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Fate and Effects of Leachate Contamination on Alaska's Tribal Drinking Water Sources

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FATE AND EFFECTS OF LEACHATE CONTAMINATION ON ALASKA'S TRIBAL DRINKING WATER SOURCES

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Notice

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List of Abbreviations/Acronyms

AAC	Alaska Administrative Code
ADEC	Alaska Department of Environmental Conservation
ANOVA	Analysis of Variance
ASET	UAA Applied Science, Engineering, and Technology Laboratory
ATSDR	Agency for Toxic Substances and Disease Registry
ATV	all terrain vehicle
bgs	below ground surface
BIA	Bureau of Indian Education
CDC	Center for Disease Control
CIS	Community Information Summaries
COC	contaminant of concern
DEC	Alaska Department of Environmental Conservation
DO	dissolved oxygen
EPA	U.S. Environmental Protection Agency
FC	Fecal Coliform
gm/kg	grams per kilogram
HASP	Health and Safety Plan
HUD	U.S. Department of Housing and Urban Development
ICP-OES	Inductively Coupled Plasma-Optical Emission Spectrometry
ID	inner diameter

MCL	maximum contaminant level
mg/l	milligrams per liter
mm	millimeter
MPN	most probable number
MSWLF	municipal solid waste landfills
MWPIISP	Monitoring Well Point Installation and Initial Sampling Plan
NPDWR	National Primary Drinking Water Regulations
NPT	National Pipe Thread
NRMRL	National Risk Management Research Laboratory
NSDWR	National Secondary Drinking Water Regulations
ORD	Office of Research and Development
ORP	oxidation reduction potential
PVC	polyvinyl chloride
QAPP	Quality Assurance Project Plan
RARE	Regional Applied Research Effort
RPM	Revolutions per Minute
RPP	Rigid Porous Polyethylene
RurAL CAP	Rural Alaskan Community Action Program
Shaw	Shaw Environmental and Infrastructure, Inc.
SOW	Statement of Work
SVOC	semivolatile organic compounds
T&E	Test and Evaluation
TDS	total dissolved solids
TICs	tentatively identified compounds
TOC	total organic carbon
TPH	total petroleum hydrocarbons
UAA	University of Alaska at Anchorage
UAF	University of Alaska at Fairbanks

µg/l	micrograms per liter
WELTS	Well Log Tracking System
WERC	UAF Water and Environmental Research Center

1.0 Introduction

In June 2009, the U.S. Environmental Protection Agency's (EPA), Office of Research and Development (ORD)/National Risk Management Research Laboratory (NRMRL) in collaboration with EPA Region 10 under the Regional Applied Research Effort (RARE) Program issued a Statement of Work (SOW) under Contract No. EP-C-04-034 (Work Assignment No. 4-19) that tasked Shaw Environmental & Infrastructure, Inc. (Shaw) to provide technical support and coordinate activities to evaluate the fate and effects of leachate contamination on Alaska's tribal drinking water sources. Subsequently, this work was continued under Contract No. EP-C-09-041 (Work Assignments No. 0-07, 1-07, and 2-07). Overall, the individual SOWs required Shaw to coordinate with EPA and the Alaskan tribal communities to identify and select five suitable Alaskan tribal landfills/dump sites and perform suitable water quality sampling and analysis to identify chemical and microbial contaminants of concern (COCs) that could potentially impact the local drinking water sources.

The goals of this research were to characterize the general surface water quality and groundwater quality in the vicinity of the selected Alaska's rural landfills, identify water contamination levels, and collect information that can be used to improve the management of the approximately 200 open tribal dump sites throughout the State of Alaska. This final report summarizes the activities, findings, and recommendations based on the approximately three years of this collaborative research.

1.1 Project Background

Rural Alaskan dump sites were often developed without any site assessment, design, or engineering, and are unlined. These open dumps usually contain mixed wastes including household hazardous waste, "honey bucket" (i.e. human) wastes, and electronic wastes such as circuit boards in computers. While permafrost may function as a "barrier/liner" to retain the leachate and prevent its immediate release into local surface water and/or groundwater, there are increasing concerns that projected changes in climate may result in the melting of the permafrost and cause a sudden increase in the release of environmental contaminants from the dump sites. Therefore, in order to evaluate the fate and effects of leachate contamination, it is important to characterize the groundwater and surface water quality in the vicinity of these landfills.

1.2 Research Collaborators

Many individuals contributed during various phases (e.g., planning, field work, sampling, analysis, and reports) of this research work. The key collaborators include:

1. EPA/ORD/NRMRL – Chris Impellitteri, Craig Patterson, Bart Faulkner, and Debbie Roose.

2. EPA Region 10 - Michelle Davis, Greg Kellogg, Tami Fordham, Fran Stefan, Roseanne Lorenzana, and Al Latourette.
3. Rural Alaskan Community Action Program (RurAL CAP) – Ted Jacobsen.
4. Centers for Disease Control (CDC)/Agency for Toxic Substances and Disease Registry (ATSDR) Alaska - Joseph Sarcone.
5. University of Alaska – Bill Schnabel, Birgit Hagedorn, and Edda Mutter.
6. Alaska Tribal Village Site Coordinators – Nick Carter (Eek), Lorraine King (Ekwok), Eric Morris (White Mountain), Clayton Tackett (Fort Yukon) and Pam Vent (Allakaket).
7. Shaw Environmental & Infrastructure – Srinivas Panguluri, Jack James, Paul McCarren, Steve Crupi, Wayne Coppell, Bill Bailor, and Kelly Birkenhauer.

Field activities performed by the Shaw Alaska team under this study were coordinated with a team of researchers at the University of Alaska at Fairbanks (UAF), University of Alaska at Anchorage (UAA), and the RurAL CAP.

In order to enhance the collaboration and information sharing, a team website was setup using the Google Sites platform and tools (https://sites.google.com/site/alaskarare/). Google Sites is a free structured wiki- and web page-creation tool offered as part of the Google Apps Productivity suite. The "alaskarare" project site was designed to serve as a portal where the project team members could collaborate and share files. This website is used for information sharing and serves as a document repository. Periodically, project related documents and other documents of interest to the RARE team are posted to this site. Access to this site can be requested by contacting the EPA Region 10 lead Ms. Michelle Davis at Davis.MichelleV@epa.gov.

1.3 Site Selection

The EPA SOW required Shaw to coordinate with the research partners to identify and select sites landfills that would include various geophysical representations. The EPA SOW called for the study to include regions with undisturbed tundra, disturbed tundra in (or in very close proximity to) a tundra pond, short distance to groundwater, and long distance to groundwater. Based on discussions with the research team, the following sites were initially identified and their participation was solicited in the form of a questionnaire (See Appendix A – for the questionnaire and responses received):

1) Ekwok – (undisturbed tundra),
2) Eek – (disturbed tundra),
3) Tuntutuliak – (in or in very close proximity to a tundra pond),
4) Iquimiut – Russian Mission (short distance to groundwater), and
5) White Mountain – (long distance to groundwater).

In 2009, three sites (Eek, Ekwork and White Mountain) were selected for the groundwater monitoring well installation. Environmental officials at the tribal villages of Tuntutuliak and Iquimiut were not able to participate because of work on other projects. Subsequently, in 2011, groundwater monitoring equipment was deployed at two additional sites (Fort Yukon and Allakaket). Fort Yukon's landfill is located in a tundra pond. Allakaket's landfill is located mostly on tundra and permafrost.

1.4 Equipment Selection

The initial planning activities for the three sites (in 2009) resulted in a conclusion that due to the remoteness of the site locations, it was not possible with the available budget to ship/transport drilling equipment. However, during the planning stages it was anticipated that many of the sites (except White Mountain) would have very shallow groundwater tables that could be accessed by hand-auger, and manually driven piezometers could serve as well points. A piezometer is an open well or standpipe with solid casing down to the depth of interest and a slotted or screened casing within the zone where water is being monitored. A piezometer well is much smaller in diameter than a production well, and therefore it can be manually driven. Stainless steel piezometers are employed in initial site investigations as they are simple, cost effective, and can be manually driven up to 25 feet in suitable soils.

The project team selected the Solinst (Model 615) Drive-Point Piezometer (Solinst Canada Ltd. Georgetown, Ontario) as an affordable method to monitor groundwater. The drive-points attach to inexpensive ¾ inch (20 millimeter (mm)) National Pipe Thread (NPT) steel drive pipe which was available through local plumbing and hardware stores in Alaska. Also, the selected drive-point piezometer could be driven into the ground using a manually-operated 25 pound slide hammer. A heavy duty drive head is used to drive the piezometer on which the slide hammer impacts. Figure 1-1 shows the piezometer installation setup using a manual slide hammer.

Groundwater samples, where available, were drawn using the Waterra inertial pumping system (Waterra Pumps Limited, Mississauga, Ontario). The Waterra system consists of a riser tube fitted with a one-way footvalve and tubing, which can be operated manually at shallow depths. It is an efficient, reliable, and inexpensive pump suitable for purging and sampling groundwater monitoring wells. The inertial pump was also suitable for smaller inner diameter (ID) drive point well installations. In cases where neither sufficient volume nor timely recharge was available to use the Waterra system, dedicated polyethylene bailers, cylindrical containers with monofilament line, were used to collect well water samples. The water samples were then transferred into suitable sample bottles as specified by the predefined analytical method for the selected compound. Rigid Porous Polyethylene (RPP) passive samplers (ALS – Columbia, Kelso, WA) were deployed in some locations for water collection. RPP samplers are made of thin sheets of foam-like porous polyethylene with pore sizes of 6-20 microns. When completely filled with water, the pores allow a water-water interface, facilitating the equilibrium of water-soluble analytes in the groundwater adjacent to the well screen with the deionized water of the RPP. Passive samplers generally remain deployed for a minimum of 14 days even though the analytes of interest may equilibrate sooner. The RPP samplers yield a relatively low volume of water per bag.

