,900
CO4	8/17/91	Transformer oil	Mill town	ND	ND	ND	ND	ND	ND	>160	18,800
Method				EP40CFR2664							
Method Reporting Limit				1	0.5	1	1	1	100		
RCRA Allowable Limits				5	2	10	100	50	4,000	100 minimum	

Abbreviations:

NA - Not Analyzed

ND - Not Detected

PCBs - Polychlorinated biphenyls

TABLE 24. FUEL OIL VISCOSITY AND SPECIFIC GRAVITY MEASUREMENTS

Sample	Date Sampled	Sample Location	Specific Gravity	Viscosity Centipoise
BF4	5/22/92	Tank 4(1)	0.97	4,300
BF5	5/22/92	Tank 4(2)	0.92	8,360

TABLE 25. CONSOLIDATED OIL AND GREASE

Source	Volume (gallons)	55-gallon Drum Number
Plat-O slime tables and James Simplex tables	36	1
Leaching and Flotation Plant circuit breakers, transformers in the Mill Building and Transformer House	103	6, 7
Machine Shop, Leaching and Flotation Plant: black grease	15	2, 5
Leaching and Flotation Plant: yellow grease	65	3, 4

TABLE 21. SOIL ANALYTICAL RESULTS - PETROLEUM HYDROCARBON CONTENT

Sample	Date Sampled	Location	Sample Depth	Soil Type	Visible Oil Stain?	TPH mg/kg	Diesel mg/kg	Benzene mg/kg	Toluene mg/kg	Ethylbenzene mg/kg	Xylenes mg/kg	PCBs mg/kg
PH1	7/23/91	W of fuel tank-4(2)	1"-12"	GW	Yes	2,970	NA	ND	ND	ND	ND	NA
PH2	7/24/91	W of bldg 38	2"-8"	SM	No	3,600	NA	NA	NA	NA	NA	NA
PH3	7/24/91	W of bldg 38	NR	GW	No	170	NA	ND	ND	ND	ND	NA
PH4	7/24/91	W of fuel tank-4(2)	2"-6"	SW	Yes	61,000	30,000	ND	ND	ND	ND	NA
PH5	7/24/91	W of sewer pipe	2"-10"	GW	Yes	9,900	NA	NA	NA	NA	NA	NA
PH6	7/24/91	W of bldg 38	2"-8"	GW	No	2,600	NA	ND	ND	ND	ND	NA
PH7	7/24/91	S of bldg 38	2"-10"	Pt	Yes	110,000	NA	NA	NA	NA	NA	NA
PH8	7/24/91	W of Power Hse	4"-12"	GW	Yes	490	NA	ND	ND	ND	ND	NA
PH9	7/24/91	W of Power Hse	3"-10"	GW	Yes	28,000	NA	NA	NA	NA	NA	NA
PH10	7/24/91	W of oil pools	NR	SM	No	97	NA	NA	NA	NA	NA	NA
PH10	7/24/91	duplicate	NR	SM	No	91	NA	NA	NA	NA	NA	NA
PH11	7/24/91	W of fuel tank-4(3)	NR	SM	No	118	NA	NA	NA	NA	NA	NA
PH12	7/24/91	W of fuel tank-4(3)	NR	SM	No	97	ND	ND	ND	ND	ND	NA
PH13	7/24/91	W of oil pools	NR	Oily sludge	Yes	620,000	270,000	ND	ND	ND	ND	NA
PH14		No sample taken										
PH15		duplicate of PH10 - see above										
PH16	7/26/91	Bonanza mine, Transf.	NR	SM	Yes	37,200	NA	NA	NA	NA	NA	ND
PH17	7/29/91	Nr fuel tank-4(1)	2"-6"	Pt	Yes	28,000	NA	NA	NA	NA	NA	NA
PH18	7/29/91	Nr fuel tank-4(1)	2"-6"	Pt	No	3,500	NA	NA	NA	NA	NA	NA
PH19	7/29/91	Nr fuel tank-4(1)	2"-6"	Pt	Yes	120,000	54,000	ND	ND	ND	ND	NA
PH20	7/29/91	Utilidor	2"-12"	Pt	Yes	320,000	250,000	ND	ND	ND	ND	NA
PH21	7/29/91	Utilidor	2"-8"	Pt	No	240	NA	NA	NA	NA	NA	NA
PH22	7/29/91	Utilidor	4"-8"	Pt	Yes	37,000	NA	NA	NA	NA	NA	NA
PH23	7/29/91	Utilidor	2"-12"	Pt	Yes	110,000	NA	NA	NA	NA	NA	NA
PH24	7/29/91	Nr bldg 13c	2"-6"	Pt	No	940	NA	NA	NA	NA	NA	NA
PH30	6/19/92	North of mill building	surface sample	GM	Yes	100,000	PH30 hydrocarbon scan 57,000 mg/kg lube oil					
PH31	6/19/92	North of mill building	surface sample	GM	Yes	55,000	PH31 hydrocarbon scan 30,000 mg/kg lube oil					
PH32	6/19/92	North of mill building	surface sample	GM	Yes	500						
PH33	6/19/92	North of mill building	surface sample	GP	Yes	500	Method 8015M, MRL = 10 mg/kg					
Method						418.1	3550/8100	5030/8020	5030/8020	5030/8020	5030/8020	3540/8080
MRL						variable	variable	0.05	0.05	0.05	0.05	1

Abbreviations MRL - Method Reporting Limit
TPH - Total Recoverable Petroleum Hydrocarbons
PCBs - Polychlorinated Biphenyls
ND - Not Detected at MRL
NA - Not Analyzed
NR - Not Recorded

1/10 hydrocarbon to Soil

TABLE 26. BOILER ASH: TOTAL RCRA METALS CONCENTRATIONS

Sample	Location	Concentrations (mg/kg)							
		Arsenic	Barium	Cadmium	Chromium	Lead	Mercury	Selenium	Silver
BA1	Ash pile west of Power House	NA	NA	NA	NA	NA	NA	NA	NA
BA2	Ash pile west of Power House	145	170	ND	107	18900	2.6	ND	59
BA3	Ash pile west of Power House	77	222	100	113	8650	3.5	ND	403
Method		7060	6010	6010	6010	6010	7471	7740	6010
Method Reporting Limit		1	10	10	20	200	0.2	1	20

Abbreviatio NA - Not Analyzed

ND - Not Detected

TABLE 27. BOILER ASH - TCLP RCRA METALS

Sample	Concentrations (mg/L)							
	Arsenic	Barium	Cadmium	Chromium	Lead	Mercury	Selenium	Silver
BA1	ND	0.9	0.1	ND	72.4	ND	ND	ND
BA2	ND	1.1	0.1	ND	71.3	ND	ND	ND
BA3	ND	1	0.12	ND	45.8	ND	ND	0.01
Regulatory Limit	5	100	1	5	5	0.2	1	5
Method Reporting Limit	0.1	0.1	0.01	0.01	0.05	0.001	0.1	0.01
Method	3010	3010	3010	3010	3010	7470	3010	3010

Abbreviations: ND - Not Detected at MRL

TABLE 28. LEAD AND CADMIUM CONTENT OF BUILDING PAINTS

Sample	Color	Location (building no.)	Concentrations (mg/kg): Cadmium	Lead
BP1	white	9	112	276,000
BP2	red	9	11	7,980
BP3	red	15	4	1,270
BP4	white	48	2	11,900
BP5	red	48	3	336,000
BP6	white	20	ND	11,900
BP7	yellow	7	282	268,000
BP8	white	14	59	249,000
BP9	red	6	6	50
Maximum Allowable Level			---	600*
Method Reporting Limit			1	20
Method			6010	6010

Abbreviations:
--- Not Applicable
ND - Not Detected at MRL
* - 29 CFR 1025

TABLE 29. CONDITION OF THE EXTERIOR PAINT ON BUILDINGS AT KENNICOTT

Building Number	Building Color (B - Body Color, T - Trim Color)	Percentage of Area Peeling or Bare Wood (B - Body Color, T - Trim Color)			
		North	South	West	East
1	B - Red T - White	10 B 70 T	70 B 70 T	80 B 80 T	50 B 100 T
2, 3	B - Red T - White	50 B 100 T	65 B 80 T	70 B 80 T	50 B 50 T
5	B - Red T - White	65 B 36 T	91 B 60 T	92 B 86 T	20 B 41 T
7	B - Red T - White	64 B 72 T	91 B 84 T	80 B 58 T	64 B 72 T
8	B - Red T - White	40 B 40 T	40 B 40 T	40 B 40 T	40 B 40 T
9	B - Red T - White	10 B 100 T	15 B 10 T	10 B 100 T	30 B 30 T
13a to 13 f	B - Red T - White	10 B 40 T	20 B 50 T	10 B 40 T	20 B 30 T
14	B - Red T - White	60 B 70 T	90 B 95 T	60 B 90 T	60 B 70 T
15	B - Red T - White	60 B 100 T	50 B 80 T	60 B 90 T	70 B 60 T
18	B - Red T - White	30 B 68 T	40 B 91 T	60 B 98 T	38 B 74 T
19	B - Red T - White	52 B 97 T	65 B 72 T	73 B 98 T	51 B 85 T
20	B - Red T - White	24 B 70 T	37 B 85 T	52 B 82 T	10 B 70 T
23	B - Red T - White	74 B 90 T	29 B 82 T	53 B 86 T	28 B 80 T
26	B - Red T - White	97 B 100 T	NA*	93 B	76 B 84 T
27	B - Red T - White	0 B 0 T	0 B 0 T	0 B 0 T	0 B 0 T
28	B - Red T - White	6 B 40 T	81 B 99 T	30 B 88 T	10 B 68 T
29c	B - Red T - White	37 B 88 T	20 B 94 T	20 B 91 T	10 B 75 T

TABLE 29. CONDITION OF THE EXTERIOR PAINT ON THE BUILDINGS AT KENNICOTT (continued)

Building Number	Building Color (B - Body Color, T - Trim Color)	Percentage of Area Peeling or Bare Wood (B - Body Color, T - Trim Color)			
		North	South	West	East
1	B - Red T - White	10 B 70 T	70 B 70 T	80 B 80 T	50 B 100 T
30a	B - Red T - White	5 B 0 T	52 B 19 T	20 B 10 T	10 B 35 T
30b	B - Red T - White	24 B 85 T	60 B 88 T	40 B 92 T	80 B 88 T
30c	B - Red T - White	20 B 90 T	60 B 70 T	40 B 80 T	10 B 61 T
32a	B - Red T - White	10 B 60 T	10 B 90 T	15 B 90 T	10 B 60 T
32b	B - Red T - White	90 B 60 T	10 B 100 T	10 B 100 T	10 B 65 T
32c	B - Red T - White	10 B 75 T	15 B 80 T	10 B 85 T	90 B 60 T
32d	B - Red T - White	25 B 90 T	10 B 85 T	20 B 90 T	25 B 85 T
34	B - Red T - White	10 B 79 T	70 B 65 T	76 B 68 T	10 B 44 T
36	B - Red T - White	10 B 70 T	10 B 40 T	60 B 50 T	13 B 40 T
37	B - Red T - White	30 B 70 T	20 B 40 T	5 B 70 T	30 B 35 T
47	B - Red T - White	4 B 80 T	22 B 36 T	42 B 80 T	0 B 55 T
48	B - Red T - White	28 B 72 T	20 B 28 T	34 B 52 T	10 B 49 T

Abbreviations: NA - Not Accessible

TABLE 30. ESTIMATED AREA OF LEAD PAINT COVER

Building Number	Facing Wall				Total
	North	South	West	East	
1	1,102	669	1,015	1,130	3,916
2,3	13,340	13,340	14,981	0	41,661
5	1,504	1,504	560	560	4,128
7	3,520	3,520	2,016	2,016	11,072
8	280	280	120	120	800
9	1,132	1,132	3,048	3,048	8,360
12	380	380	1,440	1,440	3,640
13a to 13f	248	248	336	336	7,008
14	1,504	1,504	560	560	4,128
15	3,120	2,880	6,144	6,144	18,288
18	320	320	400	400	1,440
19	960	960	800	1,200	3,920
20	2,850	2,850	1,463	975	8,138
23	720	720	360	360	2,160
28	480	480	1,328	1,328	3,616
29a to 29c,29f	240	240	336	336	4,608
30a to 30c	240	240	336	336	3,456
32a to 32d	248	248	200	200	3,584
34	120	120	240	240	720
36	780	780	1,488	1,488	4,536
37	375	375	270	270	1,290
39a to 39c	320	320	248	248	3,408
47	192	192	256	128	768
			Total Square Feet		144,645

TABLE 31. ESTIMATED AREA OF PEELING PAINT

Building Number	Facing Wall				Total
	North	South	West	East	
1	110	468	812	565	1,955
2,3	6,670	8,671	10,486	210	26,037
5	978	1,369	515	112	2,974
7	2,253	3,203	1,290	1,613	8,359
8	112	112	48	48	320
9	113	170	305	914	1,502
13a to 13f	150	300	204	402	1,056
14	902	1,354	336	336	2,928
15	1,872	1,440	3,686	4,300	11,298
18	96	128	240	152	616
19	500	624	584	612	2,320
20	684	1,055	761	497	2,997
23	532	209	191	83	1,015
28	29	389	398	133	949
29a to 29c,29f	356	192	268	136	952
30a	12	125	67	34	238
30b	58	144	134	269	605
30c	48	144	134	34	360
32a	25	25	30	20	100
32b	223	25	20	20	288
32c	25	37	20	180	262
32d	62	25	40	50	177
34	12	84	182	24	302
36	78	78	893	193	1,242
37	113	75	14	81	283
47	8	42	128	107	285
			Total Square Feet		69,420

TABLE 32. LEAD CONTENT OF SOILS NEAR SELECTED BUILDINGS

Sample	Date Sampled	Location	Sample Depth	Soil Type	Total Lead Content mg/kg
BPS1	5/21/92	1 ft. from south side bldg 19	2"-6"	GP	465
BPS2	5/21/92	1 ft from south side bldg 14	2"-6"	GW	766
BPS3	5/21/92	1 ft from south side bldg 1	2"-12"	PT	1,170
BPS4	5/21/92	1 ft from west side bldg 3	2"-5"	GW	557
BPS5	5/21/92	1 ft from west side bldg 9	2"-8"	PT	1,340
BPS6	5/21/92	duplicate sample of BPS5			3,040
BPS7	8/3/92	3 ft from south side bldg 1	2"-6"	PT	161
BPS8	8/3/92	6 ft from south side bldg 1	2"-6"	PT	123
BPS9	8/3/92	9 ft from west side bldg 1	2"-6"	PT	56
BPS10	8/3/92	3 ft from west side bldg 9	2"-6"	GW	183
BPS11	8/3/92	6 ft from west side bldg 9	2"-6"	GW	249
BPS12	8/3/92	9 ft from west side bldg 9	2"-6"	GW	608
BPS13	8/3/92	duplicate sample of BPS12			866

TABLE 33. AMMONIA TANK SOLUTION ANALYSES

	Sample NH1	Sample NH2	Method Reporting Limit (MRL)	RCRA Allowable Limit	Analytical Method
Location	Tank #2	Tank #3			
Date Sampled	7/22/91	7/22/91			
Ammonia Concentration (mg/L)	1676	1069	0.05		EPA 350.3
Metals in Solution (mg/L):					
Arsenic	0.606	0.243	0.005	5	7060
Barium	0.041	0.03	0.005	100	6010
Cadmium	ND	ND	0.003	1	6010
Chromium	ND	ND	0.005	5	6010
Lead	0.065	0.017	0.002	5	7421
Mercury	ND	ND	0.0005	0.2	7470
Silver	ND	ND	0.01	5	6010
Conductivity, uS/cm	1300	1500			Hydac meter
pH	9.32	9.5		<12.5	Hydac meter
Tank Headspace Ammonia Concentration (ppm)	>700	400			Draeger tube; approx. values only
				RCRA limit = TCLP limit	

Abbreviation: ND - not detected at MRL

TABLE 34. ORE CONCENTRATES: TOTAL METALS AND SULFIDE CONCENTRATIONS

Sample	Location	Concentrations (mg/kg): Sulfide	Arsenic	Barium	Cadmium	Chromium	Lead	Mercury	Selenium	Silver
OC1	Mother Lode mine	NA	5200	216	24	12	43	58.8	5	56
OC2	Main ore bin, Mill Bldg.	1490	3130	98	23	5	78	40.6	8	34
OC3	Hancock Jig, Mill Bldg.	444	2490	104	23	ND	140	33.5	3	54
OC4	Dorr Thickener, Mill Bldg.	300	3080	124	32	3	60	31.7	2	27
OC5	High grade bin, Mill Bldg.	68	6570	254	35	2	255	66.3	6	108
OC6	Ore bin, Mill Bldg.	656	11300	180	ND	13	173	131	9	197
OC7	Leach Plant tailings.	ND	350	8	13	ND	15	5.1	ND	8
OC8	Dorr Thickener, Leach Plant.	272	3740	118	37	4	96	20.9	2	20
OC9	Dorr Thickener, Leach Plant.	965	4280	122	50	3	121	31.6	3	30
OC10	Dorr Thickener, Leach Plant.	54	7030	154	44	5	211	155	8	144
Method Reporting Limit		20	20	1	1	2	20	0.2	1	2
Method (EPA)		9030	6010	6010	6010	6010	6010	7471	7740	6010

Abbreviations: NA - Not Analyzed
ND - Not Detected

TABLE 35. CHALCOCITE ORE ANALYSIS

Sample	Date Sampled	Location	Metals (mg/kg)									Sulfide (ppm)
			Arsenic	Barium	Cadmium	Chromium	Copper	Lead	Mercury	Selenium	Silver	
OC11	7/26/91	Glacier Mine	29	ND	2	ND	773,000	58	148	ND	245	>100,000
Method			7060	6010	6010	6010	6010	6010	7471	7740	6010	SW-846/9030M
Method Reporting Limit			1	1	1	2	2	20	0.2	1	2	-

Abbreviations: ND - Not Detected

TABLE 36. ORE CONCENTRATES: SYNTHETIC PRECIPITATION LEACHATE PROCEDURE, LEACHABLE METALS (EPA METHOD 1312)

Sample	Concentrations (mg/L):							
	Arsenic	Barium	Cadmium	Chromium	Lead	Mercury	Selenium	Silver
OC1	ND	ND	ND	ND	ND	ND	ND	ND
OC2	ND	ND	ND	ND	ND	ND	ND	ND
OC3	ND	ND	ND	ND	ND	ND	ND	ND
OC4	ND	ND	ND	ND	ND	ND	ND	ND
OC5	ND	0.1	ND	ND	ND	ND	ND	ND
OC6	ND	ND	ND	ND	ND	ND	ND	ND
OC7	ND	ND	ND	ND	ND	ND	ND	ND
OC8	ND	0.1	ND	ND	ND	ND	ND	ND
OC9	ND	ND	ND	ND	ND	ND	ND	ND
OC10	ND	ND	ND	ND	ND	0.007	ND	ND
Regulatory Limit (RCRA)	5	100	1	5	5	0.2	1	5
Method Reporting Limit	0.1	0.1	0.01	0.01	0.05	0.001	0.1	0.01
Method	3010/6010	3010/6010	3010/6010	3010/6010	3010/6010	7470	3010/6010	3010/6010

Abbreviation: ND - Not detected at method reporting limit

TABLE 37. FIREBRICK CHROMIUM CONTENT

Sample	Location	Type	Chromium (mg/kg): Total	Hexavalent	Trivalent
FB-1	Outside north end	Firebrick, non-specific	3	NA	NA
FB-2	of	Leclede-King firebrick	7	ND	7
FB-3	Power House	Evens-Howard firebrick	2	ND	2
Method			6010	3060/7195/ 6010	Difference
Method Reporting Limit:			1	0.05	1

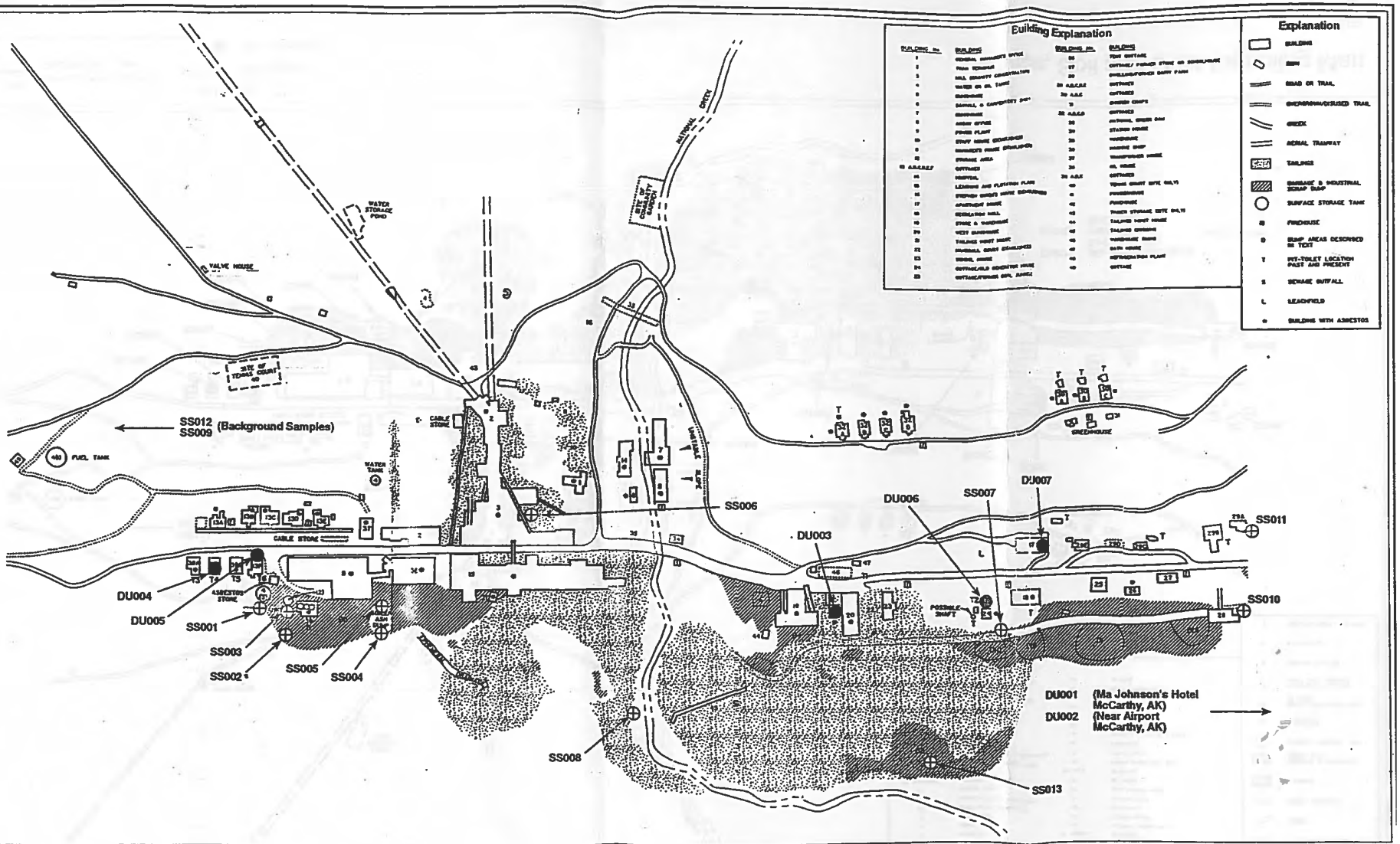
Abbreviations: NA - Not Analyzed
ND - Not Detected at method reporting limit

TABLE 38. WASTE PRODUCTS PACKAGED AND SHIPPED

Waste Product Questionnaire (WPQ) and Drum Number	Waste Product Description or Drum Contents	Quantity of Waste Product	Origin of Waste Product
Wastes shipped off site:			
AK2138, drum K1	White powder - quinine sulfate	10 lb	Building 14
AK2140, drums K3, K4	Multicolored powders	50 lb	Buildings 8, 14, 19
AK2143, drums ANI-2, ANI-5	Black grease	200 lb	Buildings 2/3, 15, 36
AK2688, drum K9	Sulfur powder and rust	150 lb	Building 15
AK2689, drum K12	Phenol	5 gallons	Building 19
AK2690, drum K17	Waste flammable liquids	2 gallons	Building 15
AK2691, drums K2, K11, K16	Corrosive solid powders	200 lb	Buildings 15, 19, 36
AK2694, drum K14	Lead-acid batteries	300 lb	General site
AK2695, drum K13	Zinc-air batteries	275 lb	Dump
Wastes remaining on site:			
Drum ANI-1	Lube oil	36 gallons	Building 2/3
Drum ANI-3	Yellow grease	50 gallons	Buildings 2/3, 15
Drum ANI-4	Yellow grease	15 gallons	Buildings 2/3, 15
ANI-6	Electrical oils	55 gallons	Mill town
ANI-7	Electrical oils	48 gallons	Mill town

See text for explanation of terms.

Appendix C-3 – Data from Roy F. Weston, Inc. 1995. Site Inspection Report, Kennicott Mine, Kennicott, Alaska.



0 125 250
Scale in Feet

Source: America North/ EMCON, Inc., 1992

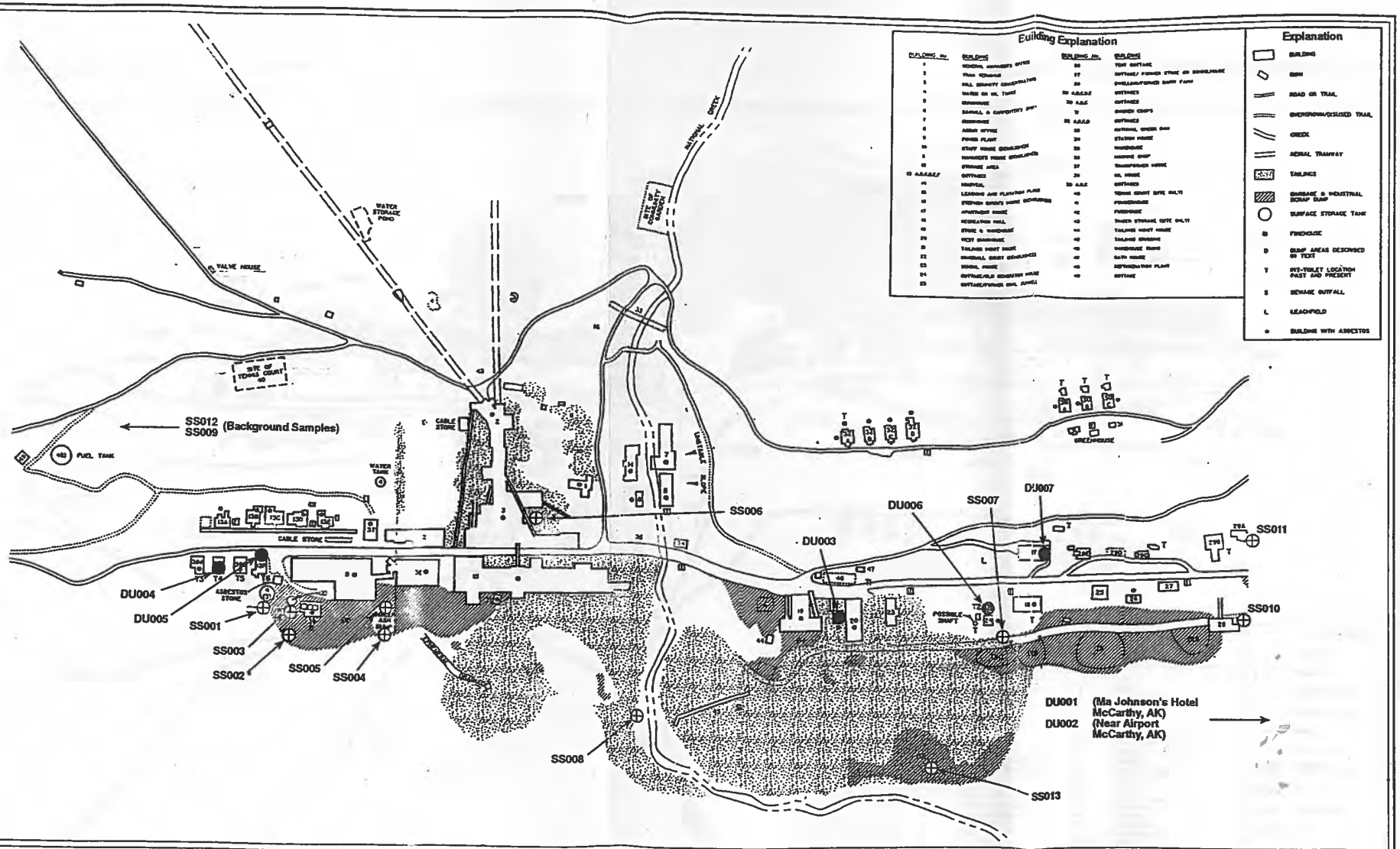
EXPLANATION
- ⊕ Soil Samples
- ● Dust Samples

WESTON MANAGERS DESIGNERS/CONSULTANTS

4000-10-10-1100
April 1995

Source, Soil and Dust Sampling Map

FIGURE
3-1



0 125 250
Scale in Feet

Source: America North/ EMCON, Inc., 1992

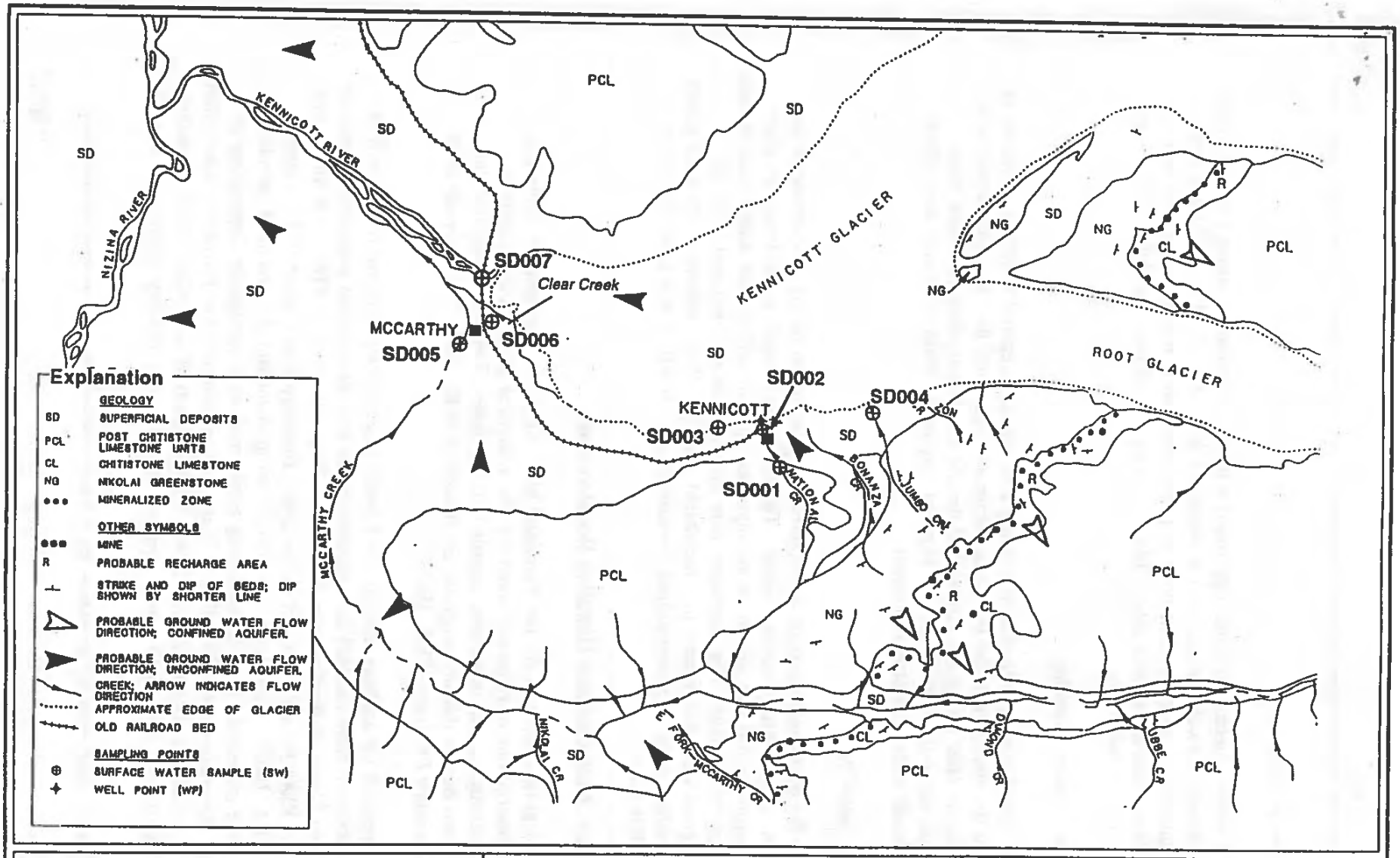
EXPLANATION
- Soil Samples
- Dust Samples

WESTON
MANAGERS DESIGNERS/CONSULTANTS

4000-15-10-1100
April 1995

Source, Soil and Dust Sampling Map

FIGURE
3-1



Source: America North/ EMCON, Inc., 1992

Surface Water and Sediment Sampling Map

WESTON MANAGERS DESIGNERS/CONSULTANTS

4000-19-10-4100
April 1995

FIGURE
3-2

Table 3-1—Sample Types, Numbers, Locations, and Rationale

Sample Matrix	Number of Samples Collected	Sample Type(s)	Sample Location(s)	Rationale
Soil (including material from wastepiles)	20	Seven surface (0-12") grab samples	Power plant oil spill (4, including one duplicate), boiler ash pile (2), tailings pile drum dump (1)	Characterize potential sources
		Two surface (0-12") grab samples	Background locations north of the mill town	Characterize background conditions
		Five soil surface and subsurface intervals (only five out of six actually taken due to shallowness of tailings at Station SS006)	Three locations in the tailings pile	Characterize tailings pile as a potential source
		Six hand auger boring intervals at 0"-2", 2"-6", and 6"-12"	Two off-site locations south of the mill town	Assess potential for particulate migration
Sediment	8	Three 0 to 6 inch grab samples	National Creek including one background sample above mill town, one in the tailings pile, and one below the tailings pile	Establish background and downgradient conditions to assess potential migration from source areas
		One 0 to 6 inch grab sample	Jumbo Creek	Assess potential migration from mines along Bonanza Ridge
		One 0 to 6 inch grab sample	McCarthy Creek background location	Establish background conditions
		Two 0 to 6 inch grab samples	Clear Creek surface water intakes (includes one duplicate)	Assess potential releases to surface water near intakes
		One 0 to 6 inch grab sample	Kennicott River	Assess potential migration from source(s)

(Continued)

Table 3-1—Sample Types, Numbers, Locations, and Rationale

Sample Matrix	Number of Samples Collected	Sample Type(s)	Sample Location(s)	Rationale
Surface Water	5	One grab sample	National Creek background location	Characterize background conditions
		One grab sample	McCarthy Creek background location	Characterize background conditions
		Two grab samples	Clear Creek surface water intakes (includes duplicate)	Assess potential releases to surface water near intakes
		One grab sample	Seep below leaching and flotation plant	Assess potential migration to surface water from tailings pile
Dust	8	Eight wipe samples	Mill town and McCarthy buildings (includes one blank)	Assess potential migration of airborne particulates
QA/QC	3	Transfer blank	Not applicable	Assess potential contamination of samples from sampling procedures
		Two trip blanks	Not applicable	Assess potential contamination of volatiles during shipping
Total	44			

Table 3-2—Sample Analytical Requirements

Sample Matrix	Number of Samples Collected	Sample Location(s)	Analytical Requirements	Analytical Program[a]	Preservation Technique	Maximum Holding Time
Soil (including material from waste piles)	8	Soil from power plant oil spill (4, including one duplicate) Tailings pile drum dump (1) Tailings pile subsurface sample at road cut (1) Background soil north of the mill town (2)	VOCs, BNAs, Pesticides, PCBs metals particle size (surface tailings pile sample only)	CLP RAS CLP RAS EPA Lab	ice none none	14 days[b] 6 months none
	2	Boiler ash pile	BNAs metals	CLP RAS CLP RAS	ice none	14 days[b] 6 months
	10	Surface and/or subsurface intervals from two locations in the tailings pile (3) Tailings pile surface sample at road cut (1) 0-2",2"-6", and 6"-12" soil sample intervals from two locations south of the mill town (6)	metals particle size (one surface tailings pile sample only)	CLP RAS EPA Lab	none none	6 months none
Sediment	4	National Creek background (1) McCarthy Creek background (1) Clear Creek surface water intakes (2; including duplicate)	VOCs, BNAs, Pesticides, PCBs metals	CLP RAS CLP RAS	ice none	14 days[b] 6.months

(Continued)

Table 3-2—Sample Analytical Requirements

Sample Matrix	Number of Samples Collected	Sample Location(s)	Analytical Requirements	Analytical Program[a]	Preservation Technique	Maximum Holding Time
Sediment	4	National Creek (2) Jumbo Creek (1) Kennicott River (1)	metals	CLP RAS	none	6 months
Surface Water	5	National Creek background location (1) McCarthy Creek background location (1) Clear Creek surface water intakes (2; includes duplicate) Seep below leaching and flotation plant (1)	metals (low concentration)	EPA Lab	HNO_3 to pH < 2; ice	6 months
Dust	8	Mill town and McCarthy buildings (includes one blank)	priority pollutant metals (excluding mercury)	EPA Lab	none	6 months
QA/QC (surface water)	1	Transfer blank	metals (low concentration)	EPA Lab	HNO_3 to pH < 2; ice	6 months
QA/QC (soil/ sediment	2	Trip blanks	VOCs	CLP RAS	HCL to pH < 2; ice	14 days

[a] Labs are specified in the following manner:
EPA Lab: Analysis performed by EPA Region X Lab
CLP RAS: Analysis performed under CLP contract, Routine Analytical Services

[b] For volatiles, extraction and analysis must be performed within 14 days; for BNAs, pesticide, and PCBs, extraction must occur within 14 days and analysis within 40 days.

Table 4-1—Source Characteristics: Power Plant Oil Spill and Boiler Ash Pile - Inorganics (mg/kg)[a]

Analyte	Background		Power Plant Oil Spill				Boiler Ash Pile	
	SS009-0	SS012-0	SS001-0	SS002-0	SS002-1 (dup.)	SS003-0	SS004-0	SS005-0
Antimony	0.52 UJ	0.78 UJ	**479 J**	0.55 UJ	0.42 UJ	1.3 UJ	165 J	10.6 J[c]
Arsenic	5.2	6.4 J	**50.7 J**	5.3	9.6	**47.7**	59	194
Barium	28.5 J[b]	31.9 J[b]	**316 J**	31.1 J[d]	36.4 J[d]	**209**	104	88.4
Beryllium	0.2 U	0.33 J[c]	0.25 U	0.2 U	0.2 U	0.21 U	0.21 U	0.42 J[c]
Cadmium	0.2 U	0.21 UJ	**4.5 J**	0.2 U	0.2 U	**1.8**	2.6	5.1
Chromium	21	17.6	20.1	12.3	12.7	18.1	96.7	10.2
Cobalt	10.6	10.1 J[c]	**68.7**	8.6 J[d]	8.2 J[d]	**34.1**	29.9 J[c]	6.8 J[c]
Copper	74.5 J	35.6 J	**1,690 J**	48 J	61.1 J	**1,660 J**	2,940 J	3,140 J
Lead	2.4	6.1 J	**359 J**	13.5	14.3	**351**	4,000	557
Manganese	303 J	330 J	306 J	234 J	269 J	215 J	1,980 J	205 J
Mercury	0.05 U	0.05 U	**1.3**	0.05 U	0.05 U	**0.44**	0.4	2.6
Nickel	20.9	19.5 J	**1,500 J**	29	34.3	**758**	118	37.2
Selenium	0.82 UJ	0.86 UJ	**3.5**	0.81 UJ	0.81 UJ	**9.4**	0.85 UJ	1.0 J[c]
Silver	0.61 U	0.64 U	0.76 U	0.61 U	0.61 U	0.62 U	6.3 U	1.8 J[c]
Thallium	1.4 UJ	1.5 UJ	1.8 UJ	1.5 J[d]	1.4 UJ	1.4 UJ	1.5 UJ	1.6 UJ
Vanadium	38.7	23.4 J	**1,800 J**	35.6	43.8	**1,010**	84 J[c]	42.7
Zinc	35.9 J	27.7 J	**185 J**	35.7 J	36.5 J	**266 J**	608 J	353 J

[a] All source samples were collected from 0 to 1 foot below the surface.
[b] Where no background values were detected above the contract-required detection limit (CRDL), the lower CRDL from the CLP, adjusted for percent solids, was used
[c] Value positively identified but the concentration is below the CRDL.
[d] Values positively identified but at concentrations below the CRDL were not used to determine areas of observed contamination.

Bold values qualify as areas of observed contamination.

U indicates that the value was not detected.

J indicates that the contaminant was positively identified but the associated numerical value is an estimated quantity because quality control criteria were not met

Table 4-2—Source Characteristics: Power Plant Oil Spill - Organics (ug/kg)

Analyte	Background		Power Plant Oil Spill[a]			
	SS009-0	SS012-0	SS001	SS002-0	SS002-1	SS003-0
Volatile Organic Compounds						
1,1,2,2-Tetrachloroethane	10 U	11 U	1 J[b]	1 J[c]	1 J[b]	10 U
Xylene (total)	10 U	11 U	1 J[b]	1 J[c]	10 U	10 U
Toluene	10 U	11 U	11 U	2 J	10 U	10 U
Semivolatile Organic Compounds						
Phenanthrene	330 U	360 U	7300 J[b]	10000 U	51000 U	11000 J[b]
Pyrene	330 U	360 U	8700 J[b]	44000	75000	14000 J[b]
Chrysene	330 U	360 U	57000 U	32000	43000 J[b]	7700 J[b]
Fluoranthene	330 U	360 U	57000 U	3100 J[b]	9500 J[b]	52000 U
Benzo(a)anthracene	330 U	360 U	57000 U	16000	21000 J[b]	52000 U
Benzo(a)pyrene	330 U	360 U	57000 U	12000	51000 U	52000 U
Benzo(b)fluoranthene	330 U	360 U	57000 U	10000 U	8100 J[b]	52000 U
Benzo(k)fluoranthene	330 U	360 U	57000 U	10000 U	12000 J[b]	52000 U

[a] All source samples were collected from 0 to 1 foot below the surface.
[b] Value positively identified below CRQL.
[c] This analyte was not detected when this sample was reanalyzed.

Organic analytical results from the Power Plant Oil Spill samples were not used for source characterization.

U indicates that the value was not detected above its CRQL.

J indicates that the contaminant was positively identified but the associated numerical value is an estimated quantity because quality control criteria were not met.

Table 4-4—Source Characteristics: Tailings Pile - Inorganics (mg/kg)

Analyte	SS006-0010 S. of mill bldg. 0-1'	SS007-0010 near cottage 24 0-1'	SS007-0040 near cottage 24 4-5'	SS008-0010 roadcut below L&F plant 0-1'	SS008-0050 roadcut below L&F plant 5'(grab)	SS013-0 drum dump 0-1'
Antimony	6.8 J*	1.7 UJ	0.76 UJ	0.47 UJ	0.76 UJ	3.3 J*
Arsenic	477	705	530	186	372	515 J
Barium	80	13.6 J*	12.8 J*	4.7 J*	7.6 J*	65.2 J
Cadmium	6.7	13	11.8	12.9	15.2	16.9 J
Chromium	3.7	8.1	1.6 J*	1.9 J*	0.97 J*	10.9
Cobalt	11.2 U	5.3 J*	11.4 U	11.1 U	11.2 U	11.1 U
Copper	17,800 J	29,400 J	5,460 J	2,920 J	3,410 J	6,240 J
Lead	166	31.6	15.8	4.5	2.8	539 J
Manganese	144 J	171 J	105 J	116 J	113 J	392 J
Mercury	4.6	3.6	6.5	1.7	1.8	5.5
Nickel	7.1 U	9.4	7.2 U	7.0 U	7.1 U	8.3 J
Silver	13.1	16.6	16	3.4 J*	3.0 U	11.6
Vanadium	6.8 J*	20.2	4.0 J*	6.7 J*	6.0 J*	8.4 J
Zinc	21.4 J	103 J	3.3 UJ	6.9 J*	3.7 UJ	128 J

* Value positively identified below CRDL.
See Table 4-1 for background sample results.
U indicates that the value was not detected.
J indicates that the contaminant was positively identified but the associated numerical value is an estimated quantity because quality control criteria were not met.

Note: Beryllium, selenium, and thallium were not detected (qualified U) in any sample.

Table 4-5—Inorganics In Sediment - National Creek and Kennicott River (mg/kg)

Analyte	SD001-0 National Creek background	SD004-0 Jumbo Creek background	SD002-0 National Creek (tailings pile)	SD003-0 National Creek (below tailings)	SD007-0 Kennicott River
Antimony	1.0 UJ	1.6 UJ	0.87 UJ	0.53 UJ	0.75 UJ
Arsenic	12.4	16.2	**129**	**103**	9.3
Barium	116	45.6 J*	136	48.9 J*	31.2 J*
Cadmium	0.26 U	0.26 U	**5.5**	**15.7**	0.25 U
Chromium	13.6	21.8	12.5	10.2	12.4
Cobalt	10.4 J*	23.9	12.6 J*	6.9 J*	7.0 J*
Copper	33.9 J	113 J	**1,100 J**	**1,050 J**	33.3 J
Lead	5.1	0.78 U	11.3	8.3	1.9
Manganese	864 J	448 J	982 J	311 J	242 J
Mercury	0.17	0.06 U	0.41	**0.84**	0.08 J*
Nickel	23.5	36.2	22.1	12.3	13.8
Silver	0.78 U	0.78 U	0.8 U	1.0 J*	0.74 U
Vanadium	39	97.6	46	21.6	32.3
Zinc	64.4 J	51 J	78.4 J	38.2 J	32.2 J

* Values positively identified below CRDL were not used for observed release determination.
Bold values qualify as observed releases.
U Indicates that the value was not detected.
J Indicates that the contaminant was positively identified but the associated numerical value is an estimated quantity because quality control criteria were not met.

Note: Beryllium, selenium, and thallium were not detected (qualified U) in any release sample.

Table 4-6—Inorganics in Clear Creek Sediment (mg/kg)

Analyte	SD004-0 Jumbo Creek background	SD005-0 McCarthy Creek background	SD006-0 Clear Creek	SD006-1 Clear Creek (duplicate)
Antimony	1.6 UJ	0.96 UJ	2.0 UJ	1.9 UJ
Arsenic	16.2	5.7	21.1	22.8
Barium	45.6*	93.5	97.3 J*	90.4 J*
Cadmium	0.26 U	0.27 U	0.92 J*	0.49 U
Chromium	21.8	22.1	37.7	32
Cobalt	23.9	9.4 J*	15.5 J*	16.1 J*
Copper	113 J	29.7 J	475 J	278 J
Lead	0.78 U	3.9	11.1	9.0
Manganese	448 J	375 J	526 J	511 J
Mercury	0.06 U	0.07 U	0.29 J*	0.16 J*
Nickel	36.2	22.5	34.4	27.3
Vanadium	97.6	48.4	66.3	64.1
Zinc	51 J	62.4 J	94.6 J	81.5 J

* Value positively identified below CRDL.

Data from Clear Creek samples were not used to determine observed releases.

U indicates that the value was not detected.

J indicates that the contaminant was positively identified but the associated numerical value is an estimated quantity because quality control criteria were not met or because the concentration is below the CRDL.

Note: Beryllium, selenium, silver, and thallium were not detected (qualified U) in any sample.

Table 4-7—Surface Water Sample Results

Analyte (µg/L)	10-SW-SD001-0 National Creek Background	10-SW-SD005-0 McCarthy Creek Background	10-SW-SD006-0 Clear Creek	10-SW-SD006-1 Clear Creek Duplicate	10-SW-SP001-0 Tailings Pile Seep
Arsenic	1.0 U	1.0 U	1.1 J	1.0 J	**8.34**
Barium	29.4	31.8	23.3	24.3	43.6
Copper	3.0 U	3.0 U	5.7[a]	5.9[a]	**74.8**
Lead	0.82 J	0.61 J	0.98 J[a]	0.50 U	0.99 J[a]
Manganese	1.6 J	15.3	1.0 U	1.0 U	1.0 U
Zinc	12.0 J	12.0 J	5.4 J[a]	4.0 U	20.4[a]

[a] indicates that the concentration was below 5 times the transfer blank, and is treated as an undetected value.
Bold values qualify as observed releases.
Data from Clear Creek samples were not used to determine observed releases.
Analytes not listed were not detected (qualified U) in the samples from Clear Creek or the seep.
U indicates that the value was not detected above its SQL.
J indicates that the contaminant was positively identified but the associated numerical value is an estimated quantity because quality control criteria were not met or because the concentration is below the SQL.

4.2.3 Discussion of Surface Water and Sediment Sample Results

Surface water and sediment results can be summarized as follows:

- In National Creek, metals characteristic of the tailings pile were elevated in sediment and seep surface water flowing into the creek. There are no human or ecological receptors in National Creek, but it is the main pathway for metals to reach Kennicott River and Clear Creek.

- There were no significant elevated concentrations in the sediment sample collected from Kennicott River.

- Arsenic was elevated in surface water samples from Clear Creek near the McCarthy surface water intakes, slightly above its cancer screening level (EPA, 1991a). Copper was elevated in sediment. There are no applicable health-based standards for evaluating elevated concentrations of copper in sediment. Although copper was detected above background in Clear Creek surface water samples, detected concentrations were below five times that detected in the transfer blank. Therefore, these data could not be used to determine observed releases.

- A clear connection between the spring feeding Clear Creek and National Creek has not been established. However, the dye test performed for the 1992 SI (America North/EMCON, 1992) established a hydraulic connection between National Creek

Table 4-8—Wipe Sample Results (µg/10 cm²)

Analyte	DU004-0 Cottage 39B	DU005-0 Cottage 13F	DU003-0 Refrigeration Plant	DU006-0 Cottage 24	DU007-0 Kennicott Lodge	DU002-0 McCarthy Airport	DU001-0 Hotel in McCarthy
Arsenic	1.33	1.97	8.58	0.1 U	0.24 J	3.11	0.912
Cadmium	U	U	0.394	0.097 J	U	U	U
Copper	18.2	21.8	247	U	2.58	16	7.52
Lead	97.4	7.79	50.8	18.2	0.59 U	24.8	6.09
Silver	.032 J	0.05 J	0.088 J	0.015 J	0.02 J	0.042 J	0.026 J

- Samples are arranged in table in a general north (upwind) to south (downwind) orientation.

J Indicates that the associated numerical value is an estimated quantity because quality control criteria were not met.
U Indicates that the value was not detected. The qualifier without an associated numerical value indicates that concentration was less than five times the concentration detected in control sample (DU008) and cannot be considered positively identified.

Note: Antimony, beryllium, selenium and thallium were analyzed for but not detected in any sample. Chromium and nickel were not detected at concentrations greater than 5 times concentrations detected in control sample and cannot be considered positively identified.

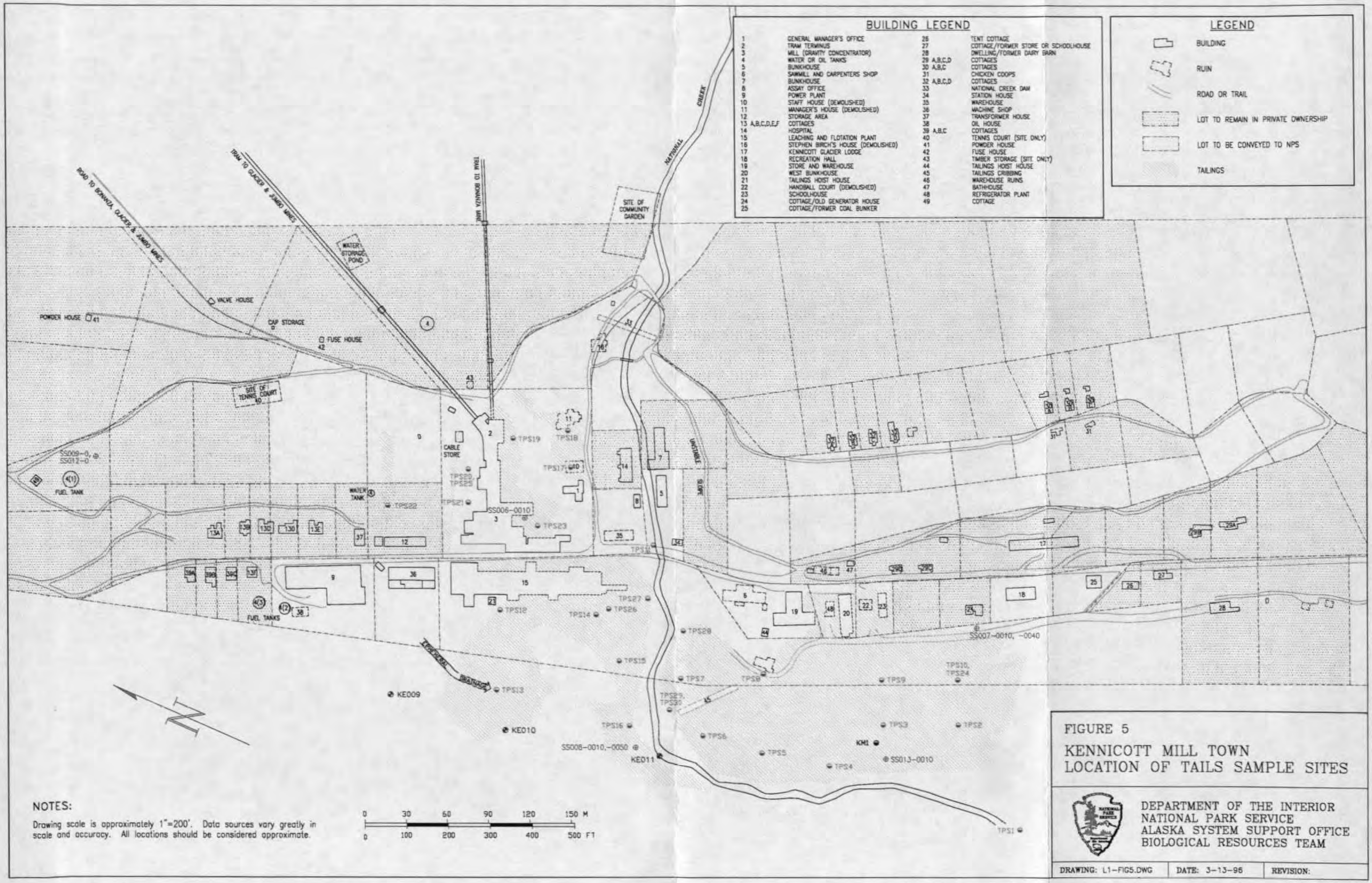
Table 4-9—Inorganics in Downwind Surface Soil (mg/kg)

Analyte	SS010-0001 dairy 0-1"	SS010-0005 dairy 1-6"	SS010-0010 dairy 6-12"	SS011-0001 cottage 29A 0-1"	SS011-0005 cottage 29A 1-6"	SS011-0010 cottage 29A 6-12"
Antimony	0.98 UJ	0.61 UJ	0.64 UJ	1.0 UJ	1.1 UJ	1.7 UJ
Arsenic	**39.9**	5.6 J	5.8 J	11.8 J	7.8 J	**19.2 J**
Barium	**170**	**48.5 J**	40.6 J*	**189 J**	**123 J**	**222 J**
Beryllium	0.27 U	0.38 J*	0.46 J*	0.28 U	0.27 U	0.23 U
Cadmium	0.71 J*	0.22 UJ	0.21 UJ	0.89 J*	0.27 UJ	0.32 J*
Chromium	8.1	10.5	6.2	13.3	9.6	13.6
Cobalt	6.4 J*	9.7 J*	7.5 J*	9.3 J*	5.0 J*	8.2 J*
Copper	**385 J**	75.7 J	46.9 J	**231 J**	131 J	**554 J**
Lead	**135**	14.3 J	9.4 J	**328 J**	**121 J**	**342 J**
Manganese	372 J	452 J	470 J	686 J	575 J	549 J
Mercury	**0.58**	0.11 J*	0.05 U	**0.19**	**0.18**	**0.15**
Nickel	10 J*	11.1 J	7.6 J*	10.3 J*	8.9 J*	11.7 J
Vanadium	19.5	27.5 J	21.5 J	27.7 J	23.9 J	29.6 J
Zinc	**124 J**	48.5 J	38.4 J	**225 J**	74.7 J	**187 J**

* Values positively identified below the CRDL were not used for observed release determination.
Bold values qualify as observed releases (see Table 4-1 for background concentrations).
U Indicates that the value was not detected.
J Indicates that the contaminant was positively identified but the associated numerical value is an estimated quantity because quality control criteria were not met.

Note: Selenium, silver, and thallium were not detected (qualified U) in any sample.

Appendix C-4 – Data from National Park Service. 1996. Kennicott Pre-Acquisition Environmental Site Assessment. U.S. Department of the Interior, National Park Service, Wrangell-St. Elias National Park and Preserve.


BUILDING LEGEND
1 GENERAL MANAGER'S OFFICE
2 TRAM TERMINUS
3 MILL (GRAVITY CONCENTRATOR)
4 WATER OR OIL TANKS
5 BUNKHOUSE
6 SAWMILL AND CARPENTERS SHOP
7 BUNKHOUSE
8 ASSAY OFFICE
9 POWER PLANT
10 STAFF HOUSE (DEMOLISHED)
11 MANAGER'S HOUSE (DEMOLISHED)
12 STORAGE AREA
13 A,B,C,D,E,F COTTAGES
14 HOSPITAL
15 LEACHING AND FLOTATION PLANT
16 STEPHEN BIRCH'S HOUSE (DEMOLISHED)
17 KENNICOTT GLACIER LODGE
18 RECREATION HALL
19 STORE AND WAREHOUSE
20 WEST BUNKHOUSE
21 TAILINGS HOIST HOUSE
22 HANDBALL COURT (DEMOLISHED)
23 SCHOOLHOUSE
24 COTTAGE/OLD GENERATOR HOUSE
25 COTTAGE/FORMER COAL BUNKER
26 TENT COTTAGE
27 COTTAGE/FORMER STORE OR SCHOOLHOUSE
28 DWELLING/FORMER DAIRY BARN
29 A,B,C,D COTTAGES
30 A,B,C COTTAGES
31 CHICKEN COOPS
32 A,B,C,D COTTAGES
33 NATIONAL CREEK DAM
34 STATION HOUSE
35 WAREHOUSE
36 MACHINE SHOP
37 TRANSFORMER HOUSE
38 OIL HOUSE
39 A,B,C COTTAGES
40 TENNIS COURT (SITE ONLY)
41 POWDER HOUSE
42 FUSE HOUSE
43 TIMBER STORAGE (SITE ONLY)
44 TAILINGS HOIST HOUSE
45 TAILINGS CRIBBING
46 WAREHOUSE RUINS
47 BATHHOUSE
48 REFRIGERATOR PLANT
49 COTTAGE
LEGEND
BUILDING
RUIN
ROAD OR TRAIL
LOT TO REMAIN IN PRIVATE OWNERSHIP
LOT TO BE CONVEYED TO NPS
TAILINGS
NATIONAL CREEK
SITE OF COMMUNITY GARDEN
ROAD TO BONANZA, GLACIER & JUMBO MINES
TRAM TO GLACIER & JUMBO MINES
TRAM TO BONANZA MINE
WATER STORAGE POND
VALVE HOUSE
POWDER HOUSE 41
CAP STORAGE
FUSE HOUSE 42
SITE OF TENNIS COURT 40
CABLE STORE
WATER TANK
FUEL TANK
FUEL TANKS
UNSTABLE SLOPE
SS009-0
SS012-0
SS006-0010
SS007-0010, -0040
SS008-0010,-0050
SS013-0010
KE009
KE010
KE011
KM1
TPS1
TPS2
TPS3
TPS4
TPS5
TPS6
TPS7
TPS8
TPS9
TPS10, TPS24
TPS12
TPS13
TPS14
TPS15
TPS16
TPS17
TPS18
TPS19
TPS20, TPS25
TPS21
TPS22
TPS23
TPS26
TPS27
TPS28
TPS29, TPS30
0 30 60 90 120 150 M
0 100 200 300 400 500 FT

NOTES:

Drawing scale is approximately 1"=200'. Data sources vary greatly in scale and accuracy. All locations should be considered approximate.