In addition to these methodologies, where water yield was insufficient, sump wells were installed at White Mountain, Fort Yukon, and Allakaket. Sumps were constructed using a 2-foot section of 6-inch diameter polyvinyl chloride (PVC) pipe. The pipe section was drilled with 1/4-inch holes spaced one inch apart and covered with seven inch round valve boxes or five gallon buckets which ever was available locally. This design was selected based on the materials that would be typically available at a big-box home improvement store in Anchorage, Alaska. After several hours following sump installation, the sumps were bailed dry. The sumps refilled with water and were allowed to rest for 12 hours prior to taking grab samples. RPP passive samplers were also deployed in some of these sumps. Figure 1-2 presents Shaw's 6-inch diameter sump well design before and after auguring the permafrost for placement and capping in the ground.

Microbial indicator analyses of surface and subsurface water samples were performed using IDEXX Laboratories, Inc. (Westbrook, ME) equipment which included: Colilert® reagent, Enterolert® reagent, Quanti-Tray®/2000, and sterile sampling bottles containing sodium thiosulfate for chlorine removal. In the field, samples were collected in sterile 200 milliliter (mL) wide mouth High Density Polyethylene (HDPE) bottles and upon arrival at the university laboratory they were split into two 100 mL sterile bottles for *E. coli* and *Enterococci* analysis separately.

1.5 Water Quality Assessment

The research team collectively performed both chemical and microbial water quality assessments at the selected five rural landfill sites. The water quality assessments performed included sampling and analysis for the following COCs:

1. SGS Alaska Commercial Laboratory – Semi-Volatile Organic Compounds (SVOCs), Tentatively Identified Compounds (TICs), Total Organic Carbon (TOC), Total Dissolved Solids (TDS), Alkalinity, Mercury, and Total Petroleum Hydrocarbons (TPH).
2. UAA Applied Science, Engineering, and Technology Laboratory (ASET) – Anions (Nitrate, Sulfate, Fluoride, Chloride, Phosphate), Cations/Metals (Priority Pollutants List, Al, Sb, As, Be, Cd, Cr, Co, Cu, Pb, Mn, Mo, Ni, Se, Ag, Tl, Th, U, V, Zn except Barium and Mercury), and Hardness.
3. UAF Water and Environmental Research Center (WERC) - Microbial indicator analysis was performed using *"most probable number"* (MPN) methods consistent with EPA protocols. The microbial indicator data were primarily collected as part of the research conducted by Ms. Edda Mutter of UAF.

In addition to the aforementioned laboratory water quality assessments, the tribal village officials were provided with YSI Professional Plus field monitoring instruments to measure routine water quality parameter data such as conductivity, temperature, pH, dissolved oxygen (DO), and oxidation reduction potential (ORP). After the initial SGS Alaska commercial laboratory results indicated "non-detect" values for the listed organic contaminants, to conserve the project funding, the later sampling events discontinued the sampling and analysis related to these compounds. Sections 4, 5 and 6 discuss these assessments in further detail.

1.6 Ash Sampling

In addition to the water quality sampling, between March 2010 and September 2011, ash samples derived from various waste burning operations at each site were also collected and analyzed for metals. This sampling and analysis was performed to see if there was a relative trend in high levels of specific metals in the ash samples in comparison to the water samples for each community. The analysis of the ash samples was performed by EPA personnel at the EPA Test and Evaluation (T&E) Facility in Cincinnati, Ohio. Ash sample collection, analytical methodology is described in Section 4.0 and the results are presented in Section 5.6.

1.7 CDC/ATSDR Health Effects Information

The CDC/ATSDR office based in Atlanta, Georgia, is a federal public health agency under the U.S. Department of Health and Human Services. Over the years, CDC/ATSDR has put together a series of substance-specific factsheets or ToxFAQs™ that provide information summaries related to hazardous substances and their health effects. It should be noted that the actual effects of exposure to any hazardous substance depend upon various factors including: the contaminant concentration and dose, the exposed duration, mode of exposure, personal traits and habits of the individual exposed, and whether other chemicals are also present resulting in a combined exposure. Section 5.0 and the attached appendices provide additional information related to the chemical substances that were found at these sites to be above selected thresholds for information purposes only.

1.8 Microbial Indicators

Since it is difficult, time-consuming, and expensive to test directly for the presence of a large variety of pathogens (disease-causing microorganisms), water samples are usually tested for the presence of one or more types of microbial indicator organisms. Prior to the publication of the 1986 bacteria criteria document (EPA 1986), EPA recommended the use of fecal coliforms (FC) as an indicator organism to protect people from gastrointestinal illness in recreational waters. Based on the results from epidemiological studies outlined in this document, EPA recommended the use of *E. coli* or *Enterococci* as microbial indicators for fresh recreational waters and *Enterococci* for marine recreational waters because levels of these organisms more accurately predict acute gastrointestinal illness than levels of FC. Subsequently, these organisms became the most commonly used for microbial indication of possible sewage contamination (Ashbolt 2001). Both *E. coli* and *Enterococci* are commonly found in human and animal excrement (feces). Although these organisms are generally not harmful themselves, their presence serves as an "indicator" of other disease-causing (i.e., pathogenic) microbial organisms. Exposure to pathogenic organisms can cause short-term effects, such as diarrhea, cramps, nausea, headaches, or other symptoms. These types of exposures pose a greater health risk for infants, young children, and people with severely compromised immune systems than for healthy humans. Both EPA and CDC maintain an extensive database of information about specific pathogenic organisms.

2.0 Alaska's Rural Landfills

Alaska is the largest state in the Union with 366,000,000 acres of land, and a population of 710,231 (2010 Census). Over 60% of the population lives near Fairbanks, Anchorage, or Juneau. The other 40% are scattered throughout the state, in over 300 communities, many of which are not connected by road and are located in diverse geographic areas ranging from maritime areas, to open tundra, to mountainous regions. This geographic disparity presents a unique challenge to the disposal of waste in the majority of the state.

2.1 Municipal Solid Waste Landfill Classes

The Alaska Department of Environmental Conservation (ADEC) has primacy over the solid waste program in Alaska and implements the program through Alaska Administrative Code (AAC) found at 18 AAC 60. There are three types of municipal solid waste landfills (MSWLF) in Alaska; Class I, II and III and 18 AAC 60.300 describes the "Purpose, scope, and applicability; classes of MSWLF"

1) Class I MSWLF is a landfill that: (A) accepts, for incineration or disposal, 20 tons or more of municipal solid waste and other solid wastes daily, based on an annual average; or (B) does not qualify as a Class II or Class III MSWLF;
2) Class II MSWLF is a landfill that: (A) accepts, for incineration or disposal, less than 20 tons daily of municipal solid waste and other solid wastes based on an annual average; (B) is located on a site where there is no evidence of groundwater pollution caused or contributed by the landfill; (C) is not connected by road to a Class I MSWLF or, if connected by road, is located more than 50 miles from a Class I MSWLF; and (D) serves a community
    - (i) that experiences, for at least three months each year, an interruption in access to surface transportation, preventing access to a Class I MSWLF; or
    - (ii) with no practicable waste management alternative, with a landfill located in an area that annually receives 25 inches or less of precipitation; and
3) Class III MSWLF is a landfill that is not connected by road to a Class I MSWLF or, if connected by road, is located more than 50 miles from a Class I MSWLF, and that accepts, for disposal, (A) ash from incinerated municipal waste in quantities less than one ton daily on an annual average, which ash must be free of food scraps that might attract animals; or (B) less than five tons daily of municipal solid waste, based on an annual average, and is not located in a place
    - (i) where public access is restricted, including restrictions on the right to move to the place and reside there; or
    - (ii) that is provided by an employer and that is populated totally by persons who are required to reside there as a condition of employment and who do not consider the place to be their permanent residence.

The surface and groundwater monitoring requirements vary depending on MSWLF class. There are no surface water or groundwater monitoring requirements for Class II or Class III landfills in Alaska, unless ADEC has reason to suspect a potential water quality or human health impact due to the landfill. The State of Alaska has designated a Class III landfill category specifically to accommodate the large proportion of rural communities. Many of these communities have less than 500 people, but every one of these small communities has a landfill. As stated previously, Class III landfills are more than 50 miles by road from a larger landfill or are not accessible by road at all. Many communities are only accessible by plane or boat. All five of the communities participating in this EPA RARE study Ekwok, Eek, White Mountain, Fort Yukon and Allakaket are considered to be Class III landfills. Overall, there are 183 active Class III landfills in rural Alaska, of which forty nine (49) are permitted. All five of the communities participating into this EPA RARE study, Ekwok, Eek, White Mountain, Fort Yukon and Allakaket are considered to be Class III landfills, and non-permitted.

2.2 Rural Solid Waste Management Practices

Effective solid waste management practices are critical to minimize the spread of potential contamination. Rural Alaskan landfills are often operated without the knowledge and insights of modern waste management practices. Even though knowledge gains have been made in the recent years, several other factors such as limited revenue streams for local governments, inability to attract and retain trained operators (i.e. heavy equipment operators), high cost of fuel, and the absence of substantial federal and/or state government grants for facility operation and maintenance makes it difficult to implement comprehensive waste management practices. The landfills may be poorly managed under conditions that could include: 1) standing water or wetland sites; 2) seasonal flooding; 3) intermittent, uncontrolled open burning on the ground (sometimes the garbage was burned on top of standing water); 4) no site control or routine maintenance; 5) very close proximity to villages; 6) no lining, leachate collection or treatment systems with no understanding of the relationship between potential leachate travel direction and drinking water sources; and 7) little or no waste separation. In the past decade or so, the State of Alaska's Division of Environmental Health (Solid Waste Program) has developed a number of factsheets and guidance documents for rural communities that can be downloaded directly from their website (http://dec.alaska.gov/eh/sw/rural_AK.htm). These documents include:

1. Tips for Solid Waste Management in Rural Alaska - Suggested guidelines for burning, burying, and recycling solid waste in rural communities.
2. Solid Waste Procedures Manual for Class III Landfills - Best Management Practices for designing, locating, operating, and closing Class III landfills.
3. Household Hazardous Waste Collection - Guidelines for establishing and conducting collection programs for household hazardous waste.
4. Open Burning in Rural Alaska - Best Management Practices for effective open burning.