FIGURE 5
KENNICOTT MILL TOWN
LOCATION OF TAILS SAMPLE SITES

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ALASKA SYSTEM SUPPORT OFFICE
BIOLOGICAL RESOURCES TEAM

DRAWING: L1-FIG5.DWG	DATE: 3-13-96	REVISION:

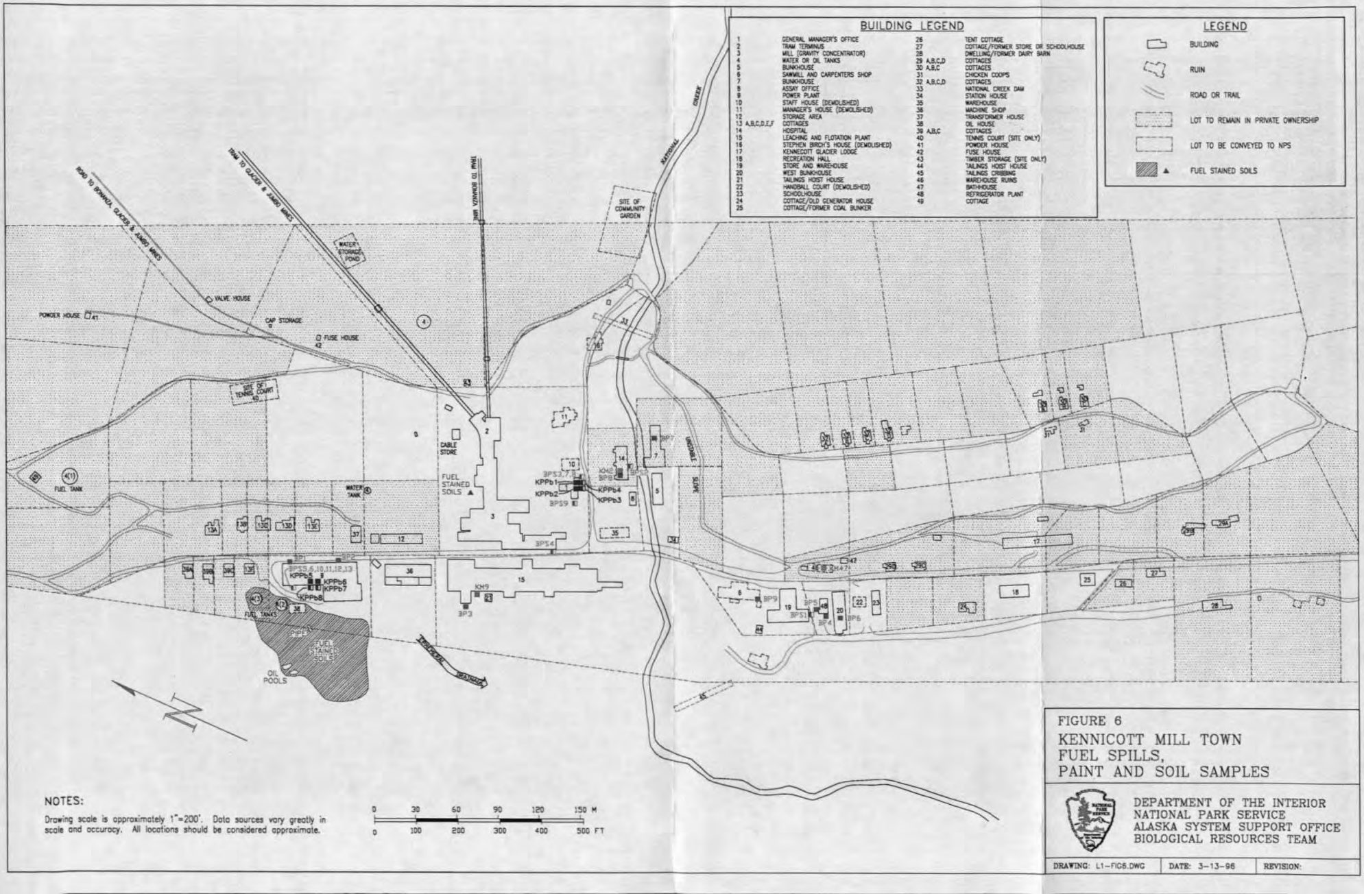

FIGURE 6
KENNICOTT MILL TOWN
FUEL SPILLS,
PAINT AND SOIL SAMPLES

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DRAWING: L1-FIG6.DWG	DATE: 3-13-96	REVISION:

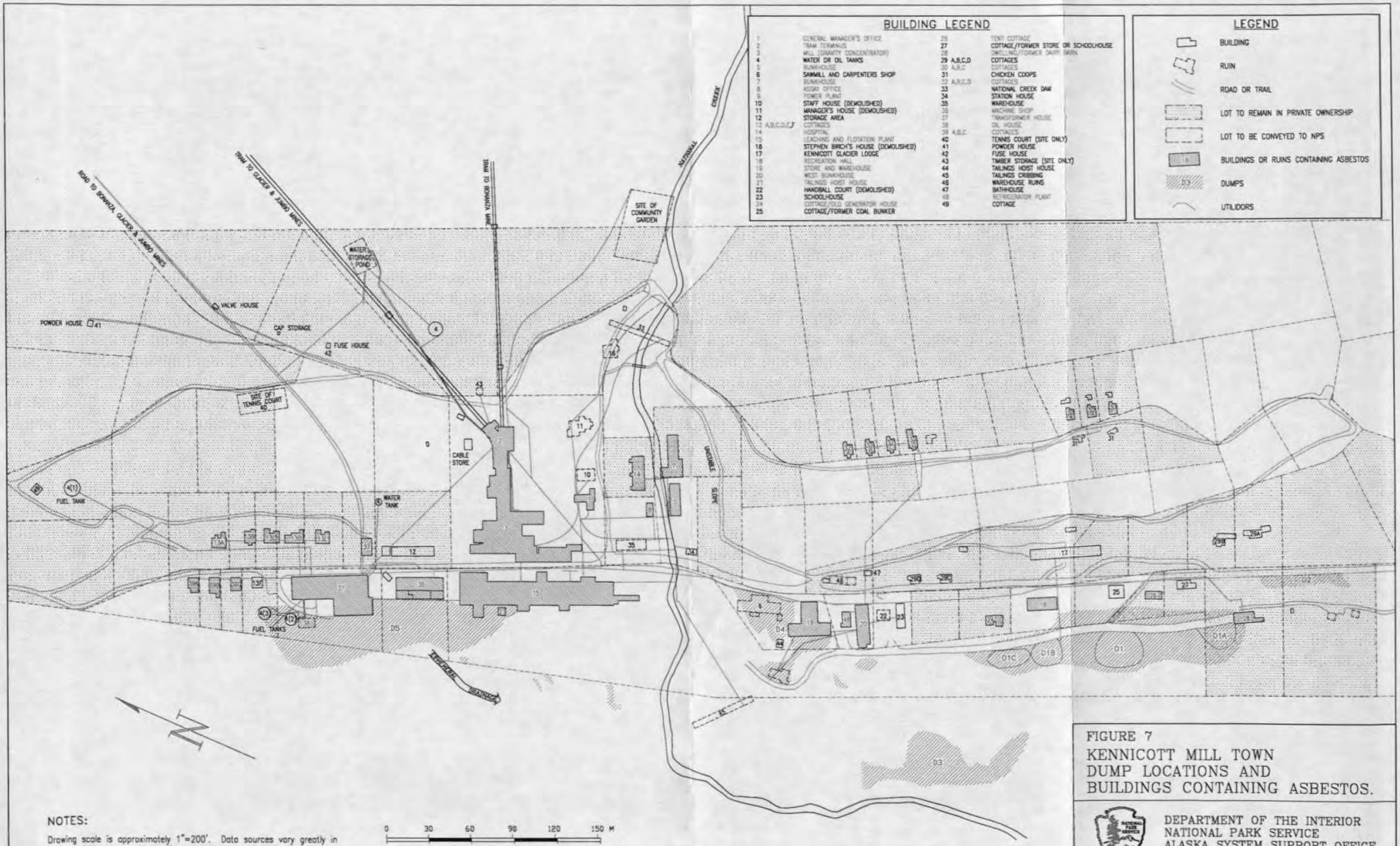

FIGURE 7
KENNICOTT MILL TOWN
DUMP LOCATIONS AND
BUILDINGS CONTAINING ASBESTOS.

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DRAWING: L1-FIG7.DWG	DATE: J-13-96	REVISION:

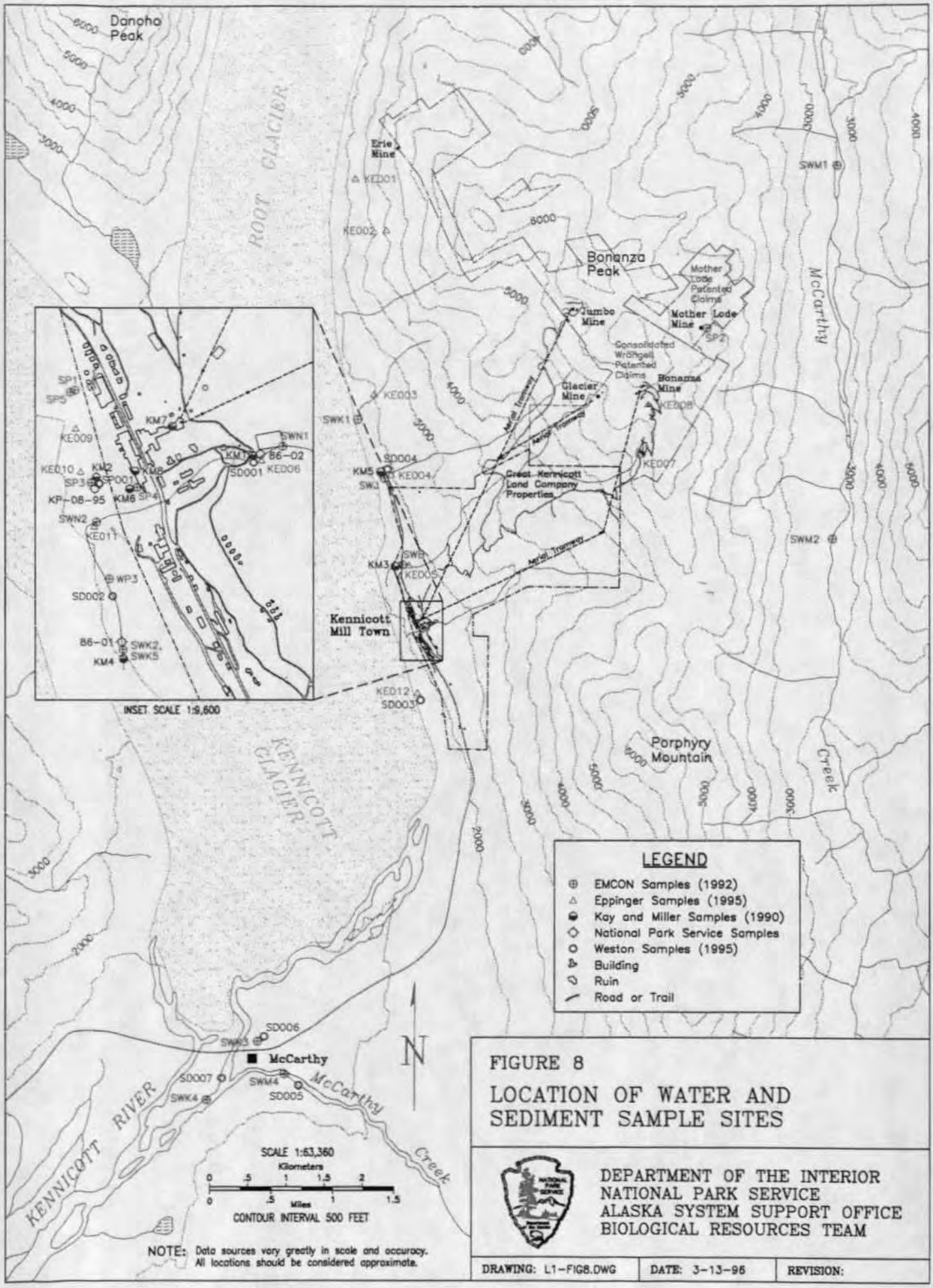

FIGURE 8

LOCATION OF WATER AND SEDIMENT SAMPLE SITES

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DRAWING: L1-FIG8.DWG	DATE: 3-13-96	REVISION:

Table 2. Compilation of Kennicott mill tailings and background samples. All units are ppm.

Sample ID	Sampler	Location	As	Cd	Cr	Cu	Pb	Hg	Ag	Zn
KE007R	Eppinger	Background; below Bonanza Mine, rock	<15	<0.75	230.00	120.00	<8	0.17	<1.2	150.00
KE009R1	Eppinger	Background; Nickolai basalt near mill tails	4.20	<0.75	81.00	62.00	8.00	0.11	<1.2	46.00
KE009R2	Eppinger	Background; Nickolai basalt near mill tails	3.40	<0.05	130.00	92.00	<8	0.13	<0.08	64.00
KE010R1	Eppinger	Background; Nickolai basalt near mill/leach plant	5.30	0.41	100.00	170.00	<8	0.08	<0.08	65.00
KE011R1	Eppinger	Background; Quartz along National Crk, below mill	2.30	<0.05	<2	4.00	19.00	<.02	<0.08	9.50
KE011R2	Eppinger	Background; siltstone, National Crk, below mill	18.00	<0.05	41.00	56.00	<8	0.15	0.18	74.00
ss009-0	Weston	background, soil	5.20	0.20	21.00	74.50	2.40	0.05	0.61	35.90
ss012-0	Weston	background, soil	6.40	0.21	17.60	35.60	6.10	0.05	0.64	27.70
		Background Mean	***6.40***	***0.19***	***77.70***	***76.76***	***6.44***	***0.09***	***0.34***	***59.01***
KE013R	Eppinger	Background, mineralized; Bonanza Mine Dump	7,900.00	73.00	5.00	377,000.00	<8	520.00	640.00	260.00
KE014R	Eppinger	Background, mineralized; Erie Mine Dump	640.00	5.00	5.00	10,000.00	<8	7.00	9.00	12.00
ss006-0010	Weston	Tails, S of mill/ 0-1' deep	477.00	6.70	3.70	17,800.00	166.00	4.60	13.10	21.40
ss007-0010	Weston	Tails, near bldg 24/0-1'	705.00	13.00	8.10	29,400.00	31.60	3.60	16.60	103.00
ss007-0040	Weston	Tails, near bldg24/ 4-5' deep	530.00	11.80	1.60	5,460.00	15.80	6.50	16.00	3.30
ss008-0010	Weston	Tails, roadcut below I&f plant/0-1'	186.00	12.90	1.90	2,920.00	4.50	1.70	3.40	6.90
ss008-0050	Weston	Tails, roadcut below I&f/5'	372.00	15.20	0.97	3,410.00	2.80	1.80	3.00	3.70
ss013-0	Weston	Tails, drum dump	515.00	16.90	10.90	6,240.00	539.00	5.50	11.60	128.00
TPS01	EMCON	Tails, 2-10"deep	353.00	7.00	3.00		<20	2.60	12.00	
TPS02	EMCON	Tails, 2-12" deep	456.00	27.00	<2		49.00	7.10	20.00	
TPS03	EMCON	Tails, 2-14" deep	283.00	11.00	<2		21.00	6.90	11.00	
TPS04	EMCON	Tails, 2-10" deep	244.00	30.00	<2		<20	5.10	5.00	
TPS05	EMCON	Tails, 2-10" deep	594.00	9.00	<2		<20	5.10	4.00	
TPS06	EMCON	Tails, 2-8" deep	961.00	14.00	<2		27.00	4.40	5.00	

Table 2. Continued.

Sample ID	Sampler	Location	As	Cd	Cr	Cu	Pb	Hg	Ag	Zn
TPS07	EMCON	Tails, 2-10 " deep	596.00	19.00	<2		27.00	11.50	11.00	
TPS08	EMCON	Tails, 2-16" deep	591.00	28.00	<2		41.00	7.50	12.00	
TPS09	EMCON	Tails, 2-12" deep	670.00	26.00	<2		32.00	7.50	15.00	
TPS10	EMCON	Tails, 2-18" deep	336.00	10.00	<2		38.00	3.90	10.00	
TPS24	EMCON	Tails, dup. of #10	339.00	5.00	<2		<20	2.60	5.00	
TPS11	EMCON	Tails, 4-12" deep	427.00	10.00	3.00		22.00	9.70	14.00	
TPS12	EMCON	Tails, 2-6" deep	1,770.00	26.00	4.00		107.00	13.00	15.00	
TPS13	EMCON	Tails, 0-8" deep	250.00	29.00	<2		<20	15.30	8.00	
TPS14	EMCON	Tails, 2-8" deep	1,230.00	66.00	<2		120.00	8.30	16.00	
TPS15	EMCON	Tails, 2-8" deep	1,270.00	48.00	<2		58.00	14.10	18.00	
TPS16	EMCON	Tails, 2-7" deep	207.00	12.00	<2		<20	3.60	5.00	
TPS17	EMCON	Tails, 2-6"	1,350.00	5.00	14.00		28.00	6.30	33.00	
TPS18	EMCON	Tails, 2-6"	205.00	5.00	19.00		<20	2.20	20.00	
TPS19	EMCON	Tails, 2-6"	3,500.00	65.00	7.00		251.00	51.80	118.00	
TPS20	EMCON	Tails, 2-6"	1,690.00	26.00	11.00		336.00	30.90	31.00	
TPS25	EMCON	Tails, dup of TSP20	1,610.00	22.00	9.00		94.00	15.40	70.00	
TPS21	EMCON	Tails, 2-8"	263.00	7.00	14.00		37.00	7.30	6.00	
TPS22	EMCON	Tails, 2-10"	3,530.00	2.00	<2		25.00	27.30	6.00	
TPS23	EMCON	Tails,	639.00	5.00	<2		<20	6.70	5.00	
TPS26	EMCON	W of Leach plt/dischg gully, 2-10"	619.00	20.00	<2		36.00	5.10	5.00	
TPS27	EMCON	Tails, W of leach plt/by Natl Crk	3,981.00	37.00	<2		58.00	5.70	33.00	
TPS28	EMCON	Tails, under flume S side Natl Crk	557.00	15.00	8.00		25.00	2.80	6.00	
TPS29	EMCON	Tails,	880.00	70.00	<2		82.00	9.90	14.00	
TPS30	EMCON	Tails, dup of TPS29	942.00	198.00	<2		70.00	7.40	9.00	
1	Kay&Miller	Tails, W of bldg #19	0.14	0.18	<0.05		<0.05	<0.0002	<0.05	

Table 3. Compilation of paint and paint-impacted soil samples, Kennicott mill town.

ID	Sampler	Location	Media	Descr1	Cd (mg/kg)	Pb (mg/kg)	Pb/ tclp (mg/l)
KPPb2	Hovis/NPS	Bldg 01	paint	red			3.910
BP9	EMCON	Bldg 06	paint	red	6	50	
BP2	EMCON	Bldg 09	paint	red	11	7,980	
KPPb6	Hovis/NPS	Bldg 09, west side	paint	red			**7.310**
KM9	Kay&Miller	Bldg 15	paint	red		8,200	
BP3	EMCON	Bldg 15	paint	red	4	1,270	
BP5	EMCON	Bldg 48	paint	red	3	336,000	
KM47	Kay&Miller	Bldg 46	paint	red powder		4,800	
						59716.667	
KPPb1	Hovis/NPS	Bldg 01	paint	white			**734.000**
BP1	EMCON	Bldg 09	paint	white	112	276,000	
KPPb5	Hovis/NPS	Bldg 09, west side	paint	white			**663.000**
KM2	Kay&Miller	Bldg 14	paint	white		525,000	
BP8	EMCON	Bldg 14	paint	white	59	249,000	
BP6	EMCON	Bldg 20	paint	white	<1	11,900	
BP4	EMCON	Bldg 48	paint	white	2	11,900	
BP7	EMCON	Bldg 07	paint	yellow	282	268,000	
KPPb3	Hovis/NPS	Bldg 01, base wall	soil				0.819
KPPb4	Hovis/NPS	Bldg 01, base wall, 2"	soil				**5.120**
BPS03	EMCON	Bldg 01, 1' from S side	soil	2-12"		1,170	
BPS07	EMCON	Bldg 01, 3 ft frm SE side	soil	2-6"		161	
BPS08	EMCON	Bldg 01, 6 ft frm SE side	soil	2-6"		123	
BPS09	EMCON	Bldg 01, 9 ft frm W side	soil	2-6"		56	
BPS04	EMCON	Bldg 03, 1 ft from W side	soil	2-5"		557	
KPPb7	Hovis/NPS	Bldg 09, N side, 8' base	soil				3.660
KPPb8	Hovis/NPS	Bldg 09, W side. 8' base	soil				3.880
BPS10	EMCON	Bldg 09, 3 ft frm W side	soil	2-6"		183	
BPS11	EMCON	Bldg 09, 6 ft from w side	soil	2-6"		249	
BPS12	EMCON	Bldg 09, 9 ft from w side	soil	2-6"		608	
BPS13	EMCON	Bldg 09, dup of 12	soil	2-6"		866	
BPS05	EMCON	Bldg 09, 1 ft from W side	soil	2-8"		1,340	
BPS06	EMCON	Bldg 09, dupl of 5	soil	dup of 5		3,040	
BPS02	EMCON	Bldg 14, 1 ft frm S side	soil	2-6"		766	
BPS01	EMCON	Bldg 19,,1 ft frm S side	soil	2-6"		465	
RCRA		***tclp limits, method 3010***	***soil***	***limits***	***<1***		***<5***

Table 4. Compilation of selected water quality attributes in the Kennicott Site. Values are averaged over each sample site. Minerals are in ppm.

SAMPLE IDs	DRAINAGE/LOCALE	#[a]	PH	As	Ca	Cd	Cr	Cu	Fe	Hg	Mn	Pb	Zn
EPA/ADEC standards			*6.5- 8.5*	*0.0500*		*0.0100*	*0.0500*	*1.0000*	*0.0500*	*0.0020*	*0.0500*	*0.0500*	*5.0000*
KE002W2[b]	Background: Kennicott Crk/stream sample above small snowfield	1	7.95	0.0009	0.02	<0.001	<0.002	<0.0006	0.0600		1.2000	<0.0001	<0.002
KE003W2	Background: Amazon Crk	1	7.88	0.0032	21.00	<0.001	<0.002	0.0006	0.0200		0.2000	<0.0001	<0.002
SWK1[c]	Background: Kennicott Crk below confluence with Amazon Crk.	3	8.07	0.0016	28.67	<0.0005	0.0039	<0.05	2.1633	<0.0002	0.0468	0.0043	<0.013
SWJ, KE004, KM5[d]	Background: Jumbo Crk	6	8.07	0.0020	21.67	<0.001	<0.005	0.0010	0.0313	<0.0002	0.1418	0.0002	<0.013
SWB, KE005, KM3	Background: Bonanza Crk.	6	7.64	0.0016	21.40	0.0002	<0.002	0.0024	0.0430	<0.0002	0.0484	<0.005	<0.013
KE008W2	Bonanza Crk, stream just below Bonanza mine	1	8.15	0.0020	19.00	<0.001	<0.002	0.0038	< 0.02		0.3000	0	<0.002
KE007W2	Bonanza Crk, sample from spring	1	8.00	<0.0008	16.00	<0.001	<0.002	< 0.0006	0.0700		1.3000	0.0001	<0.002
SWN1, KE006, KM1, NPS-86-02[e], 10-SW-SD-001[f]	Background: National Crk, abv mill town	10	7.92	0.0007	15.21	0.0001	<0.005	0.0009	0.0315	0.0001	0.1040	0.0014	0.0090
SWN2, KE011	National Crk, below Kenn. mill	4	8.14	0.0014	17.25	<0.0005	<0.005	0.0213	0.0177	<0.0002	0.2395	0.0000	0.0020
SWK2, SWK5, KE012, NPS-86-01, KM4	National/ Kenn. Cr., below tails, just above glacier	6	7.70	0.0021	16.17	<0.0005	<0.005	0.0383	0.0732	<0.002	0.1083	<0.005	0.0108
WP3	National Crk, tails well/ adjacent to Kenn Crk	3	7.90	0.0690	30.67	0.0033	<0.005	1.3667	11.5333	0.0010	0.1883	0.0223	2.3667
SP1, SP5	National Crk, tails seep, downslope and W. of power house	3	7.54	0.0130	54.67	0.0005	0.0027	0.1577	10.0800	0.0001	0.1977	0.0637	0.4933
SP4	National Crk, tails seep, near leach plant flumet	3	8.13	0.1773	72.67	0.0021	<0.005	4.2533	0.2800	0.0007	<0.05	0.0057	<0.5
SP3	National Crk, tails seep, near leach plant	3	8.12	0.0072	65.00	<0.0005	<0.005	0.0653	0.0073	<0.0002	<0.05	<0.005	<0.5
NPS-KP-08-95	National Crk, tails, seep below power plt	1	7.75	0.0140		<0.0001	<0.001	0.1210		<0.0002		<0.002	
10-SW-SP001-0[e]	National Crk, tails seep	1		0.0083	72.00	<0.0003	<0.0050	0.0748	0.0242	<0.0002	<0.0010	0.0010	0.0204
KE010W2DS	National Crk, tails seep	1	7.92	0.0078	71.00	<0.001	<0.002	0.0660	0.0200		0.2500	<0.0001	<0.002
KM2	National Crk, tails seep	1	8.10	0.0120		0.0008	<0.001	0.1000		<0.0002			
KM6	National Crk, tails seep	1	8.20	<0.025	66.00	<0.025	<0.025	0.1500			<0.025		0.0500
KM7	National Crk, ore bin	1	7.20	<0.025	200.00	<0.025	<0.025	0.6700			**0.1600**		0.3000
KM8	National Crk, mill, leach plant	1	7.90	<0.025	65.00	<0.025	<0.025	0.1100			<0.025		<0.025
KE009W2	National Crk, ponded rainwater, just below Kenn mill	1	7.85	0.0010	18.00	<0.001	<0.002	0.0110	0.1000		5.8000	0.0004	<0.002
SP2	McCarthy Crk, seep-Mother Lode mine portal	1	7.60	0.0460	20.00	<0.0005	<0.005	0.0330	0.0420	<0.002	<0.013	<0.005	<0.013
SWM1	McCarthy Crk, below Lubbe Crk	1	7.70	<0.001	28.00	<0.0005	<0.005	<0.13	1.6000	<0.002	0.0320	<0.005	0.0130
SWM1, SWM2	McCarthy Crk, below Greene Butte/near East Fork	6	7.16	0.0058	45.50	<0.0005	0.0055	<0.020	1.1795	<0.002	0.0330	<0.001	<0.013
SWM4, 10-SW-SD-005	McCarthy Crk, above town of McCarthy	6	8.15	0.0067	52.28	<0.0003	<0.005	<0.020	1.1000	<0.0002	0.0227	0.0059	0.0135

Table 4. Continued.

SAMPLE IDs	DRAINAGE/LOCALE	#[a]	PH	As	Ca	Cd	Cr	Cu	Fe	Hg	Mn	Pb	Zn
SWK4	Kennicott Crk, below. McCarthy Crk	3	7.83	0.0031	51.00	<0.0005	<0.005	<0.13	0.9433	<0.0002	0.0315	<0.005	<0.013
SWK3, 10-SW-SD006	Kennicott Crk, Clear Creek	5	7.85	0.0009	57.88	<0.0003	<0.0050	0.0058	0.0316	<0.0002	<0.0010	0.0010	0.0037

[a] #-number of observations per sample site. Within each sample site, there was often unequal number of observations between each parameter. Means with missing values are bases only on cases where value was measured. If values were below the Method Detection Limit (MDL), ½ the MDL was used for calculating means if the MDL was within the range of observed values. In cases where the MDL was greater than the observed value, the value was treated as missing.

[b] Sample numbers beginning with KE are from Eppinger et al. 1995

[c] Sample numbers beginning with SW, SP, or WP are from EMCON 1992a.

[d] Sample numbers beginning with KM are from Kay and Miller 1990.

[e] Sample numbers beginning with NPS are either from Deschu (park files) or were gathered during the current survey.

[F] Sample numbers beginning with 10 are from Weston 1995.

Table 5. Compilation of sediment data from the Kennicott Site.

ID	location	As	Ba	Ca	Cd	Cr	Cu	Pb	Mn	Hg	Ni	Ag	Zn
KE001[a] KE002	Up valley	19.50	96.75	107,000	0.09	352.50	137.50	1.35	1207.50	0.11	88.25	<0.08	71.00
KE003	Amazon Creek	50.00	170.00	105,000	0.15	135.00	150.00	1.55	925.00	0.29	53.00	<0.08	74.00
KE004 SD004[b]	Jumbo Creek	52.64	201.12	88,250	0.22	202.36	178.60	2.12	857.60	0.11	69.44	0.18	73.20
KE005	Bonanza Crk	55.50	445.00	44,000	0.45	185.00	940.00	8.75	955.00	0.26	65.00	0.61	109.50
KE008	Bonanza Mine, below tails	118.00	96.50	175,000	1.35	60.50	4850.00	15.00	425.00	0.54	26.50	3.25	52.50
KE006 SD001	National Crk, above mill	*20.13*	*635.33*	*17,000*	*0.18*	*71*	*70*	*11*	*658*	*0.13*	*40*	*0.34*	*95*
KE011 SD002	National Crk, below mill	76.00	645.33	33,500	2.93	74.17	843.33	46.77	987.33	0.52	38.37	0.71	109.47
KE012 SD003	National Crk, below mill, near glacier	217.67	146.30	285,000	9.47	15.40	3683.33	14.43	200.33	2.35	9.77	1.16	37.73
KE010	Tails seep, mill	235.00	382.50	192,250	8.95	52.75	3497.50	28.75	445.00	2.25	21.25	1.95	64.50
KE009	Tails, ponded rainwater	17.00	520.00	38,000	0.36	72.50	170.00	28.50	685.00	0.10	36.50	0.24	75.50
SD006	Clear Creek	21.95	93.85		0.71	34.85	376.50	10.05	518.50	0.23	30.85	u	88.05
SD007-0	Kennicott Crk	9.30	31.20		0.25	12.40	33.30	1.90	242.00	0.08	13.80	0.74	32.20
SD005-0	McCarthy Crk	5.70	93.50		0.27	22.10	29.70	3.90	375.00	0.07	22.50	u	62.40

[a] Sample numbers beginning with KE are from Eppinger 1995.
[b] Sample numbers beginning with SD are from Weston 1995.

and Bonanza Creeks) and are almost identical to sediments found in a seep in the tails. Consequently, it appears that the tails have eroded into National Creek and are constituting a substantial portion of its substrate. The higher concentration of contaminants at the downstream sample site is most likely due to the fact that that sample site has a lower gradient, and thus it is an accretion zone. It also has full exposure to tails and Dump #3.

There are no drinking water intakes in the lower portion of National Creek, or any wells down gradient. Consequently, there are no potential human receptors. By the time National Creek resurfaces below the glacier, it is greatly diluted. Water and sediment samples in the upper reaches of Kennicott River show no signs of contamination, and the waters of Clear Creek meet drinking water standards (Table 4).

Water quality at the mine sites has been less well documented, but there appear to be no concerns. There are no mine openings that are discharging water on the property.

The adit at the Mother Lode mine is weeping water; however the water there met drinking water standards (Table 4). Water and sediments were sampled immediately below the Bonanza Mine; As and Cu appear slightly elevated in the water, but the water meets drinking water standards. Sediments immediately below the Bonanza mine also have elevated levels of As, Cd, Cu, Pb, Hg, and Ag, similar to what was observed in the mill town, but these levels diminish to background levels further downstream (Table 5).

Appendix 2a. Co[illegible]ation of water data. Units for metals are ppm.

SAMPLE ID	Co	Cu	Cyanide	Pb	Mn	Hg	Ni	Se	Ag	Tl	V	Zn	NO3	SO4	PCB's
EPA/ADEC		*<1.00*		*<0.05*	*<0.05*	*<0.002*		*<0.01*	*<0.05*			*<5.00*	*<10.0*	*<200*	
KP-08		0.1210		<0.002		<0.0002	<0.017	0.002		<0.001					
NPS-86-01		<0.05		<0.05	<0.01	<0.1	<0.05	<0.05	<0.05		<0.05	0.05			
NPS-86-02		<0.05		<0.05	<0.01	<0.1	<0.05	<0.05	<0.05		<0.05	0.06			
NPS-86-03		<0.05		<0.05	<0.01	<0.1	<0.05	<0.05	<0.05		<0.05	<0.05			
sw-sd001-0	<0.010	<0.0030		0.0008	0.0016	<0.0002	<0.0100	<0.0020	<0.0030	<0.0010	<0.0030	0.0120			
sw-sd005-0	<0.010	<0.0030		0.0006	0.0153	<0.0002	<0.0100	<0.0020	<0.0030	<0.0010	<0.0030	0.0120			
sw-sd006-0	<0.010	0.0057		0.0010	<0.0010	<0.0002	<0.0100	<0.0020	<0.0030	<0.0010	<0.0030	0.0054			
sw-sd006-1	<0.010	0.0059		<0.0005	<0.0010	<0.0002	<0.0100	<0.0020	<0.0030	<0.0010	<0.0030	<0.0040			
sw-sp001-0	<0.010	0.0748		0.0010	<0.0010	<0.0002	<0.0100	<0.0020	<0.0030	<0.0010	<0.0030	0.0204			
KE002W3	<0.002	<0.004		<0.005	<0.002		<0.004		<0.0001	<0.0004	<0.002	<0.002	<.5	12.00	
KE003W3	<0.002	<0.004		<0.005	<0.002		<0.004		<0.0001	<0.0004	<0.002	<0.002	<.5	14.00	
KE004W3	<0.002	<0.004		<0.005	<0.002		<0.004		<0.0001	<0.0004	<0.002	<0.002	<.5	6.30	
KE004W3DS	<0.002	<0.004		<0.005	<0.002		<0.004		<0.0001	<0.0004	<0.002	<0.002	<.5	6.80	
KE005W3	<0.002	<0.004		<0.005	<0.002		<0.004		<0.0001	<0.0004	<0.002	<0.002	0.98	7.80	
KE006W3	<0.002	<0.004		<0.005	<0.002		<0.004		<0.0001	<0.0004	<0.002	<0.002	0.84	6.00	
KE007W3	<0.002	<0.004		<0.005	<0.002		<0.004		<0.0001	<0.0004	0.0020	<0.002	<.5	15.00	
KE008W3	<0.002	0.0060		<0.005	<0.002		<0.004		<0.0001	<0.0004	<0.002	<0.002	0.50	10.00	
KE009W3	<0.002	0.0120		<0.005	0.0060		<0.004		<0.0001	<0.0004	<0.002	<0.002	<.5	6.10	
KE010W3	<0.002	0.0820		<0.005	<0.002		<0.004		<0.0001	<0.0004	<0.002	<0.002	11.00	9.70	
KE010W3DS	<0.002	0.0800		<0.005	<0.002		<0.004		<0.0001	<0.0004	<0.002	<0.002	11.00	9.80	
KE011W3	<0.002	0.0050		<0.005	<0.002		<0.004		<0.0001	<0.0004	<0.002	<0.002	1.10	6.10	
KE012W3	<0.002	0.0120		<0.005	<0.002		<0.004		<0.0001	<0.0004	<0.002	<0.002	1.00	6.20	
sp1		<0.05		<0.005	<0.05	<0.0002		<0.001	<0.0001			0.6100	0.14	7.00	
sp1		0.0230	<0.01	0.0110	0.0130	<0.002		<0.001	<0.001			<0.013	1.40	8.20	<.5ug/l
sp2		0.0330		<0.005	<0.013	<0.002		<0.001	<0.001			<0.013	<0.1	5.60	
sp3		0.0660		<0.005	<0.05	<0.0002		<0.001	<0.0001			<0.5	1.40	16.00	
sp3		0.0660	<0.01	<0.005	<0.013	<0.002		<0.001	<0.001			<0.013	2.00	13.60	
sp3		0.0640		<0.005	<0.013	<0.0002		0.0008	<0.001			<0.013	1.80	17.00	
sp4		2.6000		<0.005	<0.05	0.0004		<0.001	<0.0001			<0.5	1.90	7.00	
sp4		10.0000	<0.01	0.0170	<0.013	0.0017		<0.001	0.0010			<0.013	2.40	10.10	
sp4		0.1600		<0.005	<0.013	<0.0002		<0.001	<0.001			<0.013	2.40	14.00	
sp5		0.4500		0.1800	0.6800	0.0002		0.0047	0.0010			0.8700	<0.1	13.00	
swb		<0.05		<0.005	<0.05	<0.0002		<0.001	<0.0001			<0.5	1.50	8.00	
swb		<0.13		<0.005	<0.013	<0.002		<0.001	<0.001			<0.013	0.20	6.60	
swb		<0.013		<0.005	<0.013	<0.0002		0.0006	<0.001			<0.013	0.23	8.40	
swbk		<0.13		<0.005	<0.013	<0.002		<0.001	<0.001			0.0210	<0.1	<1	
swbk3		<0.05		<0.005	<0.05	<0.0002		<0.001	<0.0001			<0.5	<0.1	<1	
swj		<0.05		<0.005	<0.05	<0.0002		<0.001	<0.0001			<0.5	0.85	9.00	
swj		<0.13		<0.005	<0.013	<0.002		<0.001	<0.001			<0.013	<0.1	10.80	
swj		<0.013		<0.005	<0.013	<0.0002		<0.001	<0.001			<0.013	0.25	13.00	
swk1		<0.05		0.0080	0.0920	<0.0002		<0.001	<0.0001			<0.5	0.16	14.00	
swk1		<0.13		<0.005	0.0420	<0.002		<0.001	<0.001			<0.013	0.70	11.50	
swk1		<0.013		<0.005	<0.013	<0.0002		<0.001	<0.001			<0.013	<0.1	<1	
swk2		0.1100		<0.005	<0.05	<0.0002		<0.001	<0.0001			<0.5	1.40	10.00	
swk2		0.0190	<0.01	<0.005	<0.013	<0.002		<0.001	<0.001			<0.013	0.20	6.20	<.5ug/l
swk2		<0.013		<0.005	<0.013	<0.0002		<0.001	<0.001			<0.013	0.22	7.60	
swk3		<0.05		<0.005	<0.05	<0.0002		<0.001	<0.0001			<0.5	0.73	2.10	
swk3		<0.13	<0.01	<0.005	<0.013	<0.002		<0.001	<0.001			<0.013	0.40	19.10	<.5ug/l
swk3		<0.013		<0.005	<0.013	<0.0002		0.0007	<0.001			<0.013	0.54	17.00	
swk4		<0.05		<0.005	<0.05	<0.0002		<0.001	<0.0001			<0.5	0.79	78.00	

Appendix 2a. Compilation of water data. Units for metals are ppm.

SAMPLE ID	date	sampler(a)	location	media	Descr1	Temp C	pH	Conductivity	D.O.	Alkalinity	Sb	As	Ba	Be	Ca	Cd	Cr
EPA/ADEC			*Limits*				*6-8.5*					*<0.05*	*<1.00*			*<0.01*	*<0.05*
KP-08	07/95	NPS	Tails, seep below power plt	water	unfiltered	18	7.8	257			<0.003	0.0140	0.0420	<0.0005		<0.0001	<0.001
NPS-86-01	07/86	NPS	National Crk, below tails	water		4.0	6.00	110	12.0	49.8		<0.005	<0.05		13.00	<0.01	<0.05
NPS-86-02	07/86	NPS	National Crk, 0.5 miles above tails	water		5.5		104		54.0		<0.005	<0.05		12.00	<0.01	<0.05
NPS-86-03	07/86	NPS	Bonanza Crk	water		6.0	6	134	10.0	60.6		<0.005	<0.05		20.00	<0.01	<0.05
sw-sd001-0	07/94	Weston(b)	National Crk	water	unfiltered						<0.0005	<0.001	0.0294	<0.0005		<0.0003	<0.0050
sw-sd005-0	07/94	Weston(b)	McC Crk	water	unfiltered						<0.0005	<0.001	0.0318	<0.0005		<0.0003	<0.0050
sw-sd006-0	07/94	Weston(b)	Clear Creek	water	unfiltered						<0.0005	0.0011	0.0233	<0.0005		<0.0003	<0.0050
sw-sd006-1	07/94	Weston(b)	Clear Creek-dup	water	unfiltered						<0.0005	0.0010	0.0243	<0.0005	62.20	<0.0003	<0.0050
sw-sp001-0	07/94	Weston(b)	Tails Seep	water	unfiltered						<0.0005	0.0083	0.0436	<0.0005	72.00	<0.0003	<0.0050
KE002W3	08/94	Eppinger(c)	Above Snowfield	water	unfiltered	4	7.95	145	11.0	60.0	<0.0002	0.0009	0.0010	<0.001	19.00	<0.001	<0.002
KE003W3	08/94	Eppinger(c)	Amazon Crk	water	unfiltered	5	7.88	160	10.0	70.0	<0.0002	0.0032	0.0050	<0.001	21.00	<0.001	<0.002
KE004W3	08/94	Eppinger(c)	Jumbo Crk	water	unfiltered	7	7.97	144	10.0	70.0	<0.0002	0.0020	0.0100	<0.001	19.00	<0.001	<0.002
KE004W3DS	08/94	Eppinger(c)	Jumbo Crk-dup	water	unfiltered	7	7.95	144	10.0	70.0	<0.0002	0.0020	0.0100	<0.001	19.00	<0.001	<0.002
KE005W3	08/94	Eppinger(c)	Bonanza Crk	water	unfiltered	9	8.12	188	11.0	80.0	<0.0002	0.0008	0.0360	<0.001	24.00	<0.001	<0.002
KE006W3	08/94	Eppinger(c)	National Crk	water	unfiltered	7	7.66	133	10.0	60.0	<0.0002	<.0008	0.0280	<0.001	14.00	<0.001	<0.002
KE007W3	08/94	Eppinger(c)	Bonanza Mine spring, bel	water	unfiltered	6	8.00	145	9.0	55.0	<0.0002	<.0008	0.0020	<0.001	16.00	<0.001	<0.002
KE008W3	08/94	Eppinger(c)	Bonanza Mine, bel tails	water	unfiltered	2	8.15	147	10.0	60.0	0.0002	0.0020	0.0020	<0.001	19.00	<0.001	<0.002
KE009W3	08/94	Eppinger(c)	Tails, ponded rainwater	water	unfiltered	13	7.85	105	8.0	45.0	<0.0002	0.0010	0.0090	<0.001	18.00	<0.001	<0.002
KE010W3	08/94	Eppinger(c)	Tails Seep, mill	water	unfiltered	6	7.90	436	11.0	230.0	<0.0002	0.0077	0.0400	<0.001	71.00	<0.001	<0.002
KE010W3DS	08/94	Eppinger(c)	Tails Seep, mill-dup	water	unfiltered	6	7.92	437	11.0	220.0	<0.0002	0.0078	0.0400	<0.001	71.00	<0.001	<0.002
KE011W3	08/94	Eppinger(c)	National Crk, below mill	water	unfiltered	8	7.96	145	11.0	60.0	<0.0002	<0.0008	0.0300	<0.001	16.00	<0.001	<0.002
KE012W3	08/94	Eppinger(c)	National Crk, above glacier	water	unfiltered	18	8.08	149	11.0	65.0	<0.0002	0.0010	0.0310	<0.001	17.00	<0.001	<0.002
sp1	05/92	EMCON(d)	Tails Seep, dwnslp of Pwr hs	water	unfiltered	1	7.6	247	12.9			<0.001	<0.05		27.00	<0.0005	<0.005
sp1	07/91	EMCON(d)	Tails Seep, dwnslp of Pwr hs	water	unfiltered	na	7.66	na	na			<0.001	0.0310			0.0006	<0.005
sp2	07/91	EMCON(d)	Seep-mother lode mine portal	water	unfiltered	na	7.6	na	na			0.0460	0.1300			<0.0005	<0.005
sp3	05/92	EMCON(d)	Tails Seep,near leach plant	water	unfiltered	2.5	8.05	413	12.2			0.0073	<0.05		52.00	<0.0005	<0.005
sp3	07/91	EMCON(d)	Tails Seep,near leach plant	water	unfiltered	na	8.19	na	na			0.0070	0.0340			<0.0005	<0.005
sp3	09/91	EMCON(d)	Tails Seep,near leach plant	water	unfiltered		8.11	409				0.0074	0.0330		67.00	<0.0005	<0.005
sp4	05/92	EMCON(d)	Tails Seep, flume/leach plt	water	unfiltered	2	7.96	462	11.4			0.0130	<0.05		59.00	0.0014	<0.005
sp4	07/91	EMCON(d)	Tails Seep, flume/leach plt	water	unfiltered	na	8.32	na	na			0.5000	0.0400			0.0050	<0.005
sp4	09/91	EMCON(d)	Tails Seep, flume/leach plt	water	unfiltered		8.11	394				0.0190	0.0260		68.00	<0.0005	<0.005
sp5	09/91	EMCON(d,e)	Tails Seep,W. of pwr hse	water	unfiltered		7.37	270				0.0390	0.1300		57.00	0.0009	0.0080
swb	05/92	EMCON(d)	Bonanza Crk	water	unfiltered	1	8.25	189	13.4			0.0011	<0.05		24.00	<0.0005	<0.005
swb	07/91	EMCON(d)	Bonanza Crk	water	unfiltered	5.1	7.7	500	11.4			0.0010	0.0270			<0.0005	<0.005
swb	09/91	EMCON(d)	Bonanza Crk	water	unfiltered	4.2	8.05	192	12.1			0.0013	0.0250		18.00	<0.0005	<0.005
swbk	07/91	EMCON(d)	blank	water	unfiltered	na	6.04	na	na			<0.001	<0.013			<0.0005	<0.005
swbk3	05/92	EMCON(d)	blank	water	unfiltered	na		na	na			<0.001	<0.05		nd	<0.0005	<0.005
swj	05/92	EMCON(d)	Jumbo Crk	water	unfiltered	0	8.5	190	12.6			0.0018	<0.05		27.00	<0.0005	<0.005
swj	07/91	EMCON(d)	Jumbo Crk	water	unfiltered	4.5	8	500	12.6			0.0020	<0.013			<0.0005	<0.005
swj	09/91	EMCON(d)	Jumbo Crk	water	unfiltered	4	8.1	217	11.8			0.0022	0.0120		23.00	<0.0005	<0.005
swk1	05/92	EMCON(d)	Kennicott Crk, S of Amazon	water	unfiltered	0	8.9	65	13.2			0.0022	0.0530		26.00	<0.0005	0.0066
swk1	07/91	EMCON(d)	Kennicott Crk, S of Amazon	water	unfiltered	2.6	8	500	12.2			0.0020	0.0310			<0.0005	<0.005
swk1	09/91	EMCON(d)	Kennicott Crk, S of Amazon	water	unfiltered	0.3	7.3	27	12.6			<0.001	<0.013		3.00	<0.0005	<0.005
swk2	05/92	EMCON(d)	Kennicott Crk, S of National	water	unfiltered	2	8.1	193	11.6			0.0071	<0.05		20.00	<0.0005	<0.005
swk2	07/91	EMCON(d)	Kennicott Crk, S of National	water	unfiltered	6.1	8	540	11.4			0.0010	0.0280			<0.0005	<0.005
swk2	09/91	EMCON(d)	Kennicott Crk, S of National	water	unfiltered	3	8	152	11.4			0.0006	0.0290		15.00	<0.0005	<0.005
swk3	05/92	EMCON(d)	Clear Creek	water	unfiltered	6	8.02	301	10.2			0.0011	<0.05		39.00	<0.0005	<0.005
swk3	07/91	EMCON(d)	Clear Creek	water	unfiltered	4.6	7.9	530	10.8			<0.001	0.0220			<0.0005	<0.005
swk3	09/91	EMCON(d)	Clear Creek	water	unfiltered	2.8	7.63	446	11.4			0.0006	0.0220		65.00	<0.0005	<0.005
swk4	05/92	EMCON(d)	Kennicott Crk, Bel. McC Crk	water	unfiltered	7	8.25	342	11.4			0.0016	<0.05		46.00	<0.0005	<0.005

Appendix 2a. Co[redacted]ation of water data. Units for metals are ppm.

SAMPLE ID	date	sampler(a)	location	media	Descr1	Temp C	pH	Conductivity	D.O.	Alkalinity	Sb	As	Ba	Be	Ca	Cd	Cr
swk4	07/91	EMCON(d)	Kennicott Crk, Bel. McC Crk	water	unfiltered	6.4	7.6	27	12.5			<0.001	0.0400			<0.0005	<0.005
swk4	09/91	EMCON(d)	Kennicott Crk, Bel. McC Crk	water	unfiltered	2.9	7.63	394	14.2			0.0072	0.0420		58.00	<0.0005	<0.005
swk5	07/91	EMCON(d)	Kennicott Crk, S of National	water	unfiltered	na	8.04	na	na			0.0010	0.0270			<0.0005	<0.005
swk5	09/91	EMCON(d)	dupl of swn1	water	unfiltered												
swm1	07/91	EMCON(d)	McC Crk, Below Lubbe Crk	water	unfiltered	4.8	7.7	26	12.6			<0.001	0.0260			<0.0005	<0.005
swm2	07/91	EMCON(d)	McC Crk, below Green butte	water	unfiltered	5.1	7.7	26	12.7			<0.001	0.0340			<0.0005	<0.005
swm3	07/91	EMCON(d)	McC Crk, S of Bonz rdge	water	unfiltered	5.5	7.7	29	12.8			<0.001	0.0400			<0.0005	0.0050
swm4	05/92	EMCON(d)	McC Crk, abv McCarthy	water	unfiltered	6	8.2	334	11.0			0.0016	<0.05		46.00	<0.0005	<0.005
swm4	07/91	EMCON(d)	McC Crk, abv McCarthy	water	unfiltered	7	8	500	11.1			<0.001	0.0410			<0.0005	<0.005
swm4	09/91	EMCON(d)	McC Crk, abv McCarthy	water	unfiltered	2.4	8.2	522	13.8			0.0005	0.0420		71.00	<0.0005	<0.005
swn1	05/92	EMCON(d)	National Crk, abv mill town	water	unfiltered	1	8.28	247	12.9			<0.001	<0.05		20.00	<0.0005	<0.005
swn1	07/91	EMCON(d)	National Crk, abv mill town	water	unfiltered	5.7	7.9	500	11.9			<0.001	0.0270			<0.0005	<0.005
swn1	09/91	EMCON(d)	National Crk, abv mill town	water	unfiltered	3	7.84		13.4			<0.001	0.0310		14.00	<0.0005	<0.005
swn1	09/91	EMCON(d)	National Crk, abv mill town-duplicate	water	unfiltered	3	7.84	165	13.4			<0.001	0.0310		14.00	<0.0005	<0.005
swn2	05/92	EMCON(d)	National Crk, below mill	water	unfiltered	1.4	8.69	610	12.5			0.0036	<0.05		21.00	<0.0005	<0.005
swn2	07/91	EMCON(d)	National Crk, below mill	water	unfiltered	5.8	7.9	590	11.3			<0.001	0.0280			<0.0005	<0.005
swn2	09/91	EMCON(d)	National Crk, below mill	water	unfiltered	3	7.99	144	12.2			0.0012	0.0300		17.00	<0.0005	<0.005
swn3	05/92	EMCON(d)	dupl of swn1	water	unfiltered	1	8.2	150	na			<0.001	<0.05		19.00	<0.0005	<0.005
wbk1	09/91	EMCON(d)	blank	water	unfiltered		5.49					<0.001	<0.013		0.20	<0.0005	<0.005
wbk2	09/91	EMCON(d)	blank	water	unfiltered		5.47					<0.001	<0.013		0.20	<0.0005	<0.005
wp3	05/92	EMCON(d)	Tails Well/ Adj. Kenn Crk	water	unfiltered	na	7.85	205	na			0.0940	0.1300		37.00	0.0051	<0.005
wp3	07/91	EMCON(d,f)	Tails Well/ Adj. Kenn Crk	water	unfiltered	5.7	7.99	134	na			0.0910	0.1200			0.0015	<0.005
wp3	09/91	EMCON(d)	Tails Well/ Adj. Kenn Crk	water	unfiltered		7.85	181				0.0220	0.1600		15.00	0.0033	<0.005
KM1	1990	Kay&Miller(g)	McC Crk	water			7.7					0.0030	0.0450			0.0008	<0.001
KM2	1990	Kay&Miller(g)	Tails	water			8.1					0.0120	0.0440			0.0008	<0.001
KM3	1990	Kay&Miller(g)	Bonanza Crk	water			7.7					0.0030	0.0290			0.0007	<0.001
KM4	1990	Kay&Miller(g)	Kennicott Crk	water			7.8					0.0060	0.0330			0.0006	<0.001
KM5	1990	Kay&Miller(g)	Jumbo Crk	water			7.9	150		74.0		<0.025	<0.025		21.00	<0.025	<0.025
KM6	1990	Kay&Miller(g)	Tails	water			8.2	370		194.0		<0.025	<0.025		66.00	<0.025	<0.025
KM7	1990	Kay&Miller(g)	Ore bin	water			7.2	1,000		50.0		<0.025	<0.025		200.00	<0.025	<0.025
KM8	1990	Kay&Miller(g)	Mill, Leach Plant	water			7.9	400		195.0		<0.025	0.2700		65.00	<0.025	<0.025
KE002W3	08/94	Eppinger(c)	Above Snowfield	water	filtered						<0.0002	<0.0008	<0.0001	<0.001	19.00	<0.001	<0.002
KE003W3	08/94	Eppinger(c)	Amazon Crk	water	filtered						<0.0002	0.0032	0.0050	<0.001	22.00	<0.001	<0.002
KE004W3	08/94	Eppinger(c)	Jumbo Crk	water	filtered						<0.0002	0.0024	0.0100	<0.001	19.00	<0.001	<0.002
KE004W3DS	08/94	Eppinger(c)	Jumbo Crk-dup	water	filtered						<0.0002	0.0022	0.0100	<0.001	19.00	<0.001	<0.002
KE005W3	08/94	Eppinger(c)	Bonanza Crk	water	filtered						<0.0002	0.0010	0.0360	<0.001	24.00	<0.001	<0.002
KE006W3	08/94	Eppinger(c)	National Crk	water	filtered						<0.0002	<0.0008	0.0290	<0.001	15.00	<0.001	<0.002
KE007W3	08/94	Eppinger(c)	Bonanza Mine spring, bel	water	filtered						<0.0002	<0.0008	0.0020	<0.001	16.00	<0.001	<0.002
KE008W3	08/94	Eppinger(c)	Bonanza Mine, bel tails	water	filtered						<0.0002	0.0024	0.0030	<0.001	19.00	<0.001	<0.002
KE009W3	08/94	Eppinger(c)	Tails, ponded rainwater	water	filtered						<0.0002	<0.0008	0.0090	<0.001	18.00	<0.001	<0.002
KE010W3	08/94	Eppinger(c)	Tails Seep, mill	water	filtered						<0.0002	0.0074	0.0390	<0.001	72.00	<0.001	<0.002
KE010W3DS	08/94	Eppinger(c)	Tails Seep, mill-dup	water	filtered						<0.0002	0.0071	0.0390	<0.001	72.00	<0.001	<0.002
KE011W3	08/94	Eppinger(c)	National Crk, below mill	water	filtered						<0.0002	<0.0008	0.0290	<0.001	16.00	<0.001	<0.002
KE012W3	08/94	Eppinger(c)	National Crk, above glacier	water	filtered						<0.0002	0.0008	0.0310	<0.001	17.00	<0.001	<0.002
sp1	05/92	EMCON(h)	Tails Seep, dwnslp of Pwr hs	water	filtered							<0.001	<0.05			<0.0005	<0.005
sp3	05/92	EMCON(h)	Tails Seep,near leach plant	water	filtered							0.0063	<0.05			<0.0005	<0.005
sp3	07/91	EMCON(h)	Tails Seep,near leach plant	water	filtered							0.0080	0.0340			0.0012	<0.005
sp3	09/91	EMCON(h)	Tails Seep,near leach plant	water	filtered							0.0080	0.0340			<0.0005	<0.005
sp4	05/92	EMCON(h)	Tails Seep, flume/leach plt	water	filtered							0.0110	<0.05			<0.0005	<0.005
sp4	07/91	EMCON(h)	Tails Seep, flume/leach plt	water	filtered							0.0460	0.0330			<0.0005	<0.005
sp4	09/91	EMCON(h)	Tails Seep, flume/leach plt	water	filtered							0.0220	0.0250			<0.0005	0.0080

Appendix 2a. Compilation of water data. Units for metals are ppm.