5. Burning Garbage and Land Disposal in Rural Alaska - Guidelines and detailed information regarding the incineration and open burning of solid waste.
6. Construction and Demolition Debris in Rural Alaska - An explanation of the available options for disposing of construction and demolition waste in rural Alaska.

A brief summary of the key recommendations is presented in Section 6.0.

3.0 Historic Data Review and Background Information

As mentioned in Section 1.0, Ekwok, Eek, and White Mountain were selected for the initial field investigation in 2009, and in 2011, Fort Yukon and Allakaket were chosen as additional sites for continuing groundwater quality investigation. These original sites were chosen based on questionnaire responses received, and the site suitability based on the project objectives described in Section 1.0. The following sections provide a summary of each site location. The detailed information collected during the initial project planning stages by the RARE team is provided in Appendix A. Additional community specific information was collected from the Alaska Community Database Community Information Summaries (CIS). Historic well logs were collected during the RARE survey and from the Alaska Department of Natural Resources Well Log Tracking System (WELTS).

3.1 Ekwok Site Background

The village of Ekwok is located approximately 50 miles northeast of Dillingham, Alaska at approximately 59.349720° North latitude and -157.475280° West longitude in the Dillingham quadrangle (Figure 3-1). The village encompasses an area of 16.0 square miles of land and 1.4 square miles of water. It has a population of approximately 115 residents. According to Census 2010, there were 51 housing units in the community of which 37 were occupied. The village is located along the Nushagak River. Ekwok is located in a climatic transition zone which is primarily maritime influenced. Summer temperatures range from 30 to 66°F, and average winter temperatures range from 4 to 30°F.

Ekwok means “end of the bluff” and is the oldest continuously-occupied Yup'ik Eskimo village on the river. During the 1800s, the settlement was used in the spring and summer as a fish camp and in the fall as a base for berry picking. By 1923, it was the largest settlement along the river. In 1930, a Bureau of Indian Affairs (BIA) school was constructed. Mail was delivered by dog sled from Dillingham until a post office opened in Ekwok in 1941. Many of the earliest homes in Ekwok were located in a low flat area near the riverbank. After a severe flood in the early 1960s, villagers relocated to the current location on higher ground. The city was incorporated in 1974. A federally-recognized tribe is located in the community -- the Ekwok Village.

Individual wells provide water for the majority of the community. Twenty U.S. Department of Housing and Urban Development (HUD) homes have individual wells and a piped septic system. The village operates a piped sewage system with a sewage lift station, which connects to 16 additional residences. The remaining homes use septic systems or a flush/haul system; a sewage pumper is available. Thirty-six homes have complete plumbing. Refuse collection services are provided. Electricity is provided by Ekwok Electric. There is one school located in the community, attended by 16 students. Local hospitals or health clinics include Ekwok Clinic.

Emergency Services have coastal and air access. Emergency service is provided by a health aide. Auxiliary health care is provided by Ekwok First.

The entire population depends on subsistence activities for various food sources. Salmon, pike, moose, caribou, duck, and berries are harvested. A few residents trap. Summer gardens are also popular, because families do not leave the village to fish for subsistence purposes. In 2010, three residents held commercial fishing permits in Ekwok. The village corporation owns a fishing lodge two miles downriver. Gravel is also mined near the community.

Air transport is most frequently used to reach Ekwok. Regular and charter flights are available from Dillingham. The state-owned 3,300 foot long by 75 foot wide gravel runway was rebuilt and lengthened in 2005. Float planes land on the Nushagak River. Cargo is brought in during ice-free months from Dillingham by Coastal Marine Transport barge service. There are no docking facilities, but a barge off-loading area exists. Skiffs, all terrain vehicles (ATVs), and snow machines are used for local transportation.

The shallow domestic wells that supply water to residences are located further than one-quarter mile removed from the landfill site. The landfill site encompasses less than one acre and is located in an upland area approximately one-half mile northeast of the village. Based on the EPA RARE information request, the dump site is estimated to be between 20 to 30 years old, 10 feet deep, its dimensions are 70 yards by 40 yards, and it is located on tundra lands. The questionnaire also indicated that the dump does not flood, nor has standing water issues. Additionally, it is estimated that groundwater would be encountered between 20 to 32 feet below ground surface (bgs).

The RARE well log search indicated that static water depths range from 10 to 32 feet bgs; shallow soils consist of gravel, sand, and silt; and frozen soil depths are solid in the winter and not encountered in the summer. A total of twelve (12) wells were identified in the well log search. The logs show that water was typically encountered during drill at depths greater than 20 feet bgs. Historic well logs are located in Appendix A.i.

3.2 Eek Site Background

Eek is located approximately 35 miles south of Bethel, Alaska at approximately 60.218890° North latitude and -162.024440° West longitude in the Baird quadrangle (Figure 3-2). It has a population of approximately 318 residents. According to Census 2010, there were 101 housing units in the community and 91 were occupied. The village is located on the south bank of the Eek River. The village area encompasses 0.9 square miles of land and 0.1 square miles of water. Eek is located in a marine climate. Summer temperatures range from 41 to 57°F, and winter temperatures range from 6 to 24°F.

The original village was located on the Apokok River, but moved to its present location in the 1930s due to flooding. A BIA school and a Moravian church were constructed at the new site. The school is currently attended by 89 students. A post office was established in 1949. The city was incorporated in 1970. A federally-recognized tribe is located in the community -- the Native Village of Eek. Eek is a traditional Yup'ik Eskimo village with a subsistence lifestyle and salmon is a dominant food source. All five Pacific salmon species spawn in the Eek River.

A state-owned 3,243 foot long by 60 foot wide gravel airstrip provides chartered and private air access. A seaplane base is also available on the Eek River. Fishing boats, skiffs, and snow machines are used for local transportation to Bethel and other villages. There is a one-mile gravel road in the city. Winter trails are marked to Quinhagak (39 mi), Eek Island (15 mi), and the Kwethluk River (45 mi). Barges deliver fuel and supplies during the summer months. A dock is also available.

The village uses the Eek River for its primary domestic water supply source. Water is treated and stored in a tank at the washeteria. Rain catchment systems and ice melt are also used for drinking water. A raw sewage waste lagoon is located adjacent to the landfill; the village does not have a sewage system. Honeybuckets are collected by the city and disposed of in the sewage lagoon. Electricity is provided by Alaska Village Electric Cooperative. Local hospitals or health clinics include Eek Health Clinic. Emergency Services have coastal and air access. Emergency service is provided by a health aide.

The 18.6 acre landfill is located within view of the town in an area characterized by surface water lagoons and tundra. Information from the RARE questionnaire indicated that the dump was approximately 33 years old. Standing water is located at the dump year round; however, the dump does not flood. Permafrost can be encountered at two feet bgs. Additionally, the dump consists of two natural ponds which are approximately five feet deep.

The RARE well log search noted that static water depth ranges from 18 to 23 feet bgs; shallow soils consist of sand and clay; and permafrost depths range from 3 to 4 feet in the summer while it is solid in the winter. A total of two wells were identified in the well log search in the village of Eek. The logs also show saltwater seepage at depths greater than 70 feet. Historic well logs are located in Appendix A.ii.

3.3 White Mountain Site Background

White Mountain is located 63 miles east of Nome, Alaska at approximately 64.681390° North latitude and -163.405560° West longitude in the Solomon quadrangle (Figure 3-3). The village has a population of approximately 199 residents and is located on the west bank of Fish River, near the head of the Golovin Lagoon, on the Seward Peninsula. According to Census 2010, there were 79 housing units in the community and 65 were occupied. The city area encompasses 1.8 square miles of land and 0.2 square miles of water. White Mountain is located in a transitional climate. Average summer temperatures range from 43 to 80°F, and average winter temperatures range from -7 to 15°F.

The Inupiat fish camp of "Nutchirviq" was located here. The bountiful resources of both the Fish and Niukluk Rivers supported the area's Native populations. White Mountain grew after the influx of prospectors during the gold rush of 1900. The first structure was a warehouse built by miner Charles Lane to store supplies for his claim in the Council District. It was the site of a government-subsidized orphanage, which became an industrial school in 1926. A post office was opened in 1932. The city government was incorporated in 1969. A federally-recognized tribe is located in the community -- the Native Village of White Mountain. White Mountain is a Kawerak Eskimo village, with historical influences from the gold rush. Subsistence activities are prevalent.

Access to White Mountain is by air and sea. There are no roads. The 3,000 foott long by 60 foot wide gravel runway is operated by the state, and scheduled flights are available daily from Nome. There is no dock in the village; supplies are lightered from Nome and offloaded on the beach. Cargo barges cannot land at White Mountain.

The village obtains its domestic water supply from groundwater wells located in the village near the Fish River. The water is treated prior to consumption. Forty-eight (48) households and facilities are connected to the piped water and sewer system. Eighteen (18) additional households haul honeybuckets. The school operates its own water and sewer system. Electricity is provided by White Mountain Utilities. There is one school located in the community. Local hospitals or health clinics include Natchirsvik Health Clinic. Emergency Services have river and air access. Emergency service is provided by a health aide.

The 2-acre landfill is located on the other side of a ridge east of the village and north of the river, in an upland area. According to the RARE information, the landfill is approximately 30 years old and 300 feet by 300 feet with plans of expansion to the west by 100 feet. The site is characterized by shallow limestone bedrock which is encountered at approximately five feet bgs. Waste is piled in the landfill and is approximately 15 feet high along the fence lines. Standing water occurs during break-up and heavy precipitation events and flows as sheet flow. Additionally, where trash is piled, water will drain out of the waste to the east/southeast.

The RARE well log search noted that static water depths range from 25 to 90 feet bgs; shallow soils consist of silt and gravel; and permafrost depths are solid in the winter and at least eight feet in the summer. A total of two wells were identified in the village of White Mountain. The logs also show that the silt and gravel are underlain by limestone which has been encountered at depths as shallow as 3 feet bgs. Water was encountered in the fractured limestone at depths greater than 20 feet bgs. Historic well logs are located in Appendix A.iii.