SAMPLE ID	Co	Cu	Cyanide	Pb	Mn	Hg	Ni	Se	Ag	Tl	V	Zn	NO3	SO4	PCB's
swk4		<0.13		<0.005	0.0250	<0.002		0.0010	<0.001			<0.013	0.20	62.30	
swk4		<0.013		<0.005	0.0380	<0.0002		0.0011	<0.001			<0.013	0.26	63.00	
swk5		0.0140		<0.005	<0.013	<0.002		<0.001	<0.001			0.0150	0.20	6.20	
swk5															
swm1		<0.13		<0.005	0.0320	<0.002		<0.001	<0.001			0.0130	<0.1	30.80	
swm2		<0.13		<0.005	0.0390	<0.002		<0.001	<0.001			<0.013	<0.1	54.10	
swm3		<0.13		<0.005	0.0270	<0.002		0.0001	<0.001			<0.013	0.20	62.20	
swm4		<0.05		<0.005	<0.05	<0.0002		0.0013	<0.0001			<0.5	0.68	44.00	
swm4		<0.13		0.0060	0.0300	<0.002		0.0020	<0.001			0.0150	0.20	54.40	
swm4		<0.013		<0.005	<0.013	<0.0002		0.0019	<0.001			<0.013	0.33	108.00	
swn1		<0.05		<0.005	<0.05	<0.0002		<0.001	<0.0001			<0.5	1.60	10.00	
swn1		<0.13		<0.005	<0.013	<0.002		<0.001	<0.001			<0.013	0.10	5.60	
swn1		<0.013		<0.005	<0.013	<0.0002		<0.001	<0.001			<0.013	0.19	7.20	
swn1		<0.013		0.0100	<0.013	<0.0002		<0.001	<0.001			<0.013	0.17	7.20	
swn2		0.0540		<0.005	<0.05	<0.0002		<0.001	<0.0001			<0.5	1.40	10.00	
swn2		<0.13	<0.01	<0.005	<0.013	<0.002		<0.001	<0.001			<0.013	0.20	6.60	<.5ug/l
swn2		<0.013		<0.005	<0.013	<0.0002		<0.001	<0.001			<0.013	0.21	7.20	
swn3		<0.05		<0.005	<0.05	0.0010		<0.001	<0.0001			<0.5	1.60	11.00	
wbk1		<0.013		<0.005	<0.013	<0.0002		<0.001	<0.001			<0.013	<0.1	0.40	
wbk2		<0.013		<0.005	<0.013	<0.0002		<0.001	<0.001			<0.013	<0.1	1.00	
wp3		1.5000		0.0220	<0.05	<0.0002		<0.001	<0.0001			1.2000	1.50	10.00	
wp3		1.6000	<0.01	0.0130	0.3100	0.0021		<0.001	<0.001			3.7000	0.60	7.10	<.5ug/l
wp3		1.0000		0.0320	0.2300	0.0010		<0.001	<0.001			2.2000	0.52	8.40	
KM1		<0.02				<0.0002		<0.002					0.10	4.80	
KM2		0.1000				<0.0002		<0.002					1.90	12.00	<0.001
KM3		<0.02				<0.0002		<0.002					0.20	4.90	
KM4		0.0900				<0.0002		<0.002					0.20	4.50	
KM5		<0.025			<0.025							<0.025	0.11	6.20	
KM6		0.1500			<0.025							0.0500	1.80	7.50	<0.001
KM7		0.6700			0.1600							0.3000	<0.1	630.00	
KM8		0.1100			<0.025							<0.025	1.80	9.10	<0.001
KE002W3	<0.002	<0.004		<0.005	<0.002		<0.004		<0.0001	<0.0004	<0.002	<0.002			
KE003W3	<0.002	<0.004		<0.005	<0.002		<0.004		<0.0001	<0.0004	<0.002	<0.002			
KE004W3	<0.002	<0.004		<0.005	<0.002		<0.004		<0.0001	<0.0004	<0.002	<0.002			
KE004W3DS	<0.002	<0.004		<0.005	<0.002		<0.004		<0.0001	<0.0004	<0.002	<0.002			
KE005W3	<0.002	<0.004		<0.005	<0.002		<0.004		<0.0001	<0.0004	<0.002	<0.002			
KE006W3	<0.002	<0.004		<0.005	<0.002		<0.004		<0.0001	<0.0004	<0.002	<0.002			
KE007W3	<0.002	<0.004		<0.005	<0.002		<0.004		<0.0001	<0.0004	<0.002	<0.002			
KE008W3	<0.002	<0.004		<0.005	<0.002		<0.004		<0.0001	<0.0004	<0.002	<0.002			
KE009W3	<0.002	0.0120		<0.005	<0.002		<0.004		<0.0001	<0.0004	<0.002	<0.002			
KE010W3	<0.002	0.0760		<0.005	<0.002		<0.004		<0.0001	<0.0004	<0.002	<0.002			
KE010W3DS	<0.002	0.0760		<0.005	<0.002		<0.004		<0.0001	<0.0004	<0.002	<0.002			
KE011W3	<0.002	<0.004		<0.005	<0.002		<0.004		<0.0001	<0.0004	<0.002	<0.002			
KE012W3	<0.002	0.0090		<0.005	<0.002		<0.004		<0.0001	<0.0004	<0.002	<0.002			
sp1				<0.005	<0.05	<0.0002		<0.001	<0.0001			<0.5			
sp3		0.0550		<0.005	<0.05	<0.0002		<0.001	<0.0001			<0.5			
sp3		0.0720		0.0120	0.0180	<0.002		<0.001	<0.001			0.0490	na		
sp3		0.0680		<0.005	<0.013	<0.0002		0.0010	<0.001			<0.013	na		
sp4		0.1500		<0.005	<0.05	<0.0002		<0.001	<0.0001			<0.5			
sp4		0.4700		0.0610	<0.013	<0.002		<0.001	<0.001			0.0800	na		
sp4		0.1600		<0.005	<0.013	<0.0002		<0.001	<0.001			<0.013			

Appendix 2a. Compilation of water data. Units for metals are ppm.

SAMPLE ID	date	sampler(a)	location	media	Descr1	Temp C	pH	Conductivity	D.O.	Alkalinity	Sb	As	Ba	Be	Ca	Cd	Cr
swb	05/92	EMCON(h)	Bonanza Crk	water	filtered							<0.001	<0.05			<0.0005	<0.005
swb	07/91	EMCON(h)	Bonanza Crk	water	filtered							0.0010	0.0240			<0.0005	<0.005
swb	09/91	EMCON(h)	Bonanza Crk	water	filtered							0.0013	0.0260			<0.0005	<0.005
swbk	07/91	EMCON(h)	blank	water	filtered							<0.001	<0.013			<0.0005	<0.005
swbk1	09/91	EMCON(h)	blank	water	filtered							<0.001	<0.013			<0.0005	<0.005
swbk2	09/91	EMCON(h)	blank	water	filtered							<0.001	<0.013			<0.0005	<0.005
swbk3	05/92	EMCON(h)	blank	water	filtered							<0.001	<0.05			<0.0005	<0.005
swj	05/92	EMCON(h)	Jumbo Crk	water	filtered							0.0015	<0.05			<0.0005	<0.005
swj	07/91	EMCON(h)	Jumbo Crk	water	filtered							0.0020	<0.013			<0.0005	<0.005
swj	09/91	EMCON(h)	Jumbo Crk	water	filtered							0.0022	0.0120			<0.0005	<0.005
swk1	05/92	EMCON(h)	Kennicott Crk, S of Amazon	water	filtered							<0.001	<0.05			<0.0005	<0.005
swk1	07/91	EMCON(h)	Kennicott Crk, S of Amazon	water	filtered							0.0020	0.0230			<0.0005	<0.005
swk1	09/91	EMCON(h)	Kennicott Crk, S of Amazon	water	filtered							<0.001	<0.013			<0.0005	<0.005
swk2	05/92	EMCON(h)	Kennicott Crk, S of National	water	filtered							0.0018	<0.05			<0.0005	<0.005
swk2	07/91	EMCON(h)	Kennicott Crk, S of National	water	filtered							<0.001	0.0260			<0.0005	<0.005
swk2	09/91	EMCON(h)	Kennicott Crk, S of National	water	filtered							<0.001	0.0280			<0.0005	<0.005
swk3	05/92	EMCON(h)	Clear Creek	water	filtered							0.0011	<0.05			<0.0005	<0.005
swk3	07/91	EMCON(h)	Clear Creek	water	filtered							<0.001	0.0220			<0.0005	<0.005
swk3	09/91	EMCON(h)	Clear Creek	water	filtered							0.0006	0.0230			<0.0005	<0.005
swk4	05/92	EMCON(h)	Kennicott Crk, Bel. McC Crk	water	filtered							<0.001	<0.05			<0.0005	<0.005
swk4	07/91	EMCON(h)	Kennicott Crk, Bel. McC Crk	water	filtered							<0.001	0.0250			<0.0005	<0.005
swk4	09/91	EMCON(h)	Kennicott Crk, Bel. McC Crk	water	filtered							0.0035	0.0310			<0.0005	<0.005
swk5	09/91	EMCON(h)	dupl of swn1	water	filtered												
swm1	07/91	EMCON(h)	McC Crk, Below Lubbe Crk	water	filtered							<0.001	0.0140			<0.0005	<0.005
swm2	07/91	EMCON(h)	McC Crk, below Green butte	water	filtered							<0.001	0.0170			<0.0005	<0.005
swm3	07/91	EMCON(h)	McC Crk, S of Bonz rdge	water	filtered							<0.001	0.0260			<0.0005	<0.005
swm4	05/92	EMCON(h)	McC Crk, abv McCarthy	water	filtered							<0.001	<0.05			<0.0005	<0.005
swm4	07/91	EMCON(h)	McC Crk, abv McCarthy	water	filtered							<0.001	0.0250			<0.0005	<0.005
swm4	09/91	EMCON(h)	McC Crk, abv McCarthy	water	filtered							0.0005	0.0390			<0.0005	<0.005
swn1	05/92	EMCON(h)	National Crk, abv mill town	water	filtered							<0.001	<0.05			<0.0005	<0.005
swn1	07/91	EMCON(h)	National Crk, abv mill town	water	filtered							<0.001	0.0240			<0.0005	<0.005
swn1	09/91	EMCON(h)	National Crk, abv mill town-dupl	water	filtered							<0.001	0.0280			<0.0005	<0.005
swn1	09/91	EMCON(h)	National Crk, abv mill town	water	filtered							<0.001	0.0290			<0.0005	<0.005
swn2	05/92	EMCON(h)	National Crk, below mill	water	filtered							0.0013	<0.05			<0.0005	<0.005
swn2	07/91	EMCON(h)	National Crk, below mill	water	filtered							<0.001	0.0260			<0.0005	<0.005
swn2	09/91	EMCON(h)	National Crk, below mill	water	filtered							<0.001	0.0280			<0.0005	<0.005
swn3	05/92	EMCON(h)	dupl of swn1	water	filtered							<0.001	<0.05			<0.0005	<0.005
wp3	05/92	EMCON(h)	Tails Well/ Adj. Kenn Crk	water	filtered							0.0025	<0.05			<0.0005	<0.005
wp3	07/91	EMCON(h)	Tails Well/ Adj. Kenn Crk	water	filtered							0.0040	0.0290			0.0015	<0.005
wp3	09/91	EMCON(h)	Tails Well/ Adj. Kenn Crk	water	filtered							0.0011	0.0280			<0.0005	<0.005

(a) Sampler: NPS-data in park files, WESTON-from Weston 1995; Eppinger-from Eppinger et al. 1995; EMCON-from EMCON 1992a; Kay&Miller-from Kay and Miller 1990

(b) Also ran Al, Fe, K, Na.

(c) Also ran Al, Au, B, Bi, Ce,Cl, Cs, Dy, Er, Eu, F, Fe, Ga, Gd, Ge, Hf,, Ho, Ir, K, La, Li,Mg, Mo.Na, Nb, Nd, Os, P, Pd,Pr, Pt, Rb, Re, Rh , Ru, Sb, Sc, Si, Sm, Sn, Sr, Ta, Tb, Te, Ti, Tl, Tm, U, W, Y Yb, Zr

(d) also analyzed for turbidity and fecal coliforms, Cl,color,,corrosive,foaming,Fe, odor,Na,Tds

(e) ran tot pet HCO's (mg/l) and diesel @6.9 ppm

(f) 10Ug/l of Bis(2-ethylhexyl Phthalate)

(g) Also ran Al, Fe, K, Mg, Na, P, Si, Cl and F

(h) also sampled Fl, turbidity, fecal coliform, Cl, color,corrosivity, foaming, Fe, odor, Na, TDS, % saturation, redox , Mg, K, COD, BOD, NH3-N, Uranium, gross Alpha

Appendix 2a. Compilation of water data. Units for metals are ppm.

SAMPLE ID	Co	Cu	Cyanide	Pb	Mn	Hg	Ni	Se	Ag	Tl	V	Zn	NO3	SO4	PCB's
swb		<0.05		<0.005	<0.05	<0.0002		<0.001	<0.0001			<0.5			
swb		<0.13		0.0060	<0.013	<0.002		<0.001	<0.001			0.0130	na		
swb		<0.013		<0.005	<0.013	<0.0002		0.0007	<0.001			<0.013			
swbk		<0.13		<0.005	<0.013	<0.002		<0.001	<0.001			<0.013	na		
swbk1		<0.013		<0.005	<0.013	<0.0002		<0.001	<0.001			<0.013			
swbk2		<0.013		<0.005	<0.013	<0.0002		<0.001	<0.001			<0.013			
swbk3		<0.05		<0.005	<0.05	<0.0002		<0.001	<0.0001			<0.5	<0.1		
swj		<0.05		<0.005	<0.05	<0.0002		<0.001	<0.0001			<0.5			
swj		<0.13		<0.005	<0.013	<0.002		<0.001	<0.001			<0.013	na		
swj		<0.013		<0.005	<0.013	<0.0002		<0.001	<0.001			<0.013			
swk1		<0.05		<0.005	<0.05	<0.0002		<0.001	<0.0001			<0.5			
swk1		<0.13		0.0120	<0.013	<0.002		<0.001	<0.001			<0.013	na		
swk1		<0.013		<0.005	<0.013	<0.0002		<0.001	<0.001			<0.013			
swk2		<0.05		<0.005	<0.05	<0.0002		<0.001	<0.0001			<0.5			
swk2		<0.13		0.0090	<0.013	<0.002		<0.001	<0.001			<0.013	na		
swk2		<0.013		<0.005	<0.013	<0.0002		<0.001	<0.001			<0.013			
swk3		<0.05		<0.005	<0.05	<0.0002		<0.001	<0.0001			<0.5			
swk3		<0.13		<0.005	<0.013	<0.002		<0.001	<0.001			<0.013	na		
swk3		<0.013		<0.005	<0.013	<0.0002		<0.001	<0.001			<0.013			
swk4		<0.05		<0.005	<0.05	<0.0002		<0.001	<0.0001			<0.5			
swk4		<0.13		<0.005	<0.013	<0.002		<0.001	<0.001			<0.013	na		
swk4		<0.013		<0.005	<0.013	<0.0002		0.0012	<0.001			0.0150			
swk5															
swm1		<0.13		0.0070	<0.013	<0.002		<0.001	<0.001			0.0160	<0.1		
swm2		<0.13		<0.005	<0.013	<0.002		<0.001	<0.001			<0.013	na		
swm3		<0.13		<0.005	<0.013	<0.002		<0.001	<0.001			<0.013	na		
swm4		<0.05		<0.005	<0.05	<0.0002		<0.001	<0.0001			<0.5			
swm4		<0.13		<0.005	<0.013	<0.002		<0.001	<0.001			<0.013	na		
swm4		<0.013		<0.005	<0.013	<0.0002		0.0012	<0.001			<0.013			
swn1		<0.05		<0.005	<0.05	<0.0002		<0.001	<0.0001			<0.5			
swn1		<0.13		<0.005	<0.013	<0.002		<0.001	<0.001			<0.013	na		
swn1		<0.013		0.0080	<0.013	<0.0002		<0.001	<0.001			<0.013			
swn1		<0.013		<0.005	<0.013	<0.0002		<0.001	<0.001			<0.013			
swn2		<0.05		0.0070	<0.05	<0.0002		<0.001	<0.0001			<0.5			
swn2		<0.13		<0.005	<0.013	<0.002		<0.001	<0.001			<0.013	na		
swn2		<0.013		<0.005	<0.013	<0.0002		<0.001	<0.001			<0.013			
swn3		<0.05		<0.005	<0.05	<0.0002		<0.001	<0.0001			<0.5			
wp3		<0.05		<0.005	<0.05	<0.0002		<0.001	<0.0001			<0.5			
wp3		0.0350		0.0190	<0.013	<0.002		<0.001	<0.001			1.1000	na		
wp3		<0.013		<0.005	0.0210	<0.0002		<0.001	<0.001			<0.013			

Appendix 2b. Oil [redacted]oiled soil data. Units are ppm.

ID	Date	Sampler	Location	media	Description	Sb	As	Ba	Be	Cd	Cr	Co	Cu	Pb	Mn	Hg	Ni	Se	Ag	Tl
KP-01	07/95	NPS	Glacier Mine, 1' deep	soil	under winch building/stain	2.40	26.70			0.23	<0.78	<0.7	52.7	31.9	50.5	<0.03	11.1	<1.6	<0.08	<0.8
KP-02	07/95	NPS	Glacier Mine, 1-3" deep	soil	under winch building/stain	48.30	58.00			1.98	2.88	5.3	4,410.0	2,410.0	214.0	0.07	29.6	1.89	3.33	<0.9
KP-03	07/95	NPS	Erie Mine, 1-3" deep	soil	by power house pilings/stai	2.70	662.00			13.30	2.19	1.5	5,840.0	68.3	113.0	43.40	17.5	<1.6	2.59	<0.8
KP-05	07/95	NPS	Jumbo Mine, 1-3" deep	soil	3' from painted bunkhouse	3.40	288.00	32.4		0.71	3.82	0.8	1,240.0	125.0	64.7	1.84	13.2		6.23	<0.7
ss001-0	07/94	Weston	pwr plnt oil spill/tnk 4(3)	soil	power plt oil spill	479.00	50.70	316.00	0.25	4.50	20.10	68.70	1690.00	359.00	306.00	1.30	1500.00	3.50	0.76	1.80
ss002-0	07/94	Weston	pwr plnt oil spill/down slop	soil	power plt oil spill	0.55	5.30	31.10	0.20	0.20	12.30	8.60	48.00	13.50	234.00	0.05	29.00	0.81	0.61	1.50
ss002-1	07/94	Weston	pwr plnt oil spill/down slop	soil	power plt oil spill	0.42	9.60	38.40	0.20	0.20	12.70	8.20	61.10	14.30	269.00	0.05	34.30	0.81	0.61	1.40
ss003-0	07/94	Weston	pwr plt oil spill/tank 4(2)	soil	power plt oil spill	1.30	47.70	209.00	0.21	1.80	18.10	34.10	1660.00	351.00	215.00	0.44	758.00	9.40	0.62	1.40
ss004-0	07/94	Weston(i)	ash/W side	ash	boiler ash pile	165.00	59.00	104.00	0.21	2.60	96.70	29.90	2940.00	4000.00	1980.00	0.40	118.00	0.85	6.30	1.50
ss005-0	07/94	Weston(i)	ash/E side	ash	boiler ash pile	10.60	194.00	88.40	0.42	5.10	10.20	6.80	3140.00	557.00	205.00	2.60	37.20	1.00	1.80	1.60
ss006-0010	07/94	Weston(i)	S of mill/ 0-1' deep	soil	tails	6.80	477.00	80.00	U	6.70	3.70	11.20	17800.00	166.00	144.00	4.60	7.10	U	13.10	U
ss007-0010	07/94	Weston(i)	near bldg 24/0-1'	soil	tails	1.70	705.00	13.60	U	13.00	8.10	5.30	29400.00	31.60	171.00	3.60	9.40	U	16.60	U
ss007-0040	07/94	Weston(i)	near bldg24/ 4-5' deep	soil	tails	0.76	530.00	12.80	U	11.80	1.60	11.40	5460.00	15.80	105.00	6.50	7.20	U	16.00	U
ss008-0010	07/94	Weston(i)	roadcut below I&f plant/0-1	soil	tails	0.47	186.00	4.70	U	12.90	1.90	11.10	2920.00	4.50	116.00	1.70	7.00	U	3.40	U
ss008-0050	07/94	Weston(i)	roadcut below/&f/5'	soil	tails	0.76	372.00	7.60	U	15.20	0.97	11.20	3410.00	2.80	113.00	1.80	7.10	U	3.00	U
ss009-0	07/94	Weston		soil	background	0.52	5.20	28.50	0.20	0.20	21.00	10.60	74.50	2.40	303.00	0.05	20.90	0.82	0.61	1.40
SS010-0001	07/94	Weston	dairy, 0-1"	soil	downwind	0.98	39.90	170.00	0.27	0.71	6.10	6.40	385.00	135.00	372.00	0.58	10.00	u	u	u
SS010-0005	07/94	Weston	dairy, 1-6"	soil	downwind	0.61	5.60	48.50	0.38	0.22	10.50	9.70	75.70	14.30	452.00	0.11	11.10	u	u	u
SS010-0010	07/94	Weston	dairy, 6-12"	soil	downwind	0.64	5.80	40.60	0.46	0.21	6.20	7.50	46.90	9.40	470.00	0.05	7.60	u	u	u
SS011-0001	07/94	Weston	bldg 29a, 0-1"	soil	downwind	1.00	11.80	189.00	0.28	0.89	13.30	9.30	231.00	328.00	686.00	0.19	10.30	u	u	u
SS011-0005	07/94	Weston	bldg 29a, 1-6"	soil	downwind	1.10	7.80	123.00	0.27	0.27	9.60	5.00	131.00	121.00	575.00	0.18	8.90	u	u	u
SS011-0010	07/94	Weston	bldg 29a, 6-12"	soil	downwind	1.70	19.20	222.00	0.23	0.32	13.60	8.20	554.00	342.00	549.00	0.15	11.70	u	u	u
ss012-0	07/94	Weston		soil	background	0.78	6.40	31.90	0.33	0.21	17.60	10.10	35.60	6.10	330.00	0.05	19.50	0.86	0.64	1.50
ss013-0	07/94	Weston	drum dump	soil	tails	3.30	515.00	65.20	U	16.90	10.90	11.10	6240.00	539.00	392.00	5.50	8.30	U	11.60	U

ID	V	Zn	Pb/tclp	PCB's	units	TPH/ TotHCOs	DRO/ Diesel	RRO	1,1,2,2-tetrachloroethane	xylene	toluene	Phenanthrene	Pyrene	Chrysene	Fluoranthene	Benzo(a)anthracene	Benzo(b)fluoranthene	Benzo(k)fluoranthene	Clorinated cmpds
KP-01		10.7		<0.025	mg/kg dry	13,500	17,000	10,900											<0.06
KP-02		649.0		<0.489	mg/kg dry	163,000	118,000	35,000											<0.34
KP-03		98.9		<.290	mg/kg dry	16,900	13,700	14,700											<0.08
KP-05		21.7	0.107																
ss001-0	1800.00	185.00							1	1	11	7300	8700	57000	57000	57000	57000	57000	
ss002-0	35.60	35.70							1	1	2	10000	44000	32000	3100	16000	12000	10000	
ss002-1	43.80	36.50							1	10	10	51000	75000	43000	9500	21000	51000	81000	
ss003-0	1010.00	266.00							10	10	10	11000	14000	7700	52000	52000	52000	52000	
ss004-0	84.00	608.00										1200	1000	1800	680	930	2300	2500	
ss005-0	42.70	353.00										610	300	1100	360	300	510	500	
ss006-0010	6.80	21.40																	
ss007-0010	20.20	103.00																	
ss007-0040	4.00	3.30																	
ss008-0010	6.70	6.90																	
ss008-0050	6.00	3.70																	
ss009-0	38.70	35.90			ug/kg				10	10	10	330	330	330	330	330	330	330	
SS010-0001	19.50	124.00																	
SS010-0005	27.50	48.50																	
SS010-0010	21.50	38.40																	
SS011-0001	27.70	225.00																	
SS011-0005	23.90	74.70																	
SS011-0010	29.60	187.00																	
ss012-0	23.40	27.70							11	11	11	360	360	360	360	360	360	360	
ss013-0	8.40	128.00																	

(i)no pesticides or PCB's detected

Appendix 2c. Oil and grease data. Units are ppm.

ID	Date	Sampler	Location	media	Description	As	Cd	Cr	Pb	Halogens	PCB's	Flash pt F	est Vol	TPH/ TotHCOs	DRO/ Diesel	RRO
BF1	07/91	EMCON	in tank 4(2)	oil		<1	1.1	<1	10.2	<100	<1	>160				
BF2	07/91	EMCON	in tank 4(1)	oil		<1	1.3	<1	9.1	166	<1	>160				
BF3	08/91	EMCON	spill in leach plant	oil		3.3	<0.5	<1	40	2000	<1	>160				
BF4	05/92	EMCON	tank 4(1)	oil												
BF5	05/92	EMCON	tank 4(2)	oil												
CO1	06/92	EMCON	Angle Station	oil	transformer	4.1	<0.5	1.7	13.5	130	<1	>160				
CO2	08/91	EMCON	plat-o and james tables	oil	lubricating	<1	<0.5	<1	<1	<100	<1	>160				
CO3	08/91	EMCON	mill bldg etc	oils	transf/circ. brkr	<1	<0.5	<1	<1	105	<1	>160				
CO4	08/91	EMCON	mill bldg etc	oils	transf/circ. brkr	<1	<0.5	<1	<1	<100	<1	>160				
KM31	1990	Kay&Miller	power house	oil/water	fuel	1.4	<.5	<1	9.9	119	<1.0	>160	793			
KM32	1990	Kay&Miller	fuel tank	oil	fuel	<.5	<.5	1.2	9.7	<100	<1.0	>160	26655			
KM35	1990	Kay&Miller	fuel tank	oil	fuel	0.8	<.5	<1	9.7	<100	<1.0	>160	235			
KM36	1990	Kay&Miller	mill	oil	transformer	<.5	<.5	<1	<1	<100	<1.0	>160	6			
KM40	1990	Kay&Miller	mill, James Table	oil	sump	<.5	<.5	<1	<1	<100	<1.0	>160	4			
KM42	1990	Kay&Miller	Leaching plant	oil	switchgear	<.5	<.5	<1	<1	<100	<1.0	>160	14			
KM48	1990	Kay&Miller	Transformer house	oil	transformer	<.5	<.5	<1	<1	<100	<1.0	>160	160			
KM50	1990	Kay&Miller	Junction Station	oil	transformer	<.5	<.5	<1	<1	<100	<1.0	>160	97			
KP-06	07/95	NPS	Jumbo Mine, 0-1" deep	oil	floor boards/power house						<3.882			290,000	209,000	90,200
CG1	07/91	EMCON	tram term bonz mine	grease	black	11.4	<0.5	<1	1.7	<100	<1	>160				
CG2	08/91	EMCON	mill bldgs	grease	black	9.8	4.3	<1	22.8	368	<1	>160				
CG3	08/91	EMCON	mill bldgs	grease	yellow	<1	<0.5	<1	<1	139	<1	>160				
CG4	08/91	EMCON	milll bldgs	grease	yellow	<1	1.9	<1	<1	<100	<1	>160				
CG5	08/91	EMCON	mill bldgs	grease	black	<1	2.6	<1	1	315	<1	>160				
KM33	1990	Kay&Miller	mill	grease/water		2.1	<.5	<1	2.1	<100	<1.0	>160	21			
KM37	1990	Kay&Miller	mill	grease	black	11.7	<.5	<1	4.5	<100	<1.0	>160	25			
KM38	1990	Kay&Miller	mill	grease	yellow	2.4	<.5	<1	8.6	<100	<1.0	>160	25			

Appendix 2d. Oiled soil data. Units are ppm.