3.4 Fort Yukon Site Background

Fort Yukon is located approximately 145 air miles northeast of Fairbanks, Alaska at approximately 66.564720° North latitude and -145.273890° West longitude in the Fort Yukon quadrangle (Figure 3-4). Fort Yukon is located near the confluence of the Yukon and Porcupine Rivers. The community population is approximately 600 residents. According to Census 2010, there were 325 housing units in the community and 246 were occupied. The city area encompasses 7.0 square miles of land and 0.4 square miles of water. Fort Yukon is characterized by long, harsh winters, and short, warm summers with average minimum temperatures below 0° for most of November through March. Summer highs range from 65 to 72°F.

Fort Yukon was founded in 1847 by Alexander Murray as a Canadian outpost in Russian territory. It became an important trade center for the Gwich'in Indians, who inhabited the vast lowlands of the Yukon Flats and River valleys. The Hudson Bay Company, a British trading company, operated at Fort Yukon from 1846 until 1869. In 1862, a mission school was established. In 1867, Alaska was purchased by the U.S., and, two years later, it was determined that Fort Yukon was on American soil. Moses Mercier, a trader with the Alaska Commercial Company, took over operation of the Fort Yukon Trading Post. A post office was established in 1898. The fur trade of the 1800s, the whaling boom on the Arctic coast (1889-1904), and the Klondike Gold Rush spurred economic activity and provided some economic opportunities for the Natives. However, major epidemics of introduced diseases struck the Fort Yukon population from the 1860s until the 1920s. In 1949, a flood damaged or destroyed many homes in Fort Yukon. During the 1950s, a White Alice Communications System and an Air Force station were established. Fort Yukon incorporated as a city in 1959.

A federally-recognized tribe is located in the community -- the Native Village of Fort Yukon; the Canyon Village Traditional Council is also located in the community; however, it is not federally-recognized. Most Fort Yukon residents are descendants of the Yukon Flats, Chandalar River, Birch Creek, Black River, and Porcupine River Gwich'in Athabascan tribes. Subsistence is an important component of the local culture.

Fort Yukon is accessible by air year-round and by barge during the summer months. Heavy cargo is brought in by barge from the end of May through mid-September; there is a barge off-loading area but no dock. Riverboats and skiffs are used for recreation, hunting, fishing, and other subsistence activities. A state-owned 5,810 foot long by 150 foot wide lighted gravel airstrip is available; Hospital Lake, adjacent to the airport, is used by float planes. There are 17 miles of local roads and over 100 automobiles and trucks. The city transit bus system provides transport throughout the town. Snow machines and dog sleds are used on area trails or the frozen river, which becomes an ice road to area villages during winter.

Water is supplied by two wells to residents' homes in a piped system. It is treated prior to consumption and stored in a 110,000-gallon tank. Sewer flows through piping to lift stations in the town and is pumped to lagoons located approximately 1.5 miles east of town. The landfill encompasses approximately 4 acres and is bordered by an allotment to the south, a lowland area stretching from the south to the north on the western side, filled and covered sewage lagoons (no longer in use), and a stand of mixed forest (aspen and spruce) on the eastern side. Based on observations made from the site visit, the landfill is located along the edge of an old river bank 25-50 feet higher than the lowland area. It appeared that debris had been pushed over this edge onto the lowland. At the base of the landfill, a semi-dense stand of scrub willow exists. The majority of this stand of trees, extending a distance of 50-100 feet from the landfill, has died but was still standing. Fort Yukon's landfill is listed for closure, and it had been covered with gravel prior to project implementation.

A total of seven (7) wells have been identified in Fort Yukon using the Alaska Well Log Tracking System (WELTS). Well logs indicate that silt, sand, and gravel should be encountered at depths up to 150 feet bgs and are underlain by lacustrine silts. Water was encountered during drilling at depths ranging from 13 to 24 feet bgs. Top of permafrost depths were noted as ranging from 30 to 32 feet bgs. Historic well logs are located in Appendix A.iv.

3.5 Allakaket Site Background

Allakaket is located approximately 190 miles northwest of Fairbanks, Alaska at approximately 66.562610° North latitude and -152.647560° West longitude in the Bettles quadrangle (Figure 3-5). It has a population of approximately 100 and is located on the south bank of the Koyukuk River. According to Census 2010, there were 58 housing units in the community and 44 were occupied. The city encompasses 3.6 square miles of land and 0.7 square miles of water. Allakaket is characterized by a cold, continental climate with extreme temperature differences. Temperatures range from -40°F to 70°F.

Several Native groups have lived in the area, including Koyukon Athabascans and Kobuk, Selawik, and Nunamiut Eskimos from the north and northwest. The Koyukon lived in several camps throughout the year, moving as the seasons changed, following the wild game and fish. The various bands established joint settlements after 1851. The old site of Alatna was a traditional trading center for Athabascans and Eskimos. The first mission on the Koyukuk River, St. John's-in-the-Wilderness Episcopal Mission, was established in 1906. A post office was opened in 1925. In 1938, the name of the community was changed to Allakaket (the old name for the mission), and the name Alatna was assumed by the small Eskimo community across the river. The village of Alatna has a population of approximately 30. The first public school was established in 1957. A flood caused by ice jamming inundated 85% of the community in the Spring of 1964. In 1975, the community incorporated as a city, including both settlements of Allakaket and Alatna. A clinic and airport were built in 1978. A new school and community roads were built in 1979. In September 1994, flood waters destroyed and swept away nearly all of the community's buildings, homes, and food caches for the winter. Residents rebuilt near the old city site, but some new homes and facilities are now located outside of the incorporated city boundaries. New Allakaket and Alatna are located outside of the city limits.

A federally-recognized tribe is located in the community -- the Allakaket Village. Allakaket is mainly an Athabascan community; Kobuk Eskimos live across the river in Alatna. Two separate village councils exist. Traditional potlatches, dances and foot races attract visitors from area villages. Subsistence activities provide the majority of food sources.

Allakaket has no road link, but winter trails connect it with Hughes, Bettles, and Tanana. River transportation is important in summer, but there is no commercial barge access due to shallow water. A state-owned 4,000 foot long by 100 foot wide gravel runway is accessible year-round. A $6 million airport improvement began construction in 1997.

Most public facilities were severely damaged in the 1994 Koyukuk River flood. Major components have been replaced -- a washeteria, well and treatment plant, 100,000-gallon water storage tank, sewage lagoon, and force main have been completed. The lagoon is connected to the washeteria and school. Residents carry treated water and haul honeybuckets or use pit privies; no households have plumbing. Electricity is provided by Alaska Power Company. There is one school located in the community, attended by 41 students. Local hospitals or health clinics include Allakaket Health Clinic. Allakaket Health Clinic is a Primary Health Care facility with river and air access.

The 2-acre landfill is shared by both communities and is located on the Allakaket side of the river. It is approximately 0.75 miles south from New Allakaket in a spruce wooded upland area along a ridge. The site is characterized by shallow permafrost around the landfill.

A total of six (6) wells were identified in Allakaket using WELTS. Well logs indicate that silt and gravel were encountered at depths up to 70 feet bgs where bedrock was then encountered. Water was encountered during drilling at depths greater than 20 feet bgs. Historic well logs are located in Appendix A.v.

4.0 Field Investigation

The field investigation was conducted by Shaw with assistance from UAA from 2009 through 2011 under EPA Contract No. EP-C-09-041 (Work Assignments No. 0-07, 1-07, and 2-07). The objectives of this effort were to install groundwater monitoring piezometers around the selected villages' landfills in order to collect groundwater and surface water samples for analysis of the contaminants of concern (COCs) as chosen with input and guidance from the research collaborators identified previously in Section 1.2. Where conditions allowed, the Monitoring Well Point Installation and Initial Sampling Plan (MWPIISP) was followed; deviations are explained in Section 4.2. The COCs identified, analytes, and parameters that were proposed included the following in Table 4-1: Analytical Methodologies.

Table 4-1: Analytical Methodologies

Parameter	Units	Method
Cations/Metals (Priority Pollutants List, except Hg, and Ba, Hardness (calc))[a]	µg/L	200.8 (EPA, 1999b) or UAA method.
Anions (Nitrate, Sulfate, Fluoride, Chloride, Phosphate)	mg/L	300.1 (EPA, 1999b) or UAA method
Semivolatile Organic Compounds (SVOCs)	mg/L	SW 8270
Total Petroleum Hydrocarbons (TPH)	mg/L	EPA 1664
Mercury	µg/L	SW 7470
Total Organic Carbon (TOC)	mg/L	SM 5310B or UAA method
Total Dissolved Solids (TDS) and Alkalinity	mg/L	SM 2540C and SM 2320B
Coliform (*E. coli*) and fecal streptococci (*Enterococci).* Bacteria	MPN/100 mL	Standard Methods Water/Wastewater Treatment
Specific conductivity	µmho/cm	Field Measurement.
Temperature	°C	Field Measurement
Oxidation Reduction Potential (ORP)	mV	Field Measurement
Dissolved Oxygen (DO)	mg/L	Field Measurement
pH	pH units	Field Measurement

Notes:

a. Al, Sb, As, Ba, Be, Cd, Cr, Co, Cu, Pb, Mn, Mo, Ni, Se, Ag, Tl, Th, U, V, Zn

The analyte list was reduced by removing the SVOCs and TPH due to limited sample volume availability in the shallow piezometers following the 2009 field event. A priority on sampling for metals was also put in place. Samples were analyzed for Total Metals. Samples collected by UAA were also analyzed for Dissolved Metals. Dissolved Metals samples were filtered through a 0.45 micron filter in the field.

Microbial indicator analysis was performed using the MPN method which is consistent with the EPA protocol (using IDEXX equipment and reagents - Colilert® for *E. coli*, and Enterolert® for

Enterococci). The MPN technique is used to estimate live and active microbial population density in situations where it is not possible to determine the exact population density.

Tribal village coordinators managed the collection and shipment of ash samples from dump sites in 2010 and 2011 for analysis at the EPA T&E Facility in Cincinnati, Ohio. Ash shipments were processed by randomly selecting portions of the ash throughout the shipping container excluding metal screws and parts. The ash was then placed in a 3" watch glass for drying in an oven at 105 degrees Celsius overnight. The ash samples were then ground with motor and pestle to provide uniform consistency. Trace metal concentrated Nitric Acid (10 mL) was then added to 0.5 grams of ground ash for digestion in a microwave digester using EPA Method 3051. In addition, trace metal concentrated Nitric Acid (10 mL) was added to 0.5 grams of NIST standard #2710 as a standard reference material to determine analytical accuracy. Digested samples (10 mL) were centrifuged at 2,000 revolutions per minute (RPM) for 10 minutes. Pipettes were used to remove supernatant from the centrifuged samples to dilute samples for Inductively Coupled Plasma Optical Emission Spectrometry (**ICP-OES**) analysis. The diluted samples (14 mL) were analyzed on a Perkin Elmer Optima Model 2100 DV-ICP OES to determine the metal content using an 18 metal standard with manufacturer recommended detection limits.

4.1 Premobilization Activities

Premobilization activities performed by Shaw consisted of developing a Health and Safety Plan (HASP), a Monitoring Well Point Installation and Initial Sampling Plan (MWPIISP), and a Quality Assurance Project Plan (QAPP); selecting analytical laboratories; and coordinating site activities with the village contacts.

Shaw personnel prepared a project-specific HASP for the field work. The HASP preparation included a thorough review of the MWPIISP to assure that all of the aspects of the MWPIISP were covered in the updated HASP. Shaw's revised HASP was used and referenced throughout the project by Shaw employees. Shaw personnel reviewed the updated HASP prior to mobilization and before commencing any field activities. Daily Safety Meetings were conducted and documented during field visits. Job safety analysis sheets were completed during field visits. All Shaw employees that performed planning or field activities under this project were familiarized with the HASP and signed the HASP acknowledgement form.

Shaw's field team documented all piezometer well installation and groundwater sampling activities. Field logs are provided in Appendix B.

4.2 Field Investigation

A total of 16 piezometers and six (6) sumps were installed in the villages of Ekwok, Eek, White Mountain, Fort Yukon, and Allakaket. Three (3) piezometers were installed in Ekwok; four piezometers in Eek; two (2) piezometers and two (2) sumps in White Mountain; four (4) piezometers and two (2) sumps in Fort Yukon; and three (3) piezometers and two (2) sumps in Allakaket.

When pre-drilling was attempted (before driving the probe) using a 2-inch solid flight auger and Roto-hammer, the torque on the auger was too great to render the operation safe (and was hence discontinued). In addition, the potential depth of the piezometer was reduced because the fittings used to connect were damaged by hand-driving with the slide hammer. This resulted in limiting the number of extensions that could be added to reach the preferred depth.

As mentioned previously in Section 1.4, hand-installation of shallow piezometers using a Solinst Probe System and Waterra Water Sampling System were proposed for the subject sites due to their remote locations and the expense involved in mobilizing drilling equipment. A slide hammer was used to drive ¾-inch steel pipe connected to a stainless steel screened probe into the ground. Refusal was typically encountered within 10 feet bgs at Ekwok, Eek, and White Mountain. At Fort Yukon and Allakaket, refusal was typically encountered 1 to 2 feet bgs where permafrost was encountered.

Hand-installation of shallow piezometers using a Solinst Probe System could be effective in areas with shallow groundwater (less than 10 feet bgs) and in areas without subsurface permafrost or gravel/cobbles. It is suggested that more resilient pipe and fitting material be considered for subsequent hand-driven piezometer installation or a different approach taken to acquire groundwater where shallow permafrost is found.

Typically, when water was observed in a piezometer, there was neither sufficient quantity nor timely recharge to use the Waterra inertial system. Therefore, dedicated polyethylene bailers and a monofilament line were used to bring water to the surface. Where sufficient volume and recovery allowed, the piezometers and sumps were purged prior to sampling by Shaw; Eek piezometers EEKPZ-01 and EEKPZ-02 and Fort Yukon piezometers FYUPZ-01, FYUPZ-02, and FYUPZ-04 all allowed for purging one well volume prior to sampling. FYUPZ-04 was the only piezometer which continuously recharged. In general, water volumes were limited and samples were collected without purging.

RPP passive samples were deployed in order to collect surface water runoff from the sumps in White Mountain, Allakaket, and Fort Yukon. When collected, the samplers were dry for all of the locations except Fort Yukon. Therefore, the only location where RPP samples were collected was from FYUSUMP-01 and FYUSUMP-02 in August 2011.

Standard water quality parameters including temperature, pH, conductivity, DO, and ORP were noted on the field forms. Turbidity was not recorded on the field forms; however, all of the samples collected by Shaw, with the exception of samples from FYUPZ-04, could be considered turbid samples with heavy sedimentation.

Surface water sampling for the microbial indicators focused on sampling at sites in the vicinity of the landfill including: the landfill itself, 1 to 50 meters down gradient of the landfill, 50 to 5,000 meters down gradient of the landfill, and non-waste impacted sites (i.e., control sites). Subsurface water for microbial analysis was also obtained from the groundwater monitoring piezometers when sufficient amount of water was present. For each microbial sampling location, the field samples were collected in sterile 200 mL wide mouth HDPE bottles.

The following sections describe the field and sampling activities at each site.

4.2.1 Ekwok

Based on a reconnaissance of the landfill and surrounding area, the groundwater gradient beneath the site was not obviously apparent. Three (3) piezometers were installed (EKWPZ01, EKWPZ02 and EKWPZ03) in lower lying areas to the north and east of the landfill where it was suspected that water could be present during periods of high groundwater in the late fall or breakup (spring). Due to the presence of cobbles, hand-driving the probe was limited to 10 feet or less at this site. It appeared that the screened intervals of the 3 piezometers were higher than the groundwater elevation during installation on September 9-10, 2009. Piezometer installation was attempted to the south of the landfill, but refusal was experienced within less than 5-feet bgs. One probe screen was abandoned in this area.

The piezometers at Ekwok were sampled for the COCs by village contacts and UAF as water was available (Table 4-2). Additionally, a total of 6 control samples, 7 landfill (dump) surface water samples, 5 surface water samples from less than 50 meters downgradient of the landfill, 7 surface water samples from between 50 and 5,000 meters downgradient of the landfill, and 2 subsurface (piezometer) samples were collected for microbial analysis.

Figure 4-1 illustrates Ekwok landfill site map with the piezometer and surface sample locations for microbial indicators. As described previously in Section 3.1, the main sources of drinking water for the community are shallow drinking water wells which are scattered around the community mainly located south of the state-owned gravel runway/airstrip and roughly 4,000 feet away from the landfill. Approximate locations of some of these wells are depicted in Figure 4-1. Table 4-2 presents a summary of the samples collected at Ekwok. The piezometer logs and site photographs are included in Appendix B.i.

Table 4-2: Ekwok Sample Summary

Sample Location	Sample ID (Microbial Sample Type)	Sample Dates	Parameters
EKWPZ-01	EK-PZ-1	5/2/2011	2, 3, 4, & 8
EKWPZ-02	042610EKWPZ02WG001	4/26/2010	2
	042710EKWPZ02WG001	4/27/2010	1
	051810EKWPZ02WG001	5/18/2010	2 & 3
	051910EKWPZ02WG001	5/19/2010	6
	071810EKWPZ02WG001	7/18/2010	1
	081110EKWPZ02WG001	8/11/2010	2 - 5
	EK-PZ-2	5/2/2011	2, 3, 4, & 8
	PZ-EK-2	8/23/2011	2, 4, & 8
EKWPZ-03	070810EKWPZ03WG001	7/8/2010	2 & 3
	081110EKWPZ03WG001	8/11/2010	6 & 7
	EK-PZ-3	5/2/2011	2, 3, 4, 8, 9
	EK-PZ-3	7/11/2011	2
	EK-PZ-3	8/23/2011	2, 4, 6, 8, 9
Klutuk Creek	Klutuk Creek (Control Sample)	4/26/2010	9
	Klutuk Creek (Control Sample)	9/30/2010	9
	Klutuk Creek (Control Sample)	5/2/2011	9
Sample 1	Sample 1 (50 – 5,000 m)	4/26/2010	9
	Sample 1 (50 – 5,000 m)	9/30/2010	9
	Sample 1 (50 – 5,000 m)	5/2/2011	9
	Sample 1 (50 – 5,000 m)	8/23/2011	9
Sample 2	Sample 2 (50 – 5,000 m)	4/26/2010	9
	Sample 2 (50 – 5,000 m)	9/30/2010	9
	Sample 2 (50 – 5,000 m)	8/23/2011	9
Nushagak River	Nushagak River (Control)	9/30/2010	9
	Nushagak River (Control)	5/2/2011	9
	Nushagak River (Control)	8/23/2011	9
S.W.S1	S.W.S1 (<50 m)	4/26/2010	9
	S.W.S1 (<50 m)	5/2/2011	9
S.W.S2	S.W.S2 (<50 m)	4/26/2010	9
S.W.S3	S.W.S3 (<50 m)	4/26/2010	9
	S.W.S3 (<50 m)	5/2/2011	9
S.W.S4	S.W.S4 (Dump)	8/23/2011	9
S.W.S5	S.W.S5 (Dump)	4/26/2010	9
	S.W.S5 (Dump)	9/30/2010	9
	S.W.S5 (Dump)	5/2/2011	9
S.W. S6	S.W. S6 (Dump)	5/2/2011	9
	S.W. S6 (Dump)	8/23/2011	9
S.W.S7	S.W.S7 (Dump)	5/2/2011	9

Parameters:

1. E7470A or E254.1 – Hg
2. UAA ICPMS or E200.8 – May include the following: Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Mo, Ni, P, K, Se, Si, Ag, Na, Tl, Th, Sn,Ti, U, V, Zn
3. UAA IC Anions – May include the following: fluoride, chloride, bromide nitrite, nitrate, sulfate, phosphate
4. SM2540B or UAA– Alkalinity
5. SM2540C – TDS
6. SM5310B – TOC
7. EPA 1664 – TPH
8. Hardness – UAA
9. *E. coli* and *Enterococcus*

4.2.2 Eek

Based on a reconnaissance of the landfill, the groundwater system was determined to be complex and influenced by tides, permafrost, surface water, and topography. Due to the presence of permafrost or other subsurface conditions, refusal was experienced within less than 10 feet bgs. Four (4) piezometers were installed around the landfill and lagoon on September 11, 2009. All of the piezometers produced water; however, only two produced enough water to allow collection of samples (EEKPZ-01 and EEKPZ-02) in 2009. Samples were collected using dedicated bailers and were analyzed for total metals (including mercury) and selected anions. The piezometers at Eek were sampled for the COCs by Shaw at initial installation and UAF or village contacts in 2011 as water was available (Table 4-3). Additionally, a total of 8 control samples, 15 landfill (dump) surface water samples, 5 surface water samples from less than 50 meters downgradient of the landfill, 13 surface water samples from between 50 and 5,000 meters downgradient of the landfill, and 2 subsurface (piezometer) samples were collected for microbial analysis.