ID	Date	Sampler	Location	media	Description	PCB's	TPH/ TotHCOs	DRO/ Diesel	Benzene	Toluene	Ethylbenzene	p-&m-xylene	0-xylene
PH01	07/91	EMCON	W of fuel tank 4(2)	soil	vis oil stain		2,970		<0.05	<0.05	<0.05	<0.05	
PH02	07/91	EMCON	W of bldg 38	soil	no oil stain		3,600						
PH03	07/91	EMCON	W of bldg 38	soil	no oil stain		170		<0.05	<0.05	<0.05	<0.05	
PH04	07/91	EMCON	W of fuel tank 4(2)	soil	oil stain		61,000	30,000	<0.05	<0.05	<0.05	<0.05	
PH05	07/91	EMCON	W of sewer pipe	soil	oil stain		9,900						
PH06	07/91	EMCON	W of bldg 38	soil	oils stain		2,600		<0.05	<0.05	<0.05	<0.05	
PH07	07/91	EMCON	S of bldg 38	soil	oil stain		110,000						
PH08	07/91	EMCON	W of power house	soil	asphalt stain		490		<0.05	<0.05	<0.05	<0.05	
PH09	07/91	EMCON	W of power house	soil	oil saturated		28,000						
PH10	07/91	EMCON	W of oil pools	soil	no oil stain		97						
PH11	07/91	EMCON	W of fuel tank 4(3)	soil	no oil stain		118						
PH12	07/91	EMCON	W of fuel tank 4(3)	soil	no oil stain		97		<0.05	<0.05	<0.05	<0.05	
PH13	07/91	EMCON	W of oil pools	soil	oil sludge		620,000	270,000	<0.05	<0.05	<0.05	<0.05	
PH15	07/91	EMCON	Dup of ph10	soil	dup of ph10		91						
PH16	07/91	EMCON	Bonanza mine, transf	soil	oil stain	<1	37,200						
PH17	07/91	EMCON	Nr fuel tank 4(1)	soil	oil stain		28,000						
PH18	07/91	EMCON	Nr fuel tank 4(1)	soil	no stain		3,500						
PH19	07/91	EMCON	Nr fuel tank 4(1)	soil	oil stain		120,000	54,000	<0.05	<0.05	<0.05	<0.05	
PH20	07/91	EMCON	Utilidor	soil	oil stain		320,000	250,000	<0.05	<0.05	<0.05	<0.05	
PH21	07/91	EMCON	Utilidor	soil	no stain		240						
PH22	07/91	EMCON	Utilidor	soil	oil stain		37,000						
PH23	07/91	EMCON	Utilidor	soil	oil stain		110,000						
PH24	07/91	EMCON	Nr bldg 13c	soil	no stain		940						
PH30	06/92	EMCON	N of mill bldg	soil	oil stain		100,000						
PH31	06/92	EMCON	N of mill bldg	soil	oil stain		55,000						
PH32	06/92	EMCON	N of mill bldg	soil	oil stain		500						
PH33	06/92	EMCON	N of mill bldg	soil	oil stain		500						
KM16	1990	Kay&Miller(j)	Bldg #4, oil tank	soil	soaked in oil leak		121,000		<0.05	0.1	0.292	0.421	0.451
KM17	1990	Kay&Miller(j)	oil tank by bldg#38	soil	soaked in oil leak		52,900		0.16	1.66	0.284	1.01	1.01
KM19	1990	Kay&Miller	Bldg#46	soil	1" depth	<0.02	115						
KM20	1990	Kay&Miller	Adj. bldg #24	soil	6" depth	<0.02	15						
KM49	1990	Kay&Miller	adj. bldg#37	soil		<1	454						
(j) also ran Chlorobenzene, 1,4, Dichlorobenzene, 1,3 dichlorobenzene, 1,2, dichlorobenzene.. allwere nd at < (0.1)													

Appendix 2e. Miscellaneous Samples

ID	Date	Sampler	Location	media	Description	pH	cond	units	Sb	As	Ba	Be	Cd	Cr	Cu	Pb	Hg	Ni	Se	Ag	Tl
BA1	07/91	EMCON		ash	tclp metals			mg/l		<0.1	0.900		0.100	<0.01		72.40	<0.001		<0.1	<0.01	
BA2	09/91	EMCON		ash	total metals			mg/kg		145.000	170.000		<10	107.00		18900.00	2.6		<1	59.000	
BA2	09/91	EMCON		ash	tclp metals			mg/l		<0.1	1.100		0.100	<0.01		71.30	<0.001		<0.1	<0.01	
BA3	09/91	EMCON		ash	total metals			mg/kg		77.000	222.000		100.000	113.00		8650.00	3.5		<1	403.000	
BA3	09/91	EMCON		ash	tclp metals			mg/l		<0.1	1.000		0.120	<0.01		45.80	<0.001		<0.1	0.010	
KM53	1990	Kay&Miller	W of Bldg #9	ash	ep tox	7.10		mg/l		<0.01	<0.05		<.1	<0.05		<0.05	<0.002		<0.01	<0.1	
NH1	06/92	EMCON(k)	Leach plant	ammonia		9.32	1300			0.606	0.041		<0.003	<0.005		0.07	<0.0005			<0.01	
NH2	06/92	EMCON(l)	Leach plant	ammonia		9.50	1500			0.243	0.030		<0.003	<0.005		0.02	<0.0005			<0.01	
DU001-0	07/94	weston	McCarthy Hotel	Dust wipe				ug/10cm	u	0.912		u	u	nd	7.52	6.09		nd	u	0.026	u
DU002-0	07/94	weston	McCarthy Airport	Dust wipe				ug/10cm	u	3.110		u	u	nd	16	24.80		nd	u	0.042	u
DU003-0	07/94	weston	refrig plant	Dust wipe				ug/10cm	u	8.580		u	0.394	nd	247	50.80		nd	u	0.088	u
DU004-0	07/94	weston	cottage 39b	Dust wipe				ug/10cm	u	1.330		u	u	nd	18.2	97.40		nd	u	0.032	u
DU005-0	07/94	weston	cottage 13f	Dust wipe				ug/10cm	u	1.970		u	u	nd	21.8	7.79		nd	u	0.050	u
DU006-0	07/94	weston	cottage 24	Dust wipe				ug/10cm	u	0.100		u	0.097	nd	u	18.20		nd	u	0.015	u
DU007-0	07/94	weston	Kennicott lodge	Dust wipe				ug/10cm	u	0.240		u	u	nd	2.58	0.59		nd	u	0.020	u
FB1	07/91	EMCON	N of power house	firebrick	general firebrick			mg/kg						3							
FB2	08/91	EMCON	N of power house	firebrick	laclede-King fb			mg/kg						7	no hexavalent Cr was detected at <0.05 MRL						
FB3	08/91	EMCON	N of power house	firebrick	Evens-Howard			mg/kg						2	no hexavalent Cr was detected at <0.05 MRL						
KP-07	07/12/	NPS	Jumbo Mine	firebrick				mg/kg						<0.92							
KP-04	07/95	NPS	Jumbo Mine	insulation	fiber on pipes under building										90% Chrysolite, 10% other						
	(k) ammonia was 1676 mg/l, airspace >700 ppm																				
	(l) ammonia was 1069 mg/l, airspace >400 ppm																				
	(m) Ran TCLP for Ag, As, Ba, Cd, Cr, Hg, Pb and Se. Allwere ND except for some Ba. All Ba were <0.4, RCRA limit is 100																				

Appendix 2f. Tails and Ore Samples

ID	Date	Sampler	Location	media	Description	units	Sb	As	Ba	Be	Ca	Cd	Cr	Co	Cu	Pb	Mn	Hg	Ni	Se	Ag	Tl	V	Zn	SO4
TPS01	07/91	EMCON(m		tails	2-10"	ppm		353	13			7	3			<20		2.8		<1	12				<25
TPS02	07/91	EMCON(m		tails	2-12"	ppm		456	12			27	<2			49		7.1		<1	20				<25
TPS03	07/91	EMCON(m		tails	2-14"	ppm		283	9			11	<2			21		6.9		<1	11				<25
TPS04	07/91	EMCON(m		tails	2-10"	ppm		244	9			30	<2			<20		5.1		<1	5				<25
TPS05	07/91	EMCON(m		tails	2-10"	ppm		594	8			9	<2			<20		5.1		<1	4				<25
TPS06	07/91	EMCON(m		tails	2-8"	ppm		961	14			14	<2			27		4.4		<1	5				<25
TPS07	07/91	EMCON(m		tails	2-10"	ppm		596	23			19	<2			27		11.5		<1	11				<25
TPS08	07/91	EMCON(m		tails	2-16"	ppm		591	14			28	<2			41		7.5		<1	12				<25
TPS09	07/91	EMCON(m		tails	2-12"	ppm		670	12			26	<2			32		7.5		<1	15				<25
TPS10	07/91	EMCON(m		tails	2-18"	ppm		336	13			10	<2			38		3.9		<1	10				<25
TPS24	07/91	EMCON(m		tails	dup of TPS10	ppm		339	9			5	<2			<20		2.6		<1	5				<25
TPS11	07/91	EMCON(m		tails	4-12"	ppm		427	22			10	3			22		9.7		<1	14				<25
TPS12	07/91	EMCON(m		tails	2-6"	ppm		1770	51			26	4			107		13		1	15				<25
TPS13	07/91	EMCON(m		tails	0-8"	ppm		250	6			29	<2			<20		15.3		<1	8				<25
TPS14	07/91	EMCON(m		tails	2-8"	ppm		1230	34			66	<2			120		8.3		<1	16				<25
TPS15	07/91	EMCON(m		tails	2-8"	ppm		1270	28			48	<2			58		14.1		<1	18				<25
TPS16	07/91	EMCON(m		tails	2-7"	ppm		207	7			12	<2			<20		3.6		<1	5				<25
TPS17	07/91	EMCON(m		tails	2-6"	ppm		1350	29			5	14			28		6.3		1	33				<25
TPS18	07/91	EMCON(m		tails	2-6"	ppm		205	31			5	19			<20		2.2		<1	20				<25
TPS19	07/91	EMCON(m		tails	2-6"	ppm		3500	162			65	7			251		51.8		2	118				<25
TPS20	07/91	EMCON(m		tails	2-6"	ppm		1690	95			26	11			336		30.9		1	31				<25
TPS25	07/91	EMCON(m		tails	dup of TSP20	ppm		1610	109			22	9			94		15.4		3	70				<25
TPS21	07/91	EMCON(m		tails	2-8"	ppm		263	74			7	14			37		7.3		<1	6				<25
TPS22	07/91	EMCON(m		tails	2-10"	ppm		3530	20			2	<2			25		27.3		2	6				<25
TPS23	07/91	EMCON(m		tails		ppm		639	9			5	<2			<20		6.7		<1	5				<25
TPS26	05/92	EMCON(m	W of Leach plt/dischg gull	tails	2-10"	ppm		619	18			20	<2			36		5.1		<1	5				
TPS27	05/92	EMCON(m	W of leach plt/by Natl Crk	tails		ppm		3981	50			37	<2			58		5.7		<1	33				
TPS28	05/92	EMCON(m	under flume S side Natl Cr	tails		ppm		557	23			15	8			25		2.8		<1	6				
TPS29	05/92	EMCON(m		tails		ppm		880	19			70	<2			82		9.9		<1	14				
TPS30	*05/92*	*EMCON(m*		*tails*	*dup of TPS29*	*ppm*		942	20			198	<2			70		7.4		<1	9				
KM011	1990	Kay&Miller	W of bldg #19	tails	ep tox	ppm		0.14	0.2			0.18	<0.05			<0.05		<0.0002		<0.01	<0.05				
O10	06/92	EMCON	dorr /flot plnt	rock	total metals	ppm		7030	154			44	5			211		155		8	144				54
O10	06/92	EMCON	dorr /flot plnt	rock	TCLP, method 1312	ppm		<0.1	<0.1			<0.01	<0.01			<0.05		<0.001		<.1	<0.01				
OC8	06/92	EMCON	bin/leach plant	rock	total metals	ppm		3740	118			37	4			96		20.9		2	20				272
OC8	06/92	EMCON	bin/leach plant	rock	TCLP, method 1312	ppm		<0.1	<0.1			<0.01	<0.01			<0.05		<0.001		<.1	<0.01				
OC9	06/92	EMCON	dorr /flot plnt	rock	TCLP, method 1312	ppm		<0.1	0.1			<0.01	<0.01			<0.05		<0.001		<.1	<0.01				
OC9	06/92	EMCON	dorr /flot plnt	rock	total metals	ppm		4280	122			50	3			121		31.6		3	30				965
KE007R	08/94	eppinger	Bonanza Mine, bel	rock	Nick Basalt/Backgroun	ppm	0.60	<15	55	<2	6.90	<0.75	230	50	120	<8	1200	0.17	91	0.10	<1.2	<0.1	340.00	150.00	
KE009R1	08/94	eppinger	Tails, mill	rock	Nick Basalt/Backgroun	ppm	0.80	4.20	600	<2	4.10	<0.75	81	28	62	8	850	0.11	45	0.30	<1.2	0.25	210.00	46.00	
KE009R2	08/94	eppinger	Tails, mill	rock	Nick Basalt/Backgroun	ppm	0.50	3.40	270	<2	5.50	<0.05	130	51	92	<8	1400	0.13	69	0.30	<0.08	0.10	390.00	84.00	
KE010R1	08/94	eppinger	Kennicott mill/leach plant	rock	Nick Basalt/Backgroun	ppm	0.50	5.30	160	<2	5.30	0.41	100	43	170	<8	1200	0.08	54	0.20	<0.08	0.10	360.00	65.00	
KE011R1	08/94	eppinger	National Crk, below mill	rock	tert. quartz	ppm	0.60	2.30	790	<2	0.23	<0.05	<2	<2	4	19	160	<.02	<4	0.10	<0.08	0.45	<4	9.50	
KE011R2	08/94	eppinger	National Crk, below mill	rock	siltstone	ppm	2.40	18.00	530	<2	4.10	<0.05	41	9	56	<8	700	0.15	26	0.50	0.18	0.20	85.00	74.00	
KE013R	08/94	eppinger	Bonanza Mine	rock	mineralized	ppm	na	7900.00	91	<2	10.00	73.00	5	<2	377000	<8	72	520.00	<4	h	640.00	0.75	<4	260.00	
KE014R	08/94	eppinger	Erie Mine	rock	mineralized	ppm	1.60	640.00	7	<2	29.00	5.00	5	2	10000	<8	92	7.00	<4	h	9.00	<0.1	<4	12.00	
OC01	06/92	EMCON	mother lode	ore	TCLP, method 1312	ppm		<0.1	<0.1			<0.01	<0.01			<0.05		<0.001		<.1	<0.01				
OC01	06/92	EMCON	mother lode	ore	total metals	ppm		5200	216			24	12			43		58.8		5	56				

Appendix 2f. Tails and Ore Samples

ID	Date	Sampler	Location	media	Description	units	Sb	As	Ba	Be	Ca	Cd	Cr	Co	Cu	Pb	Mn	Hg	Ni	Se	Ag	Tl	V	Zn	SO4
OC02	06/92	EMCON	mill bldg	ore	TCLP, method 1312	ppm		<0.1	<0.1			<0.01	<0.01			<0.05		<0.001		<.1	<0.01				
OC02	06/92	EMCON	mill bldg	ore	total metals	ppm		3130	98			23	5			78		40.6		8	34				1490
OC03	06/92	EMCON	hancock Jig	ore	total metals	ppm		2490	104			23	<2			140		33.5		3	54				444
OC03	06/92	EMCON	hancock Jig	ore	TCLP, method 1312	ppm		<0.1	<0.1			<0.01	<0.01			<0.05		<0.001		<.1	<0.01				
OC04	06/92	EMCON	dorr thickener	ore	TCLP, method 1312	ppm		<0.1	<0.1			<0.01	<0.01			<0.05		<0.001		<.1	<0.01				
OC04	06/92	EMCON	dorr thickener	ore	total metals	ppm		3080	124			32	3			60		31.7		2	27				300
OC05	06/92	EMCON	bin/mill bldg	ore	total metals	ppm		6570	254			35	2			255		66.3		8	108				68
OC05	06/92	EMCON	bin/mill bldg	ore	TCLP, method 1312	ppm		<0.1	0.1			<0.01	<0.01			<0.05		<0.001		<.1	<0.01				
OC06	06/92	EMCON	bin/mill bldg	ore	TCLP, method 1312	ppm		<0.1	<0.1			<0.01	<0.01			<0.05		<0.001		<.1	<0.01				
OC06	06/92	EMCON	bin/mill bldg	ore	total metals	ppm		11300	180			<1	13			173		131		9	197				656
OC07	06/92	EMCON	bin/leach plant	ore	TCLP, method 1312	ppm		<0.1	<0.1			<0.01	<0.01			<0.05		<0.001		<.1	<0.01				
OC07	06/92	EMCON	bin/leach plant	ore	total metals	ppm		350	8			13	<2			15		5.1		<1	8				<20
OC11	06/92	EMCON	glacier mine talus	ore	total metals	ppm		29	<1			2	<2		773000	58	148	<1			245				>100000
OC11	06/92	EMCON	glacier mine talus	ore	TCLP, method 1312	ppm		<0.1	<0.1			<0.01	<0.01			<0.05		0.007		<.1	<0.01				
KM04	1990	Kay&Miller	leach pint	ore	magnetite	% by wt		nd			0.34				nd		0.54		0.16					nd	
KM06	1990	Kay&Miller	tails	ore		% by wt		nd			21.5				23.4		nd		nd					0.14	
KM07	1990	Kay&Miller	float plt outfall pipe	ore		% by wt		0.95			33.1				8.7		nd		nd					nd	
KM08	1990	Kay&Miller	mill bldg ore bins	ore		% by wt		nd			2.2				48.9		nd		nd					0.22	
KM10	1990	Kay&Miller	mill bldg high-grd bins	ore		% by wt		0.4			22.8				25.2		nd		nd					0.15	
KM39	1990	Kay&Miller	Bldg #3	ore	ep tox	mg/l		1.06	0.21			1.6	<0.05			<0.05		<0.002		<0.01	<0.1				
	(m) Ran TCLP for Ag, As, Ba, Cd, Cr, Hg, Pb and Se. Allwere ND except for some Ba. All Ba were <0.4, RCRA limit is 100																								

Appendix C-5 – Data from Hart Crowser. 2002. Limited Hazardous Materials Survey, Former Kennecott Mining Town, Kennecott, Alaska.

Table 1 - Lead in Paint Measurements

Sample ID	Site	Floor	Room	Structure	Substrate	Paint Condition	Color	Lead in mg/cm^2 [(a)]
L23	West Bunkhouse	3	Hall-1	Wall	Wood	Fair	Brown	5.1
L24	West Bunkhouse	3	Room-19	Window Stool	Wood	Fair	White	5.1
L25	West Bunkhouse	2	Hall-2	Wall	Wood	Fair	White	5.1
L26	West Bunkhouse	2	Room-10	Ceiling	Wood	Fair	White	5.1
L27	West Bunkhouse	2	Stairwell-3	Wall Baseboard	Wood	Fair	Gray	1.01
L28	West Bunkhouse	1	Entry	Wall	Wood	Fair	Brown	28.42
L29	West Bunkhouse	1	Entry	Door Casing	Wood	Fair	White	2.33
L30	West Bunkhouse	B	Basement	Wall	Wood	Fair	White	5.1
L31	West Bunkhouse	B	Bath	Wall (Stall)	Wood	Poor	White	5.1
L32	West Bunkhouse	B	Basement	Floor	Wood	Not Painted		0.07
L33	West Bunkhouse	1	Outside	Ext Siding	Wood	Poor	Red	0.8
L34	West Bunkhouse	1	Outside	Ext Siding	Wood	Poor	Red	0.87
L64	Store and Warehouse	Ext	Outside	Wall	Wood	Poor	Red	0.05
L65	Store and Warehouse	Ext	Outside	Wall	Wood	Poor	Red	0.21
L80	Store and Warehouse	1	Retail	Door Casing	Wood	Good	Brown	0.02
L81	Store and Warehouse	1	Retail	Wall	Wood	Cracked	White	5.1
L82	Store and Warehouse	1	Retail	Ceiling	Wood	Peeling	White	5.1
L83	Store and Warehouse	1	Retail	Cabinet Shelf	Wood	Good	White	5.1
L84	Store and Warehouse	1	Office	Wall	Wood	Good	Green	5.1
L85	Store and Warehouse	1	Office	Wall	Other	Peeling	White	25.42
L95	Store and Warehouse	B	Pump Storage	Door	Wood	Cracked	White	5.1
L96	Store and Warehouse	B	Steward's Office	Wall	Other	Peeling	Yellow	5.1
L100	Old School	1	Main	Wall	Wood	Chalking	White	30.64
L101	Old School	1	Cloak Room	Door	Wood	Good	White	5.1
L102	Old School	Ext	Outside	Door	Wood	Good	White	5.1
L103	Old School	Ext	Outside	Ext Siding	Wood	Good	Red	5.1
L104	Old School	Ext	Outside	Window Sill	Wood	Cracked	White	2.38
L123	Leaching Plant	Ext	Outside	Ext Siding	Wood	Peeling	Red	0.03
L124	Leaching Plant	Ext	Outside	Ext Siding	Wood	Peeling	Red	0.09
L125	Leaching Plant	Ext	Outside	Window Sill	Wood	Peeling	White	24.42
L126	Leaching Plant	Ext	Outside	Door	Wood	Peeling	Red	0.09
L127	Leaching Plant	Ext	Outside	Wall	Wood	Peeling	Red	0.03
L128	Leaching Plant	Ext	Outside	Wall	Wood	Peeling	Red	0.07
L129	Leaching Plant	Ext	Outside	Ext Siding	Wood	Peeling	Red	0.41

Table 1 - Lead in Paint Measurements

Sample ID	Site	Floor	Room	Structure	Substrate	Paint Condition	Color	Lead in mg/cm^2 [(a)]
L151	Machine Shop	Ext	Outside	Ext Siding	Wood	Peeling	Red	0.14
L152	Machine Shop	Ext	Outside	Door	Wood	Peeling	Red	0.05
L153	Machine Shop	Ext	Outside	Window Sash	Wood	Peeling	White	26.27
L154	Machine Shop	Ext	Outside	Door Jamb	Wood	Peeling	White	38.04
L155	Machine Shop	Ext	Outside	Ext Siding	Wood	Peeling	Red	0
L156	Machine Shop	Ext	Outside	Door	Wood	Peeling	Red	0.02
L161	Machine Shop	Ext	Porch-1	Porch Trim (upper)	Wood	Peeling	White	0.01
L174	Power Plant	Ext	Outside	Ext Siding	Wood	Peeling	Red	0.1
L175	Power Plant	Ext	Outside	Door Jamb	Wood	Peeling	White	5.1
L176	Power Plant	Ext	Outside	Window Sill	Wood	Peeling	White	17.91
L177	Power Plant	Ext	Outside	Ext Siding	Wood	Peeling	Red	0.02
L178	Power Plant	1	Main	Ceiling Beam	Wood	Peeling	White	0
L204	Mill	Ext	Outside	Ext Siding	Wood	Cracked	Red	0.85
L205	Mill	Ext	Outside	Ext Siding	Wood	Cracked	Red	0.01
L206	Mill	Ext	Outside	Ext Siding	Wood	Cracked	Red	5.1
L207	Mill	Ext	Outside	Ext Siding	Wood	Cracked	Red	0.02
L208	Mill	Ext	Outside	Ext Siding	Wood	Cracked	Red	0.15
L209	Mill	Ext	Outside	Ext Siding	Wood	Cracked	Red	0.23
L216	Mill	4	Plat-o-table	Rail	Wood	Peeling	Gray	5.1
L217	Mill	5	Wilf Tables	Wall	Wood	Peeling	Red	0.02
L218	Mill	6	Shop	Beam	Wood	Peeling	Gray	20.4
L219	Mill	6	Stair-1	Wall	Wood	Peeling	Gray	5.1
L253	Recreation Hall	1	Entry	Wall	Wood	Chalking	White	22.22
L254	Recreation Hall	1	Entry	Wall	Wood	Chalking	Green	5.1
L255	Recreation Hall	1	Gym	Door	Wood	Chalking	Red	0
L256	Recreation Hall	Ext	Outside	Ext Siding	Wood	Peeling	Red	0.64
L257	Recreation Hall	Ext	Outside	Ext Wall Trim (lower)	Wood	Peeling	White	3.62
L258	Recreation Hall	Ext	Outside	Door	Wood	Peeling	Red	1.43
L275	Refrigeration Plant	1	Hall	Window Casing	Wood	Peeling	Green	2.32
L276	Refrigeration Plant	1	Hall	Door	Wood	Peeling	White	5.1
L277	Refrigeration Plant	Ext	Outside	Ext Siding	Wood	Peeling	Red	0.25
L278	Refrigeration Plant	Ext	Outside	Window Sill	Wood	Peeling	White	5.1
L279	Refrigeration Plant	Ext	Outside	Door	Wood	Peeling	Red	0.07
L294	Schoolhouse	1	Class-1	Wall	Wood	Cracked	Gray	5.1

Table 1 - Lead in Paint Measurements

Sample ID	Site	Floor	Room	Structure	Substrate	Paint Condition	Color	Lead in mg/cm^2 [(a)]
L295	Schoolhouse	1	Class-1	Door	Wood	Cracked	Tan	25.68
L296	Schoolhouse	Ext	Outside	Ext Siding	Wood	Cracked	Red	0.45
L297	Schoolhouse	Ext	Porch	Porch Trim (upper)	Wood	Cracked	White	5.1
L352	Middle Bunkhouse	Ext	Outside	Ext Siding	Wood	Peeling	Red	0.07
L353	Middle Bunkhouse	Ext	Outside	Ext Wall Trim (upper)	Wood	Peeling	White	5.1
L357	General Manager's Office	1	Office-1	Wall	Wood	Cracked	White	22.14
L358	General Manager's Office	1	Office-1	Wall	Wood	Varnish	Brown	0.03
L359	General Manager's Office	2	Office-2	Door Casing	Wood	Poor	Gray	5.1
L360	General Manager's Office	Ext	Outside	Ext Siding	Wood	Poor	Red	0.05
L361	General Manager's Office	Ext	Outside	Window Sill	Wood	Poor	White	5.1
L383	Assay Office	Ext	Outside	Ext Siding	Wood	Peeling	Red	0.14
L384	Assay Office	Ext	Outside	Window Casing	Wood	Peeling	White	27.03
L385	Mill	Ext	Ore chute		Metal	Peeling	Red	0.04
L389	Railroad Depot	Ext	Outside	Ext Siding	Wood	Peeling	Red	0.1
L390	Railroad Depot	Ext	Outside	Window Sill	Wood	Peeling	White	5.1
L391	Railroad Depot	Ext	Outside	Ext Wall Trim (upper)	Wood	Peeling	White	8.91
L392	Railroad Depot	Ext	Outside	Door	Wood	Peeling	Red	0.17
L393	Railroad Depot	1	Interior	Wall	Wood	Peeling	Pink	2.73
L406	Fire Protection Bldg-1	Ext	Outside	Wall	Wood	Cracked	Red	0.02
L407	Fire Protection Bldg-1	Ext	Outside	Door Jamb	Wood	Cracked	White	5.1
L408	Fire Protection Bldg-1	Ext	Outside	Door	Wood	Cracked	Red	0.07
L409	Fire Protection Bldg-1	Ext	Outside	Ext Wall Trim (upper)	Wood	Cracked	White	21.35
L424	Fire Protection Bldg-2	Ext	Outside	Door	Wood	Chalking	White	5.1
L425	Fire Protection Bldg-2	Ext	Outside	Ext Siding	Wood	Cracked	Red	0.05

[(a)] Value presented is XRF reading.

Table 2 - Lead in Dust Measurements

				Lead in ug/ft^2	
Sample ID	**Site**	**Floor**	**Room**	**XRF**	**XRF Adjusted [(a)]**
LWS46	West Bunkhouse	2	Room-1	4,355	9,025
LWS91	Store and Warehouse	1	Canned Goods	1,283	3,466
LWS114	Old School	1	Main	436	1,933
LWS119	Old School	1	Cloak	1,583	4,009
LWS138	Leaching Plant	1	Sacking Shed	777	2,549
LWS167	Machine Shop	1	Parts	1,188	3,293
LWS172	Machine Shop	1	Rm 17/Main	1,495	3,849
LWS195	Power Plant	1	Generator	3,597	7,652
LWS200	Power Plant	1	Main	4,128	8,614
LWS225	Mill	2	Landing	285	1,660
LWS230	Mill	4	Plat-o-table	1,298	3,493
LWS235	Mill	7	Railroad Service Access	593	2,216
LWS240	Mill	10	West Tram Dec	131	1,381
LWS268	Recreation Hall	1	Ticket Booth	2,762	6,141
LWS273	Recreation Hall	1	Gym	1,448	3,764
LWS287	Refrigeration Plant	1	Butcher Shop	1,420	3,713
LWS292	Refrigeration Plant	1	Hall	1,550	3,948
LWS305	Schoolhouse	1	Class2 - Bath-2	5,344	10,814
LWS310	Schoolhouse	1	Class2 - Bath-2	9,824	18,921
LWS342	Middle Bunkhouse	2	Hall	6,950	13,721
LWS347	Middle Bunkhouse	2	Hall	8,070	15,748
LWS367	General Manager's Office	1	Office-3	3,827	8,069
LWS372	General Manager's Office	2	Drafting Room	6,118	12,216
LWS400	Railroad Depot	1	Main	914	2,797
LWS415	Store and Warehouse	1	Retail	5,773	11,590
LWS420	Store and Warehouse	B	Basement	810	2,610
LWS432	West Bunkhouse	B	Locker	13,427	25,442
LWS437	West Bunkhouse	1	Dining	2,139	5,015
LWS442	West Bunkhouse	3	Room-29	17,920	33,572

[(a)] XRF measurements adjusted using calibration formula calculated on Figure D-1. When adjustment resulted in a value less than zero, the actual XRF measurement was retained.

Table 3 - Lead in Soil Measurements

		Lead in mg/kg		
Sample ID [a]	**Site**	**XRF [b]**	**XRF Adjusted [c]**	**Lab**
LS53	West Bunkhouse	4,880	8,302	
LS60	West Bunkhouse	4,480	7,550	
LS68	Store and Warehouse	2,200	3,265	
LS69	Store and Warehouse	2,989	4,747	
LS76	Store and Warehouse	1,500	1,949	
BPS1	Store and Warehouse			465
LS106	Old School	152	152	
LS107	Old School	123	123	
LS131	Leaching Plant	975	962	
LS132	Leaching Plant	243	243	
LS141	Leaching Plant	1,450	1,854	
LS158	Machine Shop	224	224	
LS159	Machine Shop	101	101	
LS180	Power Plant	113	113	
LS189	Power Plant	1,190	1,365	
BPS5	Power Plant			1,340
BPS6	Power Plant			3,040
BPS10	Power Plant			183
BPS11	Power Plant			249
BPS12	Power Plant			608
BPS13	Power Plant			866
LS211	Mill	1,100	1,197	
LS212	Mill	71	71	
LS242	Mill	1,010	1,027	
LS249	Mill	96	96	
BPS4	Mill			557
LS260	Recreation Hall	87	87	
LS261	Recreation Hall	96	96	
LS262	Recreation Hall	109	109	
LS281	Refrigeration Plant	6,218	10,816	
LS299	Schoolhouse	3,440	5,595	
LS349	Middle Bunkhouse	116	116	
LS350	Middle Bunkhouse	ND	ND	
LS379	General Manager's Office	2,200	3,265	2,500
BPS3	General Manager's Office			1,170
BPS7	General Manager's Office			161
BPS8	General Manager's Office			123
BPS9	General Manager's Office			56
LS402	Railroad Depot	398	398	

[a] Samples with BPS prefix collected and analyzed by America North/EMCON in 1992 using laboratory analysis. Samples with prefix LS measured by Hart Crowser in 2001 using a Niton XRF. Sample LS379 also analyzed for lead as reported in the lab column.

[b] XRF = Lead concentrations as field measured by X-ray flourescence analyzer. Many of the lead in soil measurements were multiple shots of the same sample. The XRF values in this table and on the figures present representative soil lead measurements that approximate the average values for the

[c] XRF measurements adjusted using calibration formula calculated on Figure D-2. When adjustment resulted in a value less than zero, the actual XRF measurement was retained.