Figure 4-2 illustrates Eek landfill site map with the piezometer and surface water sample locations. As described previously in Section 3.2, the community uses the Eek River as its main source of drinking water. However, the well log search indicated two wells at the BIA School which is potentially another major source of drinking water and is closer to the landfill (roughly 1,100 feet away). The approximate location of these wells is depicted in Figure 4-1. Table 4-3 presents a summary of the samples collected at Eek. The piezometer logs and site photographs are included in Appendix B.ii.

Table 4-3: Eek Sample Summary

Sample Location	Sample ID (Microbial Sample Type)	Sample Dates	Parameters
EEKPZ-01	0909EEKPZ01WG001	9/11/09	1 - 3
	E-PZ-01	8/15/11	2 - 6
	E-PZ-01	9/16/11	2
EEKPZ-02	0909EEKPZ02WG001	9/11/09	1 - 3
	E-PZ-02	8/15/11	2 - 6
	EEKPZ-02	8/17/2011	7
	E-PZ-02	9/16/11	2
EEKPZ-03	E-PZ-03	8/15/11	2 - 6
	EEKPZ-03	8/17/2011	7
	E-PZ-03	9/16/11	2 & 3
EEKPZ-04	--	--	--
Airport Lake	Airport Lake (50, - 5,000 m)	8/26/2009	7
	Airport Lake (50, - 5,000 m)	4/29/2010	7
	Airport Lake (50, - 5,000 m)	10/7/2010	7
	Airport Lake (50, - 5,000 m)	5/6/2011	7
	Airport Lake (50, - 5,000 m)	8/17/2011	7
Pond 1	Pond 1 (Control)	8/26/2009	7
Lake 1	Lake 1 (Control)	8/26/2009	7
Old Airport Lake	Old Airport Lake (Control)	10/7/2010	7
	Old Airport Lake (Control)	5/6/2011	7
	Old Airport Lake (Control)	8/17/2011	7
Eek River	Eek River (Control)	10/7/2010	7
	Eek River (Control)	5/6/2011	7
	Eek River (Control)	8/17/2011	7
Village Pond	Village Pond (Dump)	8/26/2009	7
	Village Pond (Dump)	4/29/2010	7
	Village Pond (Dump)	10/7/2010	7
	Village Pond (Dump)	5/6/2011	7
	Village Pond (Dump)	8/17/2011	7
Dump Pond	Dump Pond (Dump)	8/26/2009	7
	Dump Pond (Dump)	4/29/2010	7
	Dump Pond (Dump)	10/7/2010	7
	Dump Pond (Dump)	5/6/2011	7
	Dump Pond (Dump)	8/17/2011	7
Dump Drainage 1	Dump Drainage 1 (Dump)	8/26/2009	7
	Dump Drainage 1 (Dump)	4/29/2010	7
	Dump Drainage 1 (Dump)	10/7/2010	7
	Dump Drainage 1 (Dump)	5/6/2011	7
	Dump Drainage 1 (Dump)	8/17/2011	7
Dump Drainage 2	Dump Drainage 2 (50, - 5,000 m)	8/26/2009	7
	Dump Drainage 2 (50, - 5,000 m)	4/29/2010	7
	Dump Drainage 2 (50, - 5,000 m)	10/7/2010	7
	Dump Drainage 2 (50, - 5,000 m)	5/6/2011	7
	Dump Drainage 2 (50, - 5,000 m)	8/17/2011	7
Big Lake	Big Lake (<50 m)	8/26/2009	7
	Big Lake (<50 m)	4/29/2010	7
	Big Lake (<50 m)	10/7/2010	7
	Big Lake (<50 m)	5/6/2011	7
	Big Lake (<50 m)	8/17/2011	7
Drainage Creek	Drainage Creek – south/east 5,000m from Dump	4/26/2010	7
	Drainage Creek – south/east 5,000m from Dump	5/6/2011	7
	Drainage Creek – south/east 5,000m from Dump	8/17/2011	7

Parameters:

1. E7470A or E254.1 – Hg
2. UAA ICPMS or E200.8 – May include the following: Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Mo, Ni, P, K, Se, Si, Ag, Na, Tl, Th, Sn,Ti, U, V, Zn
3. UAA IC Anions – May include the following: fluoride, chloride, bromide nitrite, nitrate, sulfate, phosphate
4. SM2540B or UAA– Alkalinity
5. Hardness – UAA
6. SM5310B or UAA – TOC
7. *E. coli* and *Enterococcus*

4.2.3 White Mountain

The site is characterized by shallow limestone. Consequently, refusal was experienced less than 10 feet bgs. Two (2) piezometers were installed on September 18, 2009, but it appeared that the screens were above the elevation of groundwater. In an effort to capture potential runoff from the landfill, an alternate method was employed in May 2011. A motorized two-man earth auger was used for installation of the sumps at White Mountain. This facilitated installation in breakup (still frozen ground) conditions. Two sumps were installed, one up gradient and one down gradient, around the exterior of the landfill. The up gradient location was located near the head of a shallow depression outside of the fenced area but approximately in line with the trench inside the landfill area and the drainage ditch leaving it. The down gradient sump was located near the drainage ditch leaving the landfill in the same area as WMT PZ-01.

Sumps were constructed out of a 2 foot by six inch diameter piece of PVC pipe and a seven inch round valve box for a cover. Each hole was augered until refusal occurred, approximately 16 inches below ground surface. Subsurface water was noted in the holes at time of installation and within an hour had filled with water, within 3 inches of the surface. After several hours following sump installation, the sumps were bailed dry. The sumps refilled with water and were allowed to rest for 12 hours prior to taking grab samples and deployment of RPP Samplers. It was noted during installation that White Mountain staff may consider returning to the sumps later in the summer and installing them deeper as the ground should be thawed to a lower depth. This would facilitate installation of the sumps using hand shovels and not necessitate an earth auger.

The piezometers at White Mountain did not produce water volume for sampling. Two sumps were installed and sampled for the COCs by UAF or village contacts in 2011 as water was available. Water draining out of the landfill was also sampled. Additionally, a total of 4 control samples, 12 landfill (dump) surface water samples, 2 surface water samples from between 50 and 5,000 meters downgradient of the landfill, and 1 subsurface (piezometer) sample were collected for microbial analysis.

Figure 4-3 illustrates White Mountain landfill site map with the piezometer, sump, and surface water sample locations. As described previously in Section 3.3, the main sources of drinking water for the community are groundwater water wells which are located within the community close to Fish River roughly 1,700 feet away from the landfill. Approximate locations of some of these wells are depicted in Figure 4-3. Table 4-4 presents a summary of the samples collected at Eek. The piezometer logs and site photographs are included in Appendix B.iii.

Table 4-4: White Mountain Sample Summary

Sample Location	Sample ID (Microbial Sample Type)	Sample Dates	Parameters
WMTPZ-01	--	--	--
WMTPZ-02	--	--	--
WM Drainage[a]	Landfill Drainage	5/21/2009	1, 2, & 4
WMOSUMP-01	WMO Sump1	5/26/2011	6
	WM_Sump_1	5/27/2011	2, 3, & 5
WMOSUMP-02	WM_Sump_2	5/27/2011	2, 3, & 5
Village Creek	Village Creek (Control)	5/17/2010	6
	Village Creek (Control)	5/26/2011	6
Fish River	Fish River (Control)	5/17/2010	6
	Fish River (Control)	5/26/2011	6
Sample #1	Sample #1 (Dump)	5/26/2011	6
Sample #2	Sample #2 (Dump)	5/17/2010	6
	Sample #2 (Dump)	5/26/2011	6
Sample #3	Sample #3 (Dump)	5/17/2010	6
	Sample #3 (Dump)	5/26/2011	6
Sample #4	Sample #4 (Dump)	5/17/2010	6
	Sample #4 (Dump)	5/26/2011	6
Sample #5	Sample #5 (Dump)	5/17/2010	6
	Sample #5 (Dump)	5/26/2011	6
Sample #6	Sample #6 (Dump)	5/26/2011	6
Sample #7	Sample #7 (Dump)	5/17/2010	6
	Sample #7 (Dump)	5/26/2011	6
Dump Drainage	Dump Drainage (50 to 5,000m)	5/17/2010	6
	Dump Drainage (50 to 5,000m)	5/26/2011	6

Parameters:

1. E7470A or E254.1 – Hg
2. UAA ICPMS or E200.8 – May include the following: Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Mo, Ni, P, K, Se, Si, Ag, Na, Tl, Th, Sn,Ti, U, V, Zn
3. UAA IC Anions – May include the following: fluoride, chloride, bromide nitrite, nitrate, sulfate, phosphate
4. 8260B – VOCs
5. SM5310B or UAA – TOC
6. *E. coli* and *Enterococcus*

Notes:

a. Landfill Drainage – surface water runoff below White Mountain's dump; collected 5/21/09

4.2.4 Fort Yukon

A total of four (4) piezometers were installed around the landfill (FYUPZ-01, FYUPZ-02, FYUPZ-03, and FYUPZ-04) in June 2010. Three (3) (FYUPZ-01 through FYUPZ-03) along the entire western side from the south near the allotment border to the furthest up gradient position on the north but not in the area of the old lagoons. The final piezometer (FYUPZ-04) was placed on the upland level of the landfill near an area that was said to normally have standing water. Permafrost was encountered within 14 inches along the western side with refusal around one foot into the permafrost. The area around FYUPZ-01 and FYUPZ-02 was noted as being wet and the holes where the organic mat was removed filled with water. Water was found in these two piezometers. FYUPZ-03 was placed in among live willow trees where the ground was considerably drier. No water was found in this piezometer, but it is expected during wetter times of the year.