Table 4 - Lead TCLP Samples and Analytical Results

Debris Pile ID	Lead in mg/L
T1	24.00
T2	1.30
T3	2.00
T4	0.60
T5	0.40
T6	0.80

Table 5 - Summary of Lead Measurements by Building and Paint Color

Building	Sample Number	Location	Matrix	Color	Lead[(a)]	units
Assay Office	L383	Outside	Paint	Red	0.14	mg/cm^2
	L384	Outside	Paint	White	27.03	mg/cm^2
Fire Protection Building-1	L406 and L408	Outside	Paint	Red	0.02 to 0.07	mg/cm^2
	L409	Outside	Paint	White	21.35	mg/cm^2
	L425	Outside	Paint	Red	0.05	mg/cm^2
	L407 and 424	Outside	Paint	White	5.1	mg/cm^2
General Manager's Office	LWS367 and LWS372	Interior	Dust/Floor		8,069 to 12,216	ug/ft^2
	L358	Interior	Paint	Brown	0.03	mg/cm^2
	L357	Interior	Paint	White	22.14	mg/cm^2
	L359	Interior	Paint	Gray	5.1	mg/cm^2
	L360	Outside	Paint	Red	0.05	mg/cm^2
	L361	Outside	Paint	White	5.1	mg/cm^2
	L379	Outside	Soil		3,265	mg/kg
	BPS3, BPS7, BPS8, and BPS9(b)	Outside	Soil		56 to 1,170	mg/kg
Leaching Plant	LWS 138	Interior	Dust/Floor		2,549	ug/ft^2
	L123, L124, L126, L127, L128, and L129	Outside	Paint	Red	0.03 to 0.41	mg/cm^2
	L125	Outside	Paint	White	24.42	mg/cm^2
	LS131, LS132,and LS141	Outside	Soil		243 to 1,854	mg/kg
Machine Shop	LWS167 and LWS172	Interior	Dust/Floor		3,293 to 3,849	ug/ft^2
	L151, L152, L155, and L156	Outside	Paint	Red	0 to 0.14	mg/cm^2
	L153 and 154	Outside	Paint	White	26.27 to 38.04	mg/cm^2
	L161	Porch	Paint	White	0.01	mg/cm^2
	LS158 and LS159	Outside	Soil		101 to 224	mg/kg
Middle Bunkhouse	LWS342 and LWS347	Interior	Dust/Floor		13,721 to 15,748	ug/ft^2
	L352	Outside	Paint	Red	0.07	mg/cm^2
	L353	Outside	Paint	White	5.1	mg/cm^2
	LS349 and LS350	Outside	Soil		ND to 116	mg/kg

Table 5 - Summary of Lead Measurements by Building and Paint Color

Building	Sample Number	Location	Matrix	Color	Lead[(a)]	units
Mill	LWS225, LWS230, LWS235, and LWS240	Interior	Dust/Floor		1,381 to 3,493	ug/ft^2
	L385	Ore chute (metal)	Paint	Red	0.04	mg/cm^2
	L204, L205, L206, L207, L208, and L209	Outside	Paint	Red	0.01 to 5.1	mg/cm^2
	L216, L218, and L219	Interior	Paint	Gray	5.1 to 20.4	mg/cm^2
	L217	Interior	Paint	Red	0.02	mg/cm^2
	LS211, LS212, LS242, and LS249	Outside	Soil		71 to 1,197	mg/kg
	BPS4(b)	Outside	Soil		557	mg/kg
Old School	LWS114 and LWS119	Interior	Dust/Floor		1,933 to 4,009	ug/ft^2
	L100 and L101	Interior	Paint	White	5.1 to 30.64	mg/cm^2
	L102	Outside	Paint	Red	5.1	mg/cm^2
	L103 and L104	Outside	Paint	White	2.38 to 5.1	mg/cm^2
	LS106 and LS107	Outside	Soil		123 to 152	mg/kg
Power Plant	LWS195 and LWS200	Interior	Dust/Floor		7,652 to 8,614	ug/ft^2
	L178	Interior	Paint	White	0	mg/cm^2
	L174 and L177	Outside	Paint	Red	0.02 to 0.1	mg/cm^2
	L175 and L176	Outside	Paint	White	5.1 to 17.91	mg/cm^2
	LS180 and LS189	Outside	Soil		113 to 1,365	mg/kg
	BPS5, BPS6, BPS10, BPS11, BPS12, and BPS13(b)	Outside	Soil		183 to 3,040	mg/kg
Railroad Depot	LWS400	Interior	Dust/Floor		2,797	ug/ft^2
	L393	Interior	Paint	Pink	2.73	mg/cm^2
	L389 and L392	Outside	Paint	Red	0.1 to 0.17	mg/cm^2
	L390 and L391	Outside	Paint	White	5.1 to 8.91	mg/cm^2
	LS402	Outside	Soil		398	mg/kg

Table 5 - Summary of Lead Measurements by Building and Paint Color

Building	Sample Number	Location	Matrix	Color	Lead[(a)]	units
Recreation Hall	LWS268 and LWS273	Interior	Dust/Floor		3,764 to 6,141	ug/ft^2
	L254	Interior	Paint	Green	5.1	mg/cm^2
	L253	Interior	Paint	White	22.22	mg/cm^2
	L255	Interior	Paint	Red	0	mg/cm^2
	L256 and L258	Outside	Paint	Red	0.64 to 1.43	mg/cm^2
	L257	Outside	Paint	White	3.62	mg/cm^2
	LS260, LS261, and LS262	Outside	Soil		87 to 109	mg/kg
Refrigeration Plant	LWS287 and LWS292	Interior	Dust/Floor		3,713 to 3,948	ug/ft^2
	L275	Interior	Paint	Green	2.32	mg/cm^2
	L276	Interior	Paint	White	5.1	mg/cm^2
	L277 and L279	Outside	Paint	Red	0.07 to 0.25	mg/cm^2
	L278	Outside	Paint	White	5.1	mg/cm^2
	LS281	Outside	Soil		10,816	mg/kg
Schoolhouse	LWS305 and LWS310	Interior	Dust/Floor		10,814 to 18,921	ug/ft^2
	L294	Interior	Paint	Gray	5.1	mg/cm^2
	L295	Interior	Paint	Tan	25.68	mg/cm^2
	L296	Outside	Paint	Red	0.45	mg/cm^2
	L297	Porch	Paint	White	5.1	mg/cm^2
	LS299	Outside	Soil		5,595	mg/kg
Store and Warehouse	LWS91, LWS415, and LWS420	Interior	Dust/Floor		2,610 to 11,590	ug/ft^2
	L80	Retail	Paint	Brown	0.02	mg/cm^2
	L84	Interior	Paint	Green	5.1	mg/cm^2
	L81, L82, L83, L85, and L95	Interior	Paint	White	5.1 to 25.42	mg/cm^2
	L96	Steward's Office	Paint	Yellow	5.1	mg/cm^2
	L64 and L65	Outside	Paint	Red	0.05 to 0.21	mg/cm^2
	LS68, LS69, and LS76	Outside	Soil		1,949 to 4,747	mg/kg
	BPS1(b)	Outside	Soil		465	mg/kg

Table 5 - Summary of Lead Measurements by Building and Paint Color

Building	Sample Number	Location	Matrix	Color	Lead[(a)]	units
West Bunkhouse	LWS46, LWS432, LWS437, and LWS442	Interior	Dust/Floor		5,015 to 33,572	ug/ft^2
	L23 and L28	Interior	Paint	Brown	5.1 to 28.42	mg/cm^2
	L27	Interior	Paint	Gray	1.01	mg/cm^2
	L24, L25, L26, L29, L30, and L31	Interior	Paint	White	2.33 to 5.1	mg/cm^2
	L33 and L34	Outside	Paint	Red	0.8 to 0.87	mg/cm^2
	LS53 and LS60	Outside	Soil		7,550 to 8,302	mg/kg

(a) Lead values presented for dust and soil samples in this table are adjusted. See Tables 2 and 3 for field measurements and explanation of adjustment procedure.

(b) Samples with BPS prefix collected and analyzed by American North/EMCON in 1992 using laboratory analysis.

Table 6 - Suspect ACM Samples and Analytical Results

Sample ID	Building	Material and Location	Asbestos Type and Percent
AS-01	Recreation Hall	Felt behind main ext. walls	ND
AS-02	Recreation Hall	Black paper behind all exterior walls	ND
AS-03	Recreation Hall	Silver screen material	ND
AS-04	Schoolhouse	Black cloth wiring insulation	ND
AS-05	West Bunkhouse	Window putty	ND
AS-06	West Bunkhouse	Black cloth wiring insulation	ND
AS-07	West Bunkhouse	Pipe insulation (black cloth over hard white material)	Chrysotile 10%; Amosite 25%
AS-08	Refrigeration Bldg	Butchers Table Top	ND
AS-09	Power Plant	Soil/Debris from beneath building	Chrysotile 5%
AS-10	Power Plant	Soil/Debris in trench of Generator Pit area	Chrysotile 5%
AS-11	Leaching Plant	Gravel tailings below pipes previously abated	ND
AS-12	West Bunkhouse	Soil from beneath building	ND
AS-13	Machine Shop	Soil from beneath building under suspended pipes	Chrysotile <1%
AS-14	Recreation Hall	Soil from crawl space beneath building under suspended pipes	ND
AS-15	Debris Pile T2	Silver painted asphaltic material in debris pile	ND
AS-16	Debris Pile T3	Pebbled asphaltic roofing materials in debris pile	ND
AS-17	Debris Pile T4	Silver painted asphaltic material in debris pile	ND

ND = Not detected

Appendix C-6 – Arsenic Employee Exposure Assessment, Former Kennecott Mine Town, Wrangell St. Elias National Park & Preserve, Kennicott, Alaska.

to ore residues as these may contain relatively high lead and arsenic concentrations. However, the ore residues do not appear to be very friable and may not be likely to release lead or arsenic into the air. Further study is needed to evaluate these concerns.

Table 1
Air Sampling Results
Kennecott Mill Facility
June 23-24, 2003

Sample ID	Name; Occupation	Building	Task	Time Weighted Average Lead (ug/m^3)	Time Weighted Average Arsenic (ug/m^3)
SHA62301	James Sill; Carpenter	School	Repair/Rebuld Windows/ Doors- Manual Scraping/ Sanding	<19	<6
SHA62401	James Sill; Carpenter	School	Repair/Rebuld Windows/Doors- Interior: Power Sander- No Exhaust	56	<4
STA62301	Marge Gohtley; Resources	Store	Inventorying Artifacts	<21	<43*
STA62402	Susan Sura; Resources	Store	Inventorying Artifacts	<6	<87*

Notes:
1) The Permissible Exposure Limit (PEL) for Lead for 10-hour shifts is 40 ug/m^3. The PEL for Arsenic for 10-hour shifts is 8 ug/m^3.
2) Note: Results preceded by '<' indicate that no lead or arsenic was detected. The listed number is the detection limit.

*The detection limit exceeded the PEL for these short-term (apx. 2 hour) samples. This does not indicate that the concentrations exceeded the PEL, rather there was insufficient air volume to adequately evaluate the exposure for arsenic.

Table 2
Wipe Sampling Results
Kennecott Mill Facility
June 2-24, 2003

Sample ID	Building	Location	Sample Result Lead (ug/ft^2)	Sample Result Arsenic (ug/ft^2)
BRW62401	Maintenance Break Rm.	Center Table Top	<45.5	<45.5
BRW62402	Maintenance Break Rm.	Dresser Top	5.70	<5.0
BRW62403	Maintenance Break Rm.	Coffee Table Top	<5.00	<5.0
KIW62401	Resource Kitchen	Counter at Sink	<5.00	<5.0
KIW62402	Resource Kitchen	Kitchen Table Top	6.40	<5.0
MBW62401	Conc. Mill	Handrail- Level 4	1,050	<40.0
MBW62402	Conc. Mill	Handrail-Level 6C	32,779	<40.0
BKW62401	Background (Glacier Lodge)	Exterior Stairway	<45.5	<45.5
LV62501	Shower Bldg.	S. Lavatory Seat Lid	<6.70	<6.7
LV62502	Shower Bldg.	N. Lavatory Seat Cover	<5.00	<5
DC62501	Shower Bldg.	Decon-Clean Side Dresser Top	43.6	<5
DC62502	Shower Bldg.	Decon-Clean Side Floor	10.2	<5
LPW62401	Leaching Plant	Handrail- Level 2	13,004	<40

Note: Results preceded by '<' indicate that no lead or arsenic was detected. The listed number is the detection limit. The recommended OSHA guideline for break rooms and hygiene facilities is 200 ug/ft^2.

The difference in the detection limits is related to the area sampled. Sample areas that were dusty or had limited access (e.g., handrails) were limited to approximately 4 x 4 inches, resulting in a detection limit of around 40 ug/ft^2. Other areas were sampled at 12 x 12 inches, resulting in a detection limit of 5 ug/ft^2.

Table 3
Bulk Sampling Results
Kennecott Mill Facility
June 23 & 24, 2003

Sample ID	Building	Location	Sample Result Lead (mg/kg)	Sample Result Arsenic (mg/kg)
STB62301	Store	Stairway Tread	<47	<20
STB62302	Store	Shelf- Floor 1 West Side	2,100	150
STB62303	Store	Floor- Floor 1 West Wing	2,000	110
MBB62401	Conc. Mill	Floor- Level 2	3,800	3,500
MBB62402	Conc. Mill	Hopper- Level 6C	110	3,070
MBB62403	Conc. Mill	Ore Dust- Level 2 Table	2,100	660
MBB62404	Conc. Mill	Floor- Level 6C	9,000	2,820
LPB62401	Leach Plant	Trough Residue- Floor 2	60	1,510
LPB62402	Leach Plant	White Residue- Floor 2, Northeast side	<50	<20

Note: Results preceded by '<' indicate that no lead (or arsenic) was detected. The listed number is the detection limit.

Table 4
Soil Sampling Results
Kennecott Mill Facility
June 24, 2003

Sample ID	Building	Location	Sample Result Lead (mg/kg)	Sample Result Arsenic (mg/kg)
BKS62401	Background	Upgradient Store	<50	<50
RBS62401	Refrigeration Bldg.	Drip Line 18" from Bldg.	1,780	<50
RBS62402	Refrigeration Bldg.	48" from Bldg.	2,169	<50
RBS62403	Refrigeration Bldg.	84" from Bldg.	1,066	<50
WBS62401	West Bunkhouse	Drip Line 18" from Bldg.	1,610	<50
WBS62402	West Bunkhouse	48" from Bldg.	179	<50
WBS62403	West Bunkhouse	84" from Bldg.	59	<50
WBS62404	West Bunkhouse	120" from Bldg.	286	<50

Note: Results preceded by '<' indicate that no lead (or arsenic) was detected. The listed number is the detection limit.

Appendix C-7 – Data from Federal Occupational Health. 2005. Asbestos and Lead in Soil Survey, Kennecott Mining Town, Kennecott, Alaska.

TABLE 1A
SUMMARY OF ASBESTOS BULK SAMPLE RESULTS

Sample No.	Sample Location	Material Description	Results
Ammonia Leaching Plant (building identification number 15)			
WRST-15-AS-001	Level four-north, exterior, east side	Window glazing (putty)	ND
WRST-15-AS-002	Level one-north, exterior, north side	Window glazing (putty)	ND
WRST-15-AS-003	Level one-north, exterior, west side	Window glazing (putty)	ND
WRST-15-AS-004	level five-north, exterior, south side window	Window glazing (putty)	ND
WRST-15-AS-005	Level four-north, by north wall	Electrical wire insulation (yellow)	ND
WRST-15-AS-006	Level four-north, by north wall	Electrical wire insulation (black)	ND
WRST-15-AS-007	**Level four-north**	**Electrical wire insulation (white)**	**85% Ch**
WRST-15-AS-008	Level five-north, west side	Wall paper barrier (red)	ND
WRST-15-AS-009	Level four-north, west side	Wall paper barrier (red)	ND
WRST-15-AS-010	Level four-north, west side	Wall paper barrier (light brown)	ND
WRST-15-AS-011	Level four-north, west side	Wall paper barrier (light brown)	ND
WRST-15-AS-012	Level four-north on northern most tank hatch	Tank hatch gasket	ND
WRST-15-AS-013	Level one-north, on tank hatch	Tank hatch gasket	ND
WRST-15-AS-014	Level one-south, east side	Pipe valve gasket (red)	ND
WRST-15-AS-015	Level three-north, on floor	Pipe valve gasket (red)	ND
WRST-15-AS-016	Level one-south, east side on flange	Pipe valve gasket (red)	ND
WRST-15-AS-017	Level one-north, exterior, north side	Window glazing (putty) repair material	ND
WRST-15-AS-018	Level one-north, exterior, north side	Siding vapor barrier	ND
WRST-15-AS-019	**Level one-north, exterior, west side**	**Window vapor barrier**	**Trace Ch**
WRST-15-AS-020	Level one-north, exterior, west side	Roofing felt	ND
WRST-15-AS-021	Level one-north, exterior, west side	Siding vapor barrier	ND
WRST-15-AS-022	Level one-south, exterior, west side	Roofing felt	ND
WRST-15-AS-023	Level one-north, exterior, west side	Water pipe (wood) wire coating	ND
WRST-15-AS-024	Level four-north, east side on north wall	Siding vapor barrier	ND
WRST-15-AS-025	Level three-north	Bulletin board paper	ND
WRST-15-AS-026	**Level three-north, east wall**	**Electrical panel backing**	**15% Ch**

Sample No.	Sample Location	Material Description	Results
WRST-15-AS-027	Level four-north, at top of exterior entry stair landing	Wall remnant paper (poster or bulletin board)	ND
WRST-15-AS-028	Level one-south at east wall	Electrical wire insulation	ND
WRST-15-AS-029	Level one-south	Insulation debris on wood framing	ND
WRST-15-AS-030	**Level one-south**	**Insulation debris in gravel on floor**	**20% Ch**
WRST-15-AS-031	**Level one-south**	**Plaster debris in gravel on floor**	**Trace Ch Trace Am**
WRST-15-AS-032	**Level one-south, at tank on west wall**	**Insulation remnant on tank**	**80% Ch**
WRST-15-AS-033	Level one-south, at tank on west wall, north side	White debris in gravel (assumed insulation)	ND
WRST-15-AS-034	Level one-north, west side under outhouse	White debris in gravel	ND
WRST-15-AS-035	Level one-north, west side at trough	White debris in gravel	ND
WRST-15-AS-036	Level one-north, west side	White debris in gravel	ND
WRST-15-AS-037	**Level one-north, between 3 and 4 tank**	**Debris at tank base**	**Trace Ch**
WRST-15-AS-038	**Level one-north, on west wall catwalk**	**Gasket material on flange**	**80% Ch**
WRST-15-AS-039	Level one-south, tank at east wall	Gasket door material on tank	ND
Assay Office (building identification number 8)			
WRST-8-AS-040	Exterior, west side	Window glazing (putty)	ND
WRST-8-AS-041	Exterior, north side	Window glazing (putty)	ND
WRST-8-AS-042	Exterior, northeast corner	Roofing (rolled composition)	ND
WRST-8-AS-043	Exterior, south side	Roofing (rolled composition)	ND
WRST-8-AS-044	**Interior, south side**	**Electrical wire**	**40% Ch**
WRST-8-AS-045	Exterior, south side	Siding vapor barrier	ND
WRST-8-AS-046	Exterior, south side	Siding vapor barrier	ND
WRST-8-AS-047	Interior, north side at center of room	Gasket at ceiling vent penetration	ND
WRST-8-AS-048	**Interior, south side**	**Weld cloth stuffed in wall penetration**	**95% Ch**

Sample No.	Sample Location	Material Description	Results
Transformer Building (building identification number 37)			
WRST-37-AS-049	**Exterior, underneath building**	**Pipe insulation**	**65% Ch**
WRST-37-AS-050	**Exterior, underneath building**	**Pipe insulation**	**65% Ch**
WRST-37-AS-051	**Exterior, underneath building**	**Pipe insulation**	**65% Ch**
WRST-37-AS-052	Transformer room east end of building	White electrical wire	ND
WRST-37-AS-053	Second floor west end	Black electrical wire	ND
WRST-37-AS-054	Second floor west end	Black electrical wire	ND
WRST-37-AS-055	Transformer room east end of building	Dark color electrical wire	ND
WRST-37-AS-056	Second floor	Equipment box electrical wire	ND
WRST-37-AS-057	**Second floor**	**Insulation on transformer cover**	**65% Ch**
WRST-37-AS-058	Second floor	Electrical switch cover gasket	ND
WRST-37-AS-059	**Second floor**	**Gasket on transformer cover**	**65% Ch**
WRST-37-AS-060	Exterior, south side	Window glazing (putty)	ND
WRST-37-AS-061	Exterior, north side	Window glazing (putty)	ND
WRST-37-AS-062	Stair way landing to the second floor	Vapor barrier	ND
WRST-37-AS-063	Exterior, south side	Vapor barrier	ND
WRST-37-AS-064	Exterior, west side	Bulletin board backing	ND
WRST-37-AS-065	Second floor, north wall	2-strand twisted electrical wire	ND
WRST-37-AS-066	Transformer room on east end of building	Gasket on transformer lid	ND
WRST-37-AS-067	Transformer room on east end of building	Insulation debris on floor	ND
WRST-37-AS-068	Second floor	Coil insulation	ND
WRST-37-AS-069	Second floor	Coil braid string	ND
WRST-37-AS-070	Second floor	Insulator ring	ND
WRST-37-AS-071	**Second floor**	**Insulation debris**	**70% Ch**
WRST-37-AS-072	**Second floor**	**Light cover insulation**	**75% Ch**
WRST-37-AS-073	**Second floor**	**Fuse box cementitious material**	**65% Ch**
WRST-37-AS-074	Second floor	Gasket material	ND
WRST-37-AS-075	Second floor	Cloth covered conduit	ND
WRST-37-AS-076	Transformer room on east end of building	White debris on floor	ND
WRST-37-AS-077	**First floor, south side on shelves**	**Blue gasket material**	**65% Ch**

Sample No.	Sample Location	Material Description	Results
WRST-37-AS-078	Second floor	White powder in box	ND
WRST-37-AS-079	First floor, south side	White debris on floor	ND
WRST-37-AS-080	First floor, south side	White debris on floor	ND
WRST-37-AS-081	**First floor, west exterior wall**	**Fuse box insulation board (back side)**	**70% Ch**
WRST-37-AS-082	**First floor, south side**	**Stove insulation**	**65% Ch**
WRST-37-AS-083	First floor, southeast corner	Cementitious switch gear panel	ND
WRST-37-AS-084	**First floor, north side**	**Stove insulation**	**35% Ch**
WRST-37-AS-085	**First floor underneath stairs**	**Brake pad on equipment**	**40% Ch**
Machine Shop (building identification number 36)			
WRST-36-AS-086	Exterior, north side	Window glazing (putty)	ND
WRST-36-AS-087	Exterior, west side	Window glazing (putty)	ND
WRST-36-AS-088	**Exterior, east side**	**Window glazing (putty)**	**Trace Ch**
WRST-36-AS-089	Exterior, south side	Window glazing (putty)	ND
WRST-36-AS-090	Interior, east wall on north end	Electrical wire (black)	ND
WRST-36-AS-091	Interior, east side at exterior wall electrical box	Electrical wire (black)	ND
WRST-36-AS-092	Interior, southwest room on north wall	Vapor barrier	ND
WRST-36-AS-093	Interior, southwest room on north wall	Vapor barrier	ND
WRST-36-AS-094	**Interior, east side on exterior wall**	**White debris in wall shelf**	**40% Ch**
WRST-36-AS-095	Interior, southwest room	White debris on floor	ND
WRST-36-AS-096	**Interior, west side of main shop area**	**White debris on parts pile**	**70% Ch**
WRST-36-AS-097	**Deck on exterior, west side**	**Gasket on valve flange**	**50% Ch**
WRST-36-AS-098	Deck on exterior, west side	Remnant roofing tar paper	ND
WRST-36-AS-099	**Deck on exterior, west side**	**Remnant fibrous insulation**	**70% Ch**
WRST-36-AS-100	Deck on exterior, west side	White remnant material in box	ND
WRST-36-AS-101	Deck on exterior, west side	Melting pot fire brick	ND
WRST-36-AS-102	**Exterior, under building by storage**	**White insulation debris**	**65% Ch**
WRST-36-AS-103	Exterior west side	White debris on ground	ND
WRST-36-AS-104	Exterior, west side	Roofing debris on ground	ND

Sample No.	Sample Location	Material Description	Results
Power Plant (building identification number 9)			
WRST-9-AS-105	Exterior, north side	Window glazing (putty)	ND
WRST-9-AS-106	Exterior, south side	Window glazing (putty)	ND
WRST-9-AS-107	Exterior, east side	Window glazing (putty)	ND
WRST-9-AS-108	Exterior, west side	Window glazing (putty)	ND
WRST-9-AS-109	Interior, northwest exterior wall	Electrical wire (black)	ND
WRST-9-AS-110	Interior, southwest	Electrical wire (black)	ND
WRST-9-AS-111	Interior, west side of boilers	Brick floor	ND
WRST-9-AS-112	Interior, west side of boilers	Brick floor	ND
WRST-9-AS-113	Interior, west side of boilers	Brick floor	ND
WRST-9-AS-114	Interior, southwest	Electrical wire (white)	ND
WRST-9-AS-115	Interior, southwest	Electrical wire (white)	ND
WRST-9-AS-116	**Interior, east exterior wall – north end**	**White debris on floor**	**50% Ch**
WRST-9-AS-117	Interior, east exterior wall – north end	White debris on wall wood framing	ND
WRST-9-AS-118	Interior, east side – north end	White debris on floor	ND
WRST-9-AS-119	Exterior, northwest side	Debris pile – roofing felts	ND
WRST-9-AS-120	Exterior, northwest side	Debris pile – woven cloth	ND
WRST-9-AS-121	Exterior, northwest side	Debris pile – fiber board	ND
WRST-9-AS-122	**Interior, east side under mezzanine deck**	**White debris on pipe**	**70% Ch**
WRST-9-AS-123	**Interior, southwest under mezzanine**	**White debris on pipe**	**30% Ch**
WRST-9-AS-124	**Interior, center west of boiler (no date)**	**White debris on pipe**	**35% Ch**
WRST-9-AS-125	**Interior, north of boiler 1917**	**Floor dust sample**	**Trace Ch**
WRST-9-AS-126	**Interior, south of boiler (no date)**	**Floor dust sample**	**Trace Ch**
WRST-9-AS-127	Interior, southwest side of building	Floor dust sample	ND
WRST-9-AS-128	Interior, pipe on west exterior wall	Fibrous insulation on pipe	ND
WRST-9-AS-129	Interior, pipe on west exterior wall	Fibrous insulation on pipe	ND
WRST-9-AS-130	Interior, pipe on west exterior wall	Fibrous insulation on pipe	ND
WRST-9-AS-131	Interior, east exterior wall on south end	Wall box paper lining	ND
WRST-9-AS-132	**Exterior, under piping between power plant and leaching plant at end of trough**	**Insulation debris**	**65% Ch**

Sample No.	Sample Location	Material Description	Results
WRST-9-AS-133	**Exterior, under piping between power plant and leaching plant at beginning of trough**	**Insulation debris**	**65% Ch**
WRST-9-AS-134	**Exterior, under piping between power plant and leaching plant at middle of trough**	**Insulation debris**	**65% Ch**
WRST-9-AS-135	Exterior, west side	Cloth debris	ND
WRST-9-AS-136	**Interior, north generator pit, south end of building**	**Dirt debris**	**3% Ch**
WRST-9-AS-137	**Interior, large trench southwest side**	**Dirt debris**	**5% Ch**
WRST-9-AS-138	Interior of building from boiler interior	Fly ash debris, boiler 1916	ND
WRST-9-AS-139	Interior of building from boiler interior	Fire brick, boiler 1916	ND
WRST-9-AS-140	**Interior of building from boiler interior**	**Insulation behind fire brick, boiler 1916**	**8% Ch**
WRST-9-AS-141	Interior of building from boiler interior	Fire brick mortar, boiler 1916	ND
Residence 32C (building identification number 32C)			
WRST-32C-AS-142	Exterior, north side	Window glazing (putty)	ND
WRST-32C-AS-143	Exterior, south side	Window glazing (putty)	ND
WRST-32C-AS-144	Exterior, south side	Window glazing (putty) – repair material	ND
WRST-32C-AS-145	Interior, dining room west wall	Wall board	ND
WRST-32C-AS-146	Interior, under stairs	Wall board	ND
WRST-32C-AS-147	Interior, living room at west wall	Ceiling wall board	ND
WRST-32C-AS-148	Storage building interior floor	Sheet vinyl flooring	ND
WRST-32C-AS-149	Behind sauna on east side	White debris on ground	ND

Sample No.	Sample Location	Material Description	Results
West Bunkhouse (building identification number 20)			
WRST-20-AS-150	Exterior, south side	Window glazing (putty)	ND
WRST-20-AS-151	Exterior, west side	Window glazing (putty)	ND
WRST-20-AS-152	Exterior, north side	Window glazing (putty)	ND
WRST-20-AS-153	Exterior, east side	Window glazing (putty) – repair material	ND
WRST-20-AS-154	Interior, first floor	Electrical wire (white)	ND
WRST-20-AS-155	Interior, first floor	Electrical wire (black)	ND
WRST-20-AS-156	Interior, third floor	Electrical wire (braided white)	ND
WRST-20-AS-157	**Interior, second floor kitchen**	**Oven fire brick insulation**	**15% Ch**
WRST-20-AS-158	Interior, second floor kitchen	Oven fire brick	ND
WRST-20-AS-159	Interior, second floor kitchen	Oven fire brick mortar	ND
WRST-20-AS-160	**Interior, second floor kitchen**	**Oven lining**	**15% Ch**
WRST-20-AS-161	**Interior, second floor kitchen**	**Oven insulation liner**	**30% Ch**
WRST-20-AS-162	Interior, second floor dining room	Table top cloth	ND
Store and Warehouse (building identification number 19)			
WRST-19-AS-163	Exterior windows stored on 3rd floor	Window glazing (putty)	ND
WRST-19-AS-164	Exterior windows stored on 3rd floor	Window glazing (putty)	ND
WRST-19-AS-165	Interior, main floor	Electrical wire	ND
WRST-19-AS-166	Interior, 2nd floor storage area at stairs	Electrical wire	ND
WRST-19-AS-167	Interior, 2nd floor office	Hardwood floor slip sheeting	ND
WRST-19-AS-168	Interior, 3rd floor storage area	Hardwood floor slip sheeting	ND
WRST-19-AS-169	Interior, west side storage area	Ceiling sheeting	ND
WRST-19-AS-170	Interior, west side storage area	Ceiling sheeting	ND
WRST-19-AS-171	Interior, north end in storage area	Wall covering	ND
WRST-19-AS-172	Interior, north end in storage area	Bulletin board material	ND
WRST-19-AS-173	Interior, display area at front of store	Counter top sheeting	ND
WRST-19-AS-174	Interior, store office	Vapor barrier behind wall sheeting	ND
WRST-19-AS-175	Interior, store office	Wall sheeting	ND

ND = none detected, CH = Chrysotile asbestos, AM = Amosite asbestos

A more detailed lead based paint survey was conducted in 1995, and the results were reported in the "*Kennicott (sic) Pre-Acquisition Environmental Site Assessment Report*" (December 1996). An additional survey of the buildings was conducted by Hart Crowser, as reported in the document titled *"Limited Hazardous Materials Survey of the Kennecott Mill"* in May 2002. These reports document consistent application of red paint to sidings and a white paint on the trim, with the last reported painting in the 1930's. The white paint contains the highest levels of lead (up to 52% lead) while the red paint typical of the exterior walls is iron oxide based and has low levels (generally under 1%) of lead. Elevated lead levels were also detected in the yellow paint used in limited areas inside the buildings.