Two attempts were made to place a piezometer at FYUPZ-04, with the second attempt being successful. This first attempt failed after driving the point a total of 16 feet and encountering refusal. When driving, it was noted that the pipe had begun slanting after three feet. After refusal, the pipe could only be retracted a few inches. A bailer was sent down the piezometer, but it would only go to a depth of 12 feet. When the bailer came back filled with water and sand, it was believed that the first coupling had failed and the pipe had filled with sand in the area of the first coupling four feet above the well point. This well was then sealed and abandoned. The second attempt was made two feet away from the first and was successful.

Based on lessons learned during the sump installation at the White Mountain site, Ms. Edda Mutter of UAF installed two sump wells at this site in August 2011. The sumps were constructed of available materials including an embedded bucket with RPP filters to collect the surface water samples.

Samples were collected using dedicated bailers from FYUPZ-01, FYUPZ-02, FYUPZ-04, and the surface water on the western side in 2010 by Shaw. In 2011, UAF and the village contact conducted additional sampling for the COCs (Table 4-5). Additionally, a total of 7 control samples, 7 surface water samples from less than 50 meters downgradient of the landfill, 6 surface water samples from between 50 and 5,000 meters downgradient of the landfill, and 6 subsurface (piezometer) samples were collected for microbial analysis.

Figure 4-4 illustrates Fort Yukon landfill site map with the piezometer, sump, and surface water sample locations. As described previously in Section 3.4, water is supplied by two wells to residents' homes in a piped system. A new water system was built at Fort Yukon and the intake location of the new system is also depicted in Figure 4-4. This new intake is roughly 8,100 feet away from the landfill. Table 4-5 presents a summary of the samples collected at Eek. The piezometer logs and site photographs are included in Appendix B.iv.

Table 4-5: Fort Yukon Sample Summary

Sample Location	Sample ID (Microbial Sample Type)	Sample Dates	Parameters
FYUPZ-01	062310FYUPZ01WG001	6/23/2010	1, 2, 9
	FY-PZ01	5/23/2011	2 - 4, & 8
	FY-PZ01	5/26/2011	2 - 4, & 8
	FY-PZ01	8/18/2011	2 - 4, & 8
	FY-PZ-01	8/19/2011	10
FYUPZ-02	062310FYUPZ02WG001	6/23/2010	2-3
	FY-PZ02	5/23/2011	2 - 4, & 8
	FY-PZ02	8/18/2011	2 - 4, 6, & 8
	FY-PZ-02	8/19/2011	10
	FY-PZ02	9/8/2011	2, 3, 5, & 6
FYUPZ-03	FY-PZ03	5/23/2011	2 -4, & 8
	FY-PZ-03	8/18/2011	2 - 4, 6, & 8
	FY-PZ03	8/19/2011	10
	FY-PZ03	9/8/2011	2, 3, 5, & 6
FYUPZ-04	062310FYUPZ04WG001	6/23/2010	1, 2, 4-6, & 9
	FY-PZ04	5/23/2011	2
	FY-PZ04	8/18/2011	2 - 4, 6, & 8
	FY-PZ-04	8/19/2011	10
	FY-PZ04	9/8/2011	2, 3, & 5
FYUSP-01	062310FYUSP01WS001	6/23/2010	1-6, 8, & 9
FYUSUMP-01	Sump1	8/18/2011	2 – 4, 6, & 8
	FY-PZ-Sump1	8/19/2011	10
	Sump1	9/8/2011	2, 3, 5, & 6
FYUSUMP-02	Sump 2	8/18/2011	2 – 4, & 8
	FY-PZ-Sump2	8/19/2011	10
	Sump 2	9/8/2011	2, 3, & 5
Yukon River	Yukon River (Control)	6/22/2010	10
	Yukon River (Control)	5/23/2011	10
	Yukon River (Control)	8/19/2011	10
Hospital Lake	Hospital Lake (50 to 5,000 m)	6/22/2010	10
	Hospital Lake (50 to 5,000 m)	5/23/2011	10
	Hospital Lake (50 to 5,000 m)	8/19/2011	10
Porcupine River	Porcupine River (Control)	6/22/2010	10
River Slough	River Slough (50 to 5,000 m)	6/22/2010	10
	River Slough (50 to 5,000 m)	5/23/2011	10
Standing Water Upgradient	Standing Water Upgradient (Control)	6/22/2010	10
	Standing Water Upgradient (Control)	5/23/2011	10
	Standing Water Upgradient (Control)	8/19/2011	10
Sample 1	Sample 1 (<50 m)	6/22/2010	10
	Sample 1 (<50 m)	5/23/2011	10
Sample 2	Sample 2 (<50 m)	5/23/2011	10
Sample 4	Sample 4 (50 m)	6/22/2010	10
	Sample 4 (50 m)	5/23/2011	10
	Sample 4 (50 m)	8/19/2011	10
Sample 5	Sample 5 (50 m)	5/23/2011	10
Sample 6	Sample 6 (50 to 5,000 m)	5/23/2011	10

Parameters:

1. E7470A or E254.1 – Hg
2. UAA ICPMS or E200.8 – May include the following: Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Mo, Ni, P, K, Se, Si, Ag, Na, Tl, Th, Sn,Ti, U, V, Zn
3. UAA IC Anions – May include the following: fluoride, chloride, bromide nitrite, nitrate, sulfate, phosphate
4. SM2540B or UAA – Alkalinity
5. SM2540C or UAA – TDS
6. SM5310B or UAA – TOC
7. 8270D – SVOCs
8. Hardness – UAA
9. EPA 1664 – TPH
10. *E. coli* and *Enterococcus*

4.2.5 Allakaket

During the monitoring well installation efforts, refusal was experienced less than two feet bgs with permafrost at one to two feet bgs. Three (3) piezometers (AETPZ-01, AETPZ-02, and AETPZ-03) were installed in July 2010 on the outside of the fence surrounding the landfill. Piezometers AETPZ-01 and AETPZ-02 were installed on the southern side and AETPZ-03 on the eastern side. In addition, two (2) sumps (AETSUMP-01 and AETSUMP-02) were also installed during the visit. These consisted of new, clean 5 gallon plastic buckets with lids. A series of holes were drilled into the buckets to allow water to collect inside. AETSUMP-01 was located outside the fence on the northern side and AETSUMP-02 was located inside the fence on the southern end of the landfill away from the standing water but near enough to fill with water.

The piezometers and sumps installed at Allakaket were sampled for the COCs by UAA or village contacts in 2011 (Table 4-6). Additionally, a total of 7 control samples, 9 landfill surface water samples, 6 piezometer groundwater samples, and 4 sump surface water samples were collected for microbial analysis.

Figure 4-5 illustrates Allakaket landfill site map with the piezometer locations and the sampling locations for microbial indicators. As described previously in Section 3.5, the main water source is a well and water treatment plant with a 100,000 gallon water storage tank. The well intake location of this system is depicted in Figure 4-5. This intake is roughly 7,100 feet away from the landfill. Table 4-6 presents a summary of the samples collected at Eek. The piezometer logs and site photographs are included in Appendix B.v.

Table 4-6: Allakaket Sample Summary

Sample Location	Sample ID (Microbial Sample Type)	Sample Dates	Parameters
AETPZ-01	AEKPZ-01	6/7/2010	6
	AK_PZ01	8/17/11	1 -6
AETPZ-02	AEKPZ-02	6/7/2010	6
	AK_PZ02	8/17/11	1 - 6
AETPZ-03	AEKPZ-03	6/7/2010	6
	AK_PZ03	8/17/11	1 - 6
AETSUMP-01	Sump 1	6/7/2010	6
	AK_SUMP-01	6/17/2011	1, 2, & 5
	Sump 1	8/17/2011	6
AETSUMP-02	Sump 2	6/7/2010	6
	AK_SUMP-02	8/17/11	1 - 6
Koyukuk River	Koyukuk River (Control)	6/7/2010	6
	Koyukuk River (Control)	8/17/2011	6
Creek at old Allakaket Village	Creek at old Allakaket Village (50 to 5,000 m)	6/7/2010	6
Slough at tribal office	Slough at tribal office (50 to 5,000 m)	6/7/2010	6
Slough at drinking water well	Slough at drinking water well (Control)	6/7/2010	6
	Slough at drinking water well (Control)	8/17/2011	6
Sough in front of airport bridge	Sough in front of airport bridge (50 to 5,000 m)	6/7/2010	6
Standing Water #5	Standing Water #5 (Dump)	6/7/2010	6
	Standing Water #5 (Dump)	8/17/2011	6
Standing Water #6	Standing Water #6 (Dump)	6/7/2010	6
	Standing Water #6 (Dump)	8/17/2011	6
Standing Water #7	Standing Water #7 (<50 m)	6/7/2010	6
	Standing Water #7 (<50 m)	8/17/2011	6
Standing Water #8	Standing Water #8 (<50 m)	8/17/2011	6
Standing Water #9	Standing Water #9 (<50 m)	6/7/2010	6
	Standing Water #9 (<50 m)	8/17/2011	6

Parameters:

1. UAA ICPMS or E200.8 – May include the following: Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Mo, Ni, P, K, Se, Si, Ag, Na, Tl, Th, Sn,Ti, U, V, Zn
2. UAA IC Anions – May include the following: fluoride, chloride, bromide nitrite, nitrate, sulfate, phosphate
3. SM2540B or UAA – Alkalinity
4. Hardness – UAA
5. SM5310B or UAA – TOC
6. *E. coli* and *Enterococcus*

5.0 Intrusive Field Study Results

Findings from the investigative tasks including the analytical results are presented below for each site. Appendix C contains the initial SGS Analytical Laboratory Reports. Analytical results were compared to the EPA drinking water maximum contaminant levels (MCLs) including both the National Primary Drinking Water Regulations (NPDWR) and the National Secondary Drinking Water Regulations (NSDWR). NPDWRs are legally enforceable standards that apply to public water systems. NSDWRs are non-enforceable guidelines regulating contaminants that may cause cosmetic or aesthetic effects in drinking water. Additionally, they were compared to the Alaska Water Quality Criteria Manual for Toxic and Other Deleterious Organic and Inorganic Substances. These standards were identical to the EPA NPDWRs list. In general the Alaska standards are comparable to the NPDWRs.