Lead in Painted Surfaces

Paint samples were collected from the Assay Office to verify lead levels and from select areas of the Power Plant where previous sampling had not been performed (mostly equipment paint). Analytical results are provided in Table 3 below.

Table 3. Summary of Bulk Paint Chip Sampling

Sample No.	Sample Location	Substrate	Color	Results[1] (% weight)
Assay Office (building identification number 8)				
WRST-8-PbB-001	Exterior on north side	Wood	Red	0.239
WRST-8-PbB-002	Exterior on north side	Wood	White	9.38
WRST-8-PbB-003	Interior, north side on ceiling	Wood	White	8.72
Power Plant (building identification number 9)				
WRST-9-PbB-004	Mezzanine tank	Metal	Red	9.76
WRST-9-PbB-005	Mezzanine storage tank	Metal	Black	0.207
WRST-9-PbB-006	Boiler 1917	Metal	Black	0.088
WRST-9-PbB-007	Mezzanine post	Wood	Gray	4.47
WRST-9-PbB-008	North generator sump	Soil	Not applicable	26,700 mg/k[2]
WRST-9-PbB-009	South generator sump	Soil	Not applicable	<50.0 mg/k
WRST-9-PbB-010	Southwest exterior wall	Wood	White	6.05
WRST-9-PbB-011	Generator pad	Concrete	Gray	8.14

[1] EPA defines lead-based paint as any paint with greater than 5,000 parts per million or 0.5% by weight. OSHA defines a lead material as any item with a measurable level of lead, see 29 CFR 1926.62. One percent is equal to 10,000 parts per million (ppm).

[2] These two samples included paint chips and debris and were reported in amount let found, not % weight.

Lead in surface dust

Limited lead dust sampling had been performed in three of the previous surveys and in one case included arsenic analysis. The results of the previous surveys indicated some level of lead contamination in areas sampled. For wipe samples, "Ghost Wipe" brand wipes was used with a one-foot square template. The wipes conform to American Standards for Testing Materials E1792-96A, *Standard Specification for Wipe Sampling Materials for Lead in Surface Dust*. The wipe samples were placed in labeled plastic Ziplock bags. Wipe samples were analyzed for lead.

Table 4 on the next page lists lead wipe surface sample results collected during this survey. A figure indicating sampling locations is provided in Appendix D.

Table 4. Summary of Lead Wipe Sampling Results

Sample No.	Sample Location	Surface	Results[3] (ug/ft^2)
Ammonia Leaching Plant (building identification number 15)			
WRST-15-PbW-001	Level 3 on main floor	Floor	775
WRST-15-PbW-002	Level 3 on tank	Tank wall	21.7
WRST-15-PbW-003	Level 3 on wall by stairs	Wall	25.1
WRST-15-PbW-004	Level 4 in sacking shed	Floor	2.50
WRST-15-PbW-005	Level 4 on L4 catwalk	Floor	3910
WRST-15-PbW-006	Level 5 on L5 catwalk	Floor	855
WRST-15-PbW-007	Level 5 on L5 catwalk	Floor	398
Assay Office (building identification number 8)			
WRST-8-PbW-008	Interior shelving on north wall	Shelving	15400
Transformer Building (building identification number 37)			
WRST-37-PbW-009	Second floor	Floor	1990
WRST-37-PbW-010	First floor	Floor	855
Machine Shop (building identification number 36)			
WRST-36-PbW-011	Main entry on east side	Floor	245
WRST-36-PbW-012	Interior on northwest entrance	Hearth duct/floor	170
WRST-36-PbW-013	Interior on east wall	Shelving	895
WRST-36-PbW-014	Interior east room	Floor	675
WRST-36-PbW-015	Interior east room on north end	Shelving	1140
WRST-36-PbW-016	Interior, northwest end	Work bench surface	373

[3] EPA regulates lead dust in residential structures at 40 ug/ft^2 for floors, 250 ug/ft^2 for window sills, and 400 ug/ft^2 for window wells. OSHA does not have a minimum level of lead in dust for compliance purposes. However, in compliance directive CPL 02-02-058, "OSHA recommends the use of HUD's recommended level for acceptable decontamination of 200 ug/ft^2 for floors in evaluating cleanliness of change areas, storage facilities, and lunchrooms/eating areas. OSHA would not expect that surfaces should be any cleaner than this level."

Sample No.	Sample Location	Surface	Results[3] (ug/ft^2)
Power Plant (building identification number 9)			
WRST-9-PbW-017	Boiler	Concrete	630
WRST-9-PbW-018	Mezzanine, northwest	Wood	3100
WRST-9-PbW-019	Under mezzanine on floor	Brick	1010
WRST-9-PbW-020	Generator area	Concrete	1400
WRST-9-PbW-021	Sump area	Concrete	2270
WRST-9-PbW-022	Southwest mezzanine floor	Wood	780
WRST-9-PbW-023	West side of boilers 1915/1916 on floor	Concrete	1360
WRST-9-PbW-024	West side of boiler 1916 on floor	Concrete	402
Residence Building 32C			
WRST-32C-PbW-025	Living room	Floor	118
WRST-32C-PbW-026	Dining room	Floor	25.3
WRST-32C-PbW-027	Living room, southwest window	Sill	3730
WRST-32C-PbW-028	Kitchen, cabinet interior west end	Cupboard door	97.5
WRST-32C-PbW-029	Kitchen counter on east end	Counter top	1420
WRST-32C-PbW-030	Rear entry room	Floor	497
WRST-32C-PbW-031	Stairs to second floor (3rd stair from bottom)	Stair tread	249
WRST-32C-PbW-032	Second floor hallway (stair landing)	Floor	214
WRST-32C-PbW-033	Second floor east bedroom, west wall	Wall	24.6
WRST-32C-PbW-034	Second floor east bedroom, west wall window	Sill	44.1
West Bunkhouse (building identification number 20)			
WRST-20-PbW-035	Dining area	Floor	26.7
WRST-20-PbW-036	Kitchen	Floor	860
WRST-20-PbW-037	Kitchen pantry	Shelving	1440
WRST-20-PbW-038	2nd floor hall by room 8	Floor	2860
WRST-20-PbW-039	Dining area	Column	57.0
Store and Warehouse (building identification number 19)			
WRST-19-PbW-040	General store area on south side	Shelving	2080
WRST-19-PbW-041	General store area on counter, @ entry north side	Counter top	930
WRST-19-PbW-042	General store area at entry	Floor	560
WRST-19-PbW-043	Post office area	Mailbox interior	1190
WRST-19-PbW-044	Store office, north wall on tin wainscot	Wall	875
WRST-19-PbW-045	Tool room, north end	Shelving	439
WRST-19-PbW-046	Tool room, north end	Floor	755
WRST-19-PbW-047	Control sample	n/a	40.5
WRST-19-PbW-048	Control sample	n/a	55.5

Lead in Soil

Soil samples were collected from bare soil and rock (some locations the fill was mine tailings) using a Sterileware® sampling spoon pushed into the soil/rock approximately 1-inch at each location. Subsurface samples were excavated with a shovel to undisturbed soil/rock for sample collection. Each sample was then placed into sealed plastic bottles and sent to the laboratory for lead analysis. Table 5 below provides soil sample lead analytical results.

Table 5. Summary of Soil Sampling Results

Sample No.	Sample Location	Depth	Results[4] (mg/kg)
Ammonia Leaching Plant (building identification number 15)			
WRST-15-PbS-001	West exterior at wall foundation	Surface	4040
WRST-15-PbS-002	West exterior at 3-foot from foundation	Surface	643
WRST-15-PbS-003	West exterior at 6-foot from foundation	Surface	1440
WRST-15-PbS-004	West exterior at wall foundation	Subsurface <6-inch>	224
WRST-15-PbS-005	West exterior at 3-foot from foundation	Subsurface <6-inch>	208
WRST-15-PbS-006	West exterior at 6-foot from foundation	Subsurface <6-inch>	387
WRST-15-PbS-007	North exterior at wall foundation	Surface	348
WRST-15-PbS-008	North exterior at 3-foot from foundation	Surface	328
WRST-15-PbS-009	North exterior at wall foundation	Subsurface <6-inch>	278
WRST-15-PbS-010	North exterior at 3-foot from foundation	Subsurface <6-inch>	198
WRST-15-PbS-011	East exterior at wall foundation	Surface	361
WRST-15-PbS-012	East exterior at 3-foot from foundation	Surface	986
WRST-15-PbS-013	East exterior at 6-foot from foundation	Surface	549
WRST-15-PbS-014	East exterior at wall foundation	Subsurface <6-inch>	757
WRST-15-PbS-015	East exterior at 3-foot from foundation	Subsurface <6-inch>	389
WRST-15-PbS-016	East exterior at 6-foot from foundation	Subsurface <6-inch>	248
Assay Office (building identification number 8)			
WRST-8-PbS-017	West exterior at wall foundation	Surface	34600
WRST-8-PbS-018	West exterior at 3-foot from foundation	Surface	296
WRST-8-PbS-019	West exterior at 6-foot from foundation	Surface	576
WRST-8-PbS-020	West exterior at 3-foot from foundation	Subsurface <6-inch>	<50.0
WRST-8-PbS-021	North exterior at wall foundation	Surface	8480
WRST-8-PbS-022	North exterior at 3-foot from foundation	Surface	265
WRST-8-PbS-023	North exterior at 6-foot from foundation	Surface	<50.0

[4] At 400-2,000 ppm EPA recommends risk reduction activities when children are present. 2,000 – 5,000 ppm EPA recommends additional risk reduction, even if children are present infrequently. Over 5,000 ppm considers soil removal or permanent cover. According to ADEC Technical Memorandum -01-003, for commercial or industrial land use, the cleanup level is set at 1,000 mg/kg.

Sample No.	Sample Location	Depth	Results[4] (mg/kg)
Transformer Building (building identification number 37)			
WRST-37-PbS-024	West exterior at wall foundation	Surface	<50.0
WRST-37-PbS-025	West exterior at 3-foot from foundation	Surface	<50.0
WRST-37-PbS-026	West exterior at 6-foot from foundation	Surface	<50.0
WRST-37-PbS-027	West exterior at wall foundation	Subsurface <6-inch>	<50.0
WRST-37-PbS-028	West exterior at 3-foot from foundation	Subsurface <6-inch>	<50.0
WRST-37-PbS-029	West exterior at 6-foot from foundation	Subsurface <6-inch>	<50.0
WRST-37-PbS-030	North exterior at wall foundation	Surface	<50.0
WRST-37-PbS-031	North exterior at 3-foot from foundation	Surface	<50.0
WRST-37-PbS-032	North exterior at 6-foot from foundation	Surface	<50.0
WRST-37-PbS-033	North exterior at wall foundation	Subsurface <6-inch>	<50.0
WRST-37-PbS-034	North exterior at 3-foot from foundation	Subsurface <6-inch>	<50.0
WRST-37-PbS-035	North exterior at 6-foot from foundation	Subsurface <6-inch>	<50.0
Machine Shop (building identification number 36)			
WRST-36-PbS-036	South exterior at wall foundation	Surface	3880
WRST-36-PbS-037	South exterior at 3-foot from foundation	Surface	1030
WRST-36-PbS-038	South exterior at 6-foot from foundation	Surface	5590
WRST-36-PbS-039	South exterior at wall foundation	Subsurface <6-inch>	377
WRST-36-PbS-040	South exterior at 3-foot from foundation	Subsurface <6-inch>	411
WRST-36-PbS-041	South exterior at 6-foot from foundation	Subsurface <6-inch>	374
WRST-36-PbS-042	West exterior at wall foundation	Surface	2480
WRST-36-PbS-043	West exterior at 3-foot from foundation	Surface	829
WRST-36-PbS-044	West exterior at 6-foot from foundation	Surface	654
WRST-36-PbS-045	West exterior at wall foundation	Subsurface <6-inch>	432
WRST-36-PbS-046	West exterior at 3-foot from foundation	Subsurface <6-inch>	208
WRST-36-PbS-047	West exterior at 6-foot from foundation	Subsurface <6-inch>	529
Power Plant (building identification number 9)			
WRST-9-PbS-048	North exterior at wall foundation	Surface	<50.0
WRST-9-PbS-049	North exterior at 3-foot from foundation	Surface	<50.0
WRST-9-PbS-050	North exterior at 6-foot from foundation	Surface	<50.0
WRST-9-PbS-051	North exterior at 3-foot from foundation	Subsurface <6-inch>	<50.0
WRST-9-PbS-052	North exterior at 6-foot from foundation	Subsurface <6-inch>	<50.0
WRST-9-PbS-053	South exterior at wall foundation	Surface	3000
WRST-9-PbS-054	South exterior at 3-foot from foundation	Surface	2450
WRST-9-PbS-055	South exterior at 6-foot from foundation	Surface	1570
WRST-9-PbS-056	South exterior at wall foundation	Subsurface <6-inch>	388
WRST-9-PbS-057	South exterior at 3-foot from foundation	Subsurface <6-inch>	214
WRST-9-PbS-058	South exterior at 6-foot from foundation	Subsurface <6-inch>	1300
Residence Building 32C			
WRST-32C-PbS-059	North exterior at wall foundation	Surface	75.0
WRST-32C-PbS-060	North exterior at 3-foot from foundation	Surface	138
WRST-32C-PbS-061	North exterior at 6-foot from foundation	Surface	354
WRST-32C-PbS-062	North exterior at wall foundation	Subsurface <6-inch>	157

Sample No.	Sample Location	Depth	Results[4] (mg/kg)
WRST-32C-PbS-063	North exterior at 3-foot from foundation	Subsurface <6-inch>	517
WRST-32C-PbS-064	North exterior at 6-foot from foundation	Subsurface <6-inch>	2840
WRST-32C-PbS-065	South exterior at wall foundation	Surface	<50.0
WRST-32C-PbS-066	South exterior at 3-foot from foundation	Surface	<50.0
WRST-32C-PbS-067	South exterior at 6-foot from foundation	Surface	167
WRST-32C-PbS-068	South exterior at wall foundation	Subsurface <6-inch>	<50.0
WRST-32C-PbS-069	South exterior at 3-foot from foundation	Subsurface <6-inch>	<50.0
WRST-32C-PbS-070	South exterior at 6-foot from foundation	Subsurface <6-inch>	<50.0

Sample results with less than the limit of detection were taken within areas recently excavated and backfilled by NPS personnel. The exception is the transformer building that had continuous water running through the north and south areas of the building. All other areas had substantial levels of lead in the soil, at the surface and below with the highest results generally at the building foundation where deteriorating paint tends to collect.

Sample results indicate widespread lead contamination around the base of the buildings as suspected in previous surveys which is clearly the result of deteriorating painted surfaces (significant lead content was not identified in mine tailings). Areas where excavation and back filling have not been performed likely are contaminated, although, not all sides of buildings were included in the sampling activities.

Appendix C-8 – Data from SGS North America, Inc. 2010. Laboratory Analysis Report, Work Order 1101090, 1010 East Bunkhouse.

1101090

White Environmental Consultants Inc.
731 I Street, Ste 201
Anchorage, AK 99501
Phone - (907) 258-8661
FAX - (907) 258-8662

For Lab Use Only:
Project #
Due Date:
Conditions on Receipt (Name and Da

Samples Received Chilled? YES NO

Client Information:
Wrangell-St. Elias National Park and Preserve
106.8 Richardson Hwy
P.O. Box 439
Copper Center, Alaska 99573

Attn: Jim Baker, 907-822-7228, FAX - 907-822-7216
(At Kennecott NHL - Ken - 259-7226, Jim - 259-7228)

Sample Type[1]	Media Type[2]	Container[3]	Preservatives:°
1-Air	1-Charcoal	Types:	A-None
2-Water	2-XAD	p-Plastic	B-H2SO4
3-Paint	3-Matched Weight	G-Glass	C-HNO3
4-Soil	4-Preweighed	V-VOC	D-NaOH
5-Wipe	**5-Other**		
6-Bulk			

Sample I.D.	Type[1]	Media[2]	Collected Date	Collected Time	Sample Location	Air Flow (LPM)	Air Time (Min.)	Air Volume (Liters)	Water Container[3]	Water Volume (Liters)	Water Preservative°	Lab I.D. #	Analysis Requested: LEAD	Analysis Requested: Cadmium
1010	3		3-11	10:00AM	East Bunkhouse	-	-	-	-	-	-	01A	✓	✓

Agency DOI-NPS Location WRST - Kennecott NHL POIS#
Relinquished by: Jim Baker Date: 3-11-10 Time: 10:30 AM
Received by: Joel Hicklin Date: 3-15-10 Time: 3PM
Task order number#
Turn Around Time Rush 24 hour Routine

COMMENTS(Instruction, sample hazards): 24 hour turn around, results to be faxed (907) 822-7216, invoices to be paid by credit card
received at SGS at 16:54 amy Cind 3/11/10

1101090

SGS

SAMPLE RECEIPT FORM

SGS WO#: _____

Yes	No	NA		
✓			Are samples **RUSH**, priority or *w/in 72 hrs* of **hold time**?	**TAT (circle one):** Standard -or- Rush
✓			If yes, have you done *e-mail ALERT notification*?	**Received Date:** 3/15/10
✓			Are samples *within 24 hrs.* of **hold time** or **due date**?	**Received Time:** 17:00
✓			If yes, have you also *spoken with* supervisor?	
	✓		Archiving bottles: Are lids marked w/ red "X" ?	
		✓	Were samples collected with proper preservative?	
	✓		**Any problems (ID, cond'n , HT, etc)? Explain:**	

RUSH

Cooler ID	Temperature	Measured w/ (Therm #)
none	Amb °C	
	°C	
	°C	
	°C	

Note: Temperature readings include thermometer correction factors

			If this is for PWS, provide **PWSID:** _____
	✓		Payment received: $_____ by Check or Credit Card
	✓		Will courier charges apply?
	✓		Data package required? (Level: 1 / 2 / 3 / 4)
			Notes: _____
	✓		Is this a DoD project? (USACE, Navy, AFCEE)

Delivery method (circle all that apply):
(Client) / Alert Courier / Lynden / SGS UPS / FedEx / USPS / DHL / Carlile AkAir Goldstreak / NAC / ERA / PenAir
Other: _____

Additional Sample Remarks: *(√ if applicable)*
_____ Extra Sample Volume?
_____ Limited Sample Volume?
_____ Multi-Incremental Samples?
_____ Lab-filtered for dissolved_____
_____ Ref Lab required for_____
_____ Foreign Soil?

This section must be filled out for DoD projects (USACE, Navy, AFCEE):

Yes	No		Yes	N/A
		Is received temperature ≤6°C?		Was pH verified upon receipt?
		Were containers ice-free? *Notify PM **immediately** of any ice in samples.* If some cooler temperatures are non-compliant, see form FS-0029 (attached) for samples/analyses affected.		
		Was there an airbill? *(If "yes," see attached.)*		
		Was cooler sealed with custody seals & were they intact? # / where: _____		
		Was there a COC with cooler?		
		Was COC sealed in plastic bag & taped inside lid of cooler?		
		Was the COC filled out properly? Did labels correspond?		
		Did the COC indicate USACE / Navy / AFCEE project?		
		Samples were packed to prevent breakage with *(circle one)*: Bubble Wrap Vermiculite Other (specify): _____		
		Were all samples sealed in separate plastic bags?		
		Were all VOCs free of headspace and/or MeOH preserved?		
		Were correct container / sample sizes submitted?		
		Was the PM notified of arrival so they can send Sample Receipt Acknowledgement to client?		

Cooler ID_____ Cooler Temp °C_____ Cooler ID_____ Cooler Temp °C_____
Cooler ID_____ Cooler Temp °C_____ Cooler ID_____ Cooler Temp °C_____

This section must be completed if problems are noted.

Was client notified of problems? Yes / No

By (SGS PM): _____

Individual contacted: _____
Via: Phone / Fax / E-mail (*circle one*)
Date/Time: _____
Reason for contact: _____

Change Order Required? Yes / No

Notes: Due Date 3/16/10
anylasis is Lead and Cadmium in Paint ale

Completed by (sign): Amy Arel **(print):** Amy Arel

Login proof: **Self-check completed** ale **Peer-reviewer's In itials** JAT

1101090

SGS

SAMPLE RECEIPT FORM - Bottle Tracking **SGS WO#**

#	Container ID	Matrix	Test	QC	TB	Container Volume: 1L	500mL	250mL or 8oz	125mL or 4oz	60mL	40mL	Other: Ziplock bag	Container Type: AG	CG	HDPE	Nalgene	Coli	Septa	Other:	Preservative: None	HCl	HNO3	H2SO4	NaOH	Ascorbic Acid	NH_4Cl	Other:	*Notes
1	A	T	Lead, Cadium in Paint									X1							X	X								
Bottle Totals												1															

* Note: Containers which require (additional) chemical preservation upon receipt must be documented per SOP#106

Completed by: Amy Arnold Date: 3/15/10

Appendix C-9 – Data from Shields, Mike. 2013. Blasting Caps Diagram.

MILL EXPLOSIVES DIAGRAM
MAY 10, 2013

LEVEL 7
PROPOSED EGRESS ROUTE

BOUNDARY OF DEPOSITS 2012

ESTIMATE EDGE OF DEPOSITS
1915 EDGE / POST 1925 EDGE

MILL SECTION ADDED 1923-24

LEVEL 7C
20'-6½"

48'-0½"

EXIT

LEVEL 7

DEPOSITION AREA 3

POST 1923 DEPOSITION AREA 2

PRE 1923 DEPOSITION AREA 1

PROPOSED CRIBBING REPAIR

BLASTING CAP FOUND IN 2011

54'-5"

DEPTH 6'+
(CRIBBING BUILT POST 1924)

LEVEL 6
PROPOSED EGRESS ROUTE

CONVEYOR DECK & MOTOR HOUSING BUILT 1923-24 (PROTECT)

21'-2"

BOTTOM ELEVATOR SHAFT

LEVEL 6

EXIT

35'-4"

MILL SECTION ADDED 1923-24

25'-5"

32'-2"

LEVEL 4
PROPOSED EGRESS ROUTE

EXIT

PROPERTY LINE

PROPOSED CABLE FENCE

INCLINE TRACK BUILT 1923-24

LIMITS OF CONSTRUCTION

POSTED CLOSURE SIGNS ON POSTS
CABLE FENCE WITH POSTS AT 10'-0"

2 PROPOSED PERIMETER FENCE
NO SCALE

3"x8" BATTER BOARDS
1" PIPE BRACE
3" TO 4" OF 1" MINUS GRAVEL TREAD
8" OF 2" TO 4" ANGULAR COBBLE BASE
NATIVE SOIL

3 PROPOSED EGRESS TREAD
NO SCALE

PARK TO PROVIDE EXPLOSIVES CLEARING IN BOTH AREAS AND SAFETY PLANKING IN THIS AREA

2013 PROPOSED STABILIZATION PROJECT AREA

LEVEL 6
PROPOSED EGRESS (RECONSTRUCT HISTORIC STAIR)

KEY

- TEST PIT W/OUT FUSE OR CAPS
- TEST PIT WITH FUSE
- TEST PIT WITH CAPS
- DEPTH OF TEST PIT
- TOUR AND EGRESS ROUTE

HATCHED AREA IS 4,000 SF (BIRD'S EYE)

Appendix C-10 – Data from SH Alaska. 2015. Report of Records and Data Review – National Park Service, Wrangell-St. Elias National Park and Preserve, Historic Kennecott Mine Town Site.

Appendix C-11 – Data from White Environmental Consultants, Inc. 2015. Final Report: Kennecott National Historic Landmark Soil Sampling Supplemental Services.

Table 1 – Summary of Mercury Wipe Samples – July 22, 2015

Sample #	Location	Concentration (µg/16 in^2)
413-Hg-1	Level 1 – Helmet donning area – shelf	100
413-Hg-2	Level 2 – East of dorr thickener – surface of crib	40
413-Hg-3	Level 3 – Shaker table – north side	9.7
413-Hg-4	Level 3A – North side of dorr thickener – top of crib	6.4
413-Hg-5	Level 4 – North shaker table – surface	5.2
413-Hg-6	Level 5 – High grade collection box – south	5.9
413-Hg-7	Level 6 – Mill support of south shaker table	5.7
413-Hg-8	Level 6A – Hancock jig cross member	3.1
413-Hg-9	Level 7 – North roller crusher	16
413-Hg-10	Level 8 – East ore tipple	1.1
413-Hg-11	Level 9 – Elevator dump site – south side	4.5
413-Hg-12	Level 10 – South elevator – horizontal support	0.82
413-Hg-13	Upper deck – Casing packing tool	4.0
413-Hg-14	Main ore bin – Wood siding	0.26
413-Hg-15	Base of north jaw crusher foundation	92
	NJ DHHS Guidance	**< 1**

Table 2 – Summary of Soil Results – July 22, 2015

Metal	Sample # / Location of Highest Concentration	Highest Concentration (mg/kg)	AK Cleanup Level (mg/kg)
Antimony	#5 – West side cover over tram- North side	84	33
Arsenic	#8 – Main ore bin	10,000	3.7
Barium	#3 – West end ore bin- South side	260	16,600
Cadmium	#11 – East of Hancock addition	480	65
Chromium	#3 – West end ore bin- South side #16 – Road at Scalehouse	21	250
Lead	#11 – East of Hancock addition	1500	400
Mercury	#8 – Main ore bin	64	25
Selenium	----------	Not Detected	410
Silver	#11 – East of Hancock addition	110	410

Table 3 – NPS Wipes – Lead, Arsenic, Mercury

Sample #	Date Sampled	Lead Result Total µg	Arsenic Result Total µg	Mercury Result Total µg
MW #1	7/15/15	1370	4080	
MW #2	7/15/15	2060	1230	
MW #3	7/15/15	5140	1820	
MW #4	7/15/15	7180	3900	
MW #5	7/15/15	3260	1040	
MW #6	7/15/15	7710	2040	
MW #7	7/15/15	4690	920	
MW #8	7/15/15	1280	1070	
MW #9	7/15/15	1950	2300	
MW #10	7/15/15	2090	2140	
MW #11	7/15/15	3520	235	
MW #12	7/15/15	41400	184	
MW #13	7/15/15	178	176	
MW #14	7/15/15	84	83.5	
MW #15	7/15/15	51.8	351	
MW #16	7/15/15	88.9	483	
MW #17	7/15/15	1270	129	
MS #18	7/15/15	1320	1460	
MS #19	7/15/15			1.4
MS #20	7/15/15	183	211	
MS #21	7/15/15			21.8
MW #22	7/15/15	992	1550	
ME #23	7/15/15	13.2	29.4	
NW #24	7/15/15	130	45.6	
BP-1	7/30/15	33.2	33.2	
BP-2	7/30/15	76	40.1	
BP-3	7/30/15			0.56
REGULATION or STANDARD		HUD- Window Troughs 400 µg/ft^2	EPA COPC Committee 36 µg/ft^2	NJDHSS < 1 µg/16 in^2 < 9 µg/ft^2

Table 4 – NPS Airs – Lead, Arsenic, Mercury

Sample #	Date Sampled	Lead Results (mg/m^3)	Arsenic Results (mg/m^3)	Mercury Results (mg/m^3)
EBW-01-015	6/25/15	0.005	< 0.00019	
MS-01-015	7/1/15	0.0032	< 0.002	
ML-01-15	6/11/15			< 0.000070
EBW-02-015	7/12/15	0.0026	< 0.00024	
OC-01-015	7/9/15	0.00031	< 0.00024	
MW-02-015	7/16/15	< 0.0013	< 0.001	
EBW-03-015	7/14/15			< 0.000028
OC-02-015	7/9/15			< 0.000049
MW-01-015	7/16/15			< 0.00011
EB-03-015	7/27/15	0.013	< 0.00048	
EB-04-015	7/28/15	0.014	< 0.00025	
ML7-01-015	7/23/15	0.00055	< 0.00022	
ML5-02-015	7/23/15	0.00074	< 0.00025	
CIH-02-015	7/22/15	< 0.002		
REGULATION		**OSHA 8 Hour PEL** 0.05 mg/m^3	**OSHA 8 Hour PEL** 0.01 mg/m^3	**AKOSH 8 Hour PEL** 0.05 mg/m^3