The ATSDR ToxFAQs™ and CDC Drinking Water from Private Wells fact sheets were also used as references for information purposes for understanding the toxicological effects of selected compounds in the event there was an exposure to these compounds. These references are located in Appendix D for each of the COCs identified which exceed either the NPDWRs or the NSDWRs.

The analytical results were also compared to the EPA's 1988 Municipal Landfill Leachate Data-Indicator Parameters and Inorganic Compounds table (Gray, Koerner, and Qian, 1988). These ranges represent maximum and minimum concentrations for the indicator parameters reported at Municipal Solid Waste Landfills. Additionally, ADEC provided data from the drinking water source in each village following treatment. This data is included in Tables 5-1 through 5-5 for each site as a comparison. Where more than one sample was provided, the sample with the highest concentration was used in the tables for comparison.

The microbial samples were split upon arrival at the university laboratory into 100 mL sterile bottles to perform three replications for *E. coli* and *Enterococci* analysis separately. The target organism specific reagents (Colilert® and Enterolert®) were added into the respective 100 mL sample bottles. The reagent containing samples were dispensed into individual Quanti-Tray/2000 trays, sealed, and incubated at 35 degree Celsius for Coliform/*E. coli* samples and at 41 degree Celsius for *Enterococcus* samples for 24 – 28 hours. A 6-watt, 365 nanometer (nm) ultraviolet (UV) light was used to determine the count of numbers for positive wells of the Quanti-Tray/2000, and MPN numbers were derived from those counts using tables provided by IDEXX. The Quanti-Tray/2000 is designed to automatically provide counts of up to 2,419 organisms per 100 mL without dilutions.

Statistical Analysis of Variance (ANOVA) was performed to determine the statistical significant differences between the Log MPN values of microbial indicators observed in the surface and subsurface water samples compared to control samples.

The community-specific *E. coli* and *Enterococcus* microbial indicator results from the collected surface and subsurface waters were compared to EPA's recommended water quality criteria for these bacteria in recreational and fresh waters (EPA 2004). These recommended water quality criteria specify a geometric mean of 126 per 100 mL for *E. coli* and a geometric mean of 33 per 100 mL for *Enterococci* microbial organism (See Appendix E Table 1). Despite EPA recommendations, the State of Alaska continues to follow the older FC bacteria standards as well (Appendix E Table 2). The Alaska regulatory standards for secondary recreational waters are set levels for a monthly period with a geometric mean of 200 FC per 100 mL, and not more than 10 percentage of the total sample may exceed 400 FC per 100 mL (18 AAC 70).

Note: Exceedances of these standards does not represent any immediate danger to the community as it is reasonably expected that individuals are not directly exposed to these contaminants at the levels found in the samples at the dump sites. Additionally, there is no evidence that these contaminants have migrated to the community drinking water sources at these levels.

5.1 Ekwok

A total of 14 samples were collected from piezometers EKWPZ-01, EKW-PZ-02, and EKWPZ-03 in Ekwok from April 2010 through August 2011. Analysis included mercury, cations (metals), anions, alkalinity, TDS, TOC, TPH, and hardness. Results are presented in Table 5-1.

Groundwater analytical results exceeded NPDWRs for beryllium in EKWPZ-01, chromium in EKWPZ-02, and lead in EKWPZ-01, EKWPZ-02, and EKWPZ-03. NSDWRs were exceeded for aluminum, iron, and manganese in all three piezometers. Zinc exceeded the NSDWR in EKWPZ-01 and EKWPZ-03.

EPA leachate ranges were exceeded for aluminum in five samples. None of the other parameters exceeded the maximum concentrations reported. Multiple samples were less than the minimum concentrations reported.

Microbial data were divided into Spring and Fall samples for both the *E. coli* and *Enterococcus* samples. Spring samples were collected on April 26, 2010 and May 2, 2011. Fall samples were collected on September 30, 2010 and August 23, 2011. During the September 30, 2010 sampling event, standing surface water sampling was limited and subsurface water in the piezometers was frozen; therefore, overall sampling was limited.

E. coli and *Enterococcus* microbial indictor organisms were found to be present and statistically significant in all of the Spring and Fall samples collected from the dump samples, subsurface samples, and samples less than 50 meters from the dump. Only Spring samples collected between 50 to 5,000 meters from the dump site indicated the presence of *E. coli* and *Enterococcus* microbial indictor organisms. The EPA standard for *E. coli* was exceeded in 7 samples. The EPA standard for *Enterococcus* was exceeded in 8 samples. The microbial data is presented in Appendix F.i.

Analytical results from the WM Nelson School (AK2260171) are also provided in Table 5-1 for comparison. Concentrations for copper exceed NPDWRs. No other samples exceed MCLS; however, samples were not analyzed for all of the parameters included in this study. Aluminum, iron, manganese, and zinc exceeded NPDWRs in the piezometer samples, but were not tested for in the drinking water. Microbial data was collected for *E. coli* and coliform. Concentrations were reported as zero.

5.2 Eek

A total of 8 samples were collected from piezometers EEKPZ-01, EEKPZ-02, and EEKPZ-03 in Eek from September 2009 through September 2011. No samples were collected from EEKPZ-04. Analysis included mercury, cations (metals), anions, alkalinity, hardness, and TOC. Results are presented in Table 5-2.

Groundwater analytical results exceeded the NPDWRs for arsenic in EEKPZ-01 and EEKPZ-02; beryllium in EEKPZ-01; cadmium in EEKPZ-01; chromium in EEKPZ-01 and EEKPZ-02; and lead in EEKPZ-01 and EEKPZ-02. No NPDWR were exceeded in EEKPZ-03. NSDWRs were exceeded for aluminum, iron, and manganese in all three piezometers. Zinc exceeded the NSDWR in EEKPZ-02 and EEKPZ-03.

EPA leachate ranges were exceeded for aluminum in five samples. None of the other parameters exceeded the maximum concentrations reported. Multiple samples were less than the minimum concentrations reported.

Cumulative *E. coli* and *Enterococcus* microbial data were obtained from the Spring and Fall sampling events. Spring samples were collected on April 29, 2010 and May 6, 2011. Fall samples were collected on August 26, 2009, October 7, 2010, and August 17, 2011. Abundant surface water was present for sampling in Eek; however, during the April 29, 2010 and October 7, 2010 sampling events, the majority of the surface water was frozen which limited sampling. During the May 6, 2011 sampling event, snowmelt runoff water was also collected.

E. coli and *Enterococcus* microbial indictor organisms were found to be present in all of the surface water samples; however, they were only statistically significant in the Spring and Fall samples collected from the dump surface water samples compared to controls. *E. coli* and *Enterococcus* were not found in any of the subsurface water samples. The EPA standard for *E. coli* was exceeded in 3 samples collected from the dump surface water. The EPA standard for *Enterococcus* was exceeded in 5 samples collected from the dump surface water. The microbial data is presented in Appendix F.ii.

Analytical results from the Eek Water System (AK2270281) are also provided in Table 5-2 for comparison. None of the concentrations exceed NPDWRs or NSDWRs. Samples from the drinking water were not analyzed for all of the parameters included in this study. Aluminum, beryllium, copper, iron, manganese, and zinc exceeded NPDWRs in the piezometer samples, but were not tested for in the drinking water. Microbial data was collected for *E. coli* and coliform. Concentrations were reported as zero.

5.3 White Mountain

No samples were collected from the two piezometers located in White Mountain, WMTPZ-01 and WMTPZ-02. One sample was collected from the landfill drainage, and two samples were collected from the White Mountain sumps, WMOSUMP-01 and WMOSUMP-02. Analysis for the landfill drainage included mercury, cations (metals), and VOCs. Analysis for the sump samples included cations (metals), anions, and TOC. Results are presented in Table 5-3.

Groundwater analytical results exceeded NPDWRs for lead in the landfill drainage. No other results exceeded NPDWRs. All VOCs were non-detect. NSDWRs were exceeded for aluminum and iron in the landfill drainage sample and sump samples. Manganese results exceeded the NSDWR in both sump samples.

EPA leachate ranges were exceeded for aluminum in one sample. None of the other parameters exceeded the maximum concentrations reported. Multiple samples were less than the minimum concentrations reported.

Microbial samples were collected in the Spring only Snowmelt runoff and standing water samples were obtained on May 17, 2010 and May 26, 2011. Samples were collected from snowmelt runoff and standing surface water, and from the WMOSUMP-01 during the May 26, 2011 sampling event.

E. coli and *Enterococcus* microbial indictor organisms were found to be present in all of the surface and subsurface water samples; however, a statistical significance were only detected for dump surface water and less than 50 meters from the dump samples compared to controls. The EPA standard for *E. coli* was exceeded in 4 samples collected from the dump surface water and less than 50 meters from the dump. The EPA standard for *Enterococcus* was exceeded in 4 samples collected from the dump surface water and less than 50 meters from the dump. The microbial data is presented in Appendix F.iii.

Analytical results from the White Mountain Water System (AK2340507) are also provided in Table 5-3 for comparison. Cation (metal) analysis was not performed for drinking water samples. Microbial data was collected for *E. coli* and coliform. Concentrations were reported as zero.

5.4 Fort Yukon

A total of 20 samples were collected from the four piezometers FYUPZ-01, FYUPZ-02, FYUPZ-03, and FYUPZ-04; two sumps FYUSUMP-01 and FYUSUMP-02; and the seep at the front of the landfill FYUSP-01 located in Fort Yukon. Analysis for the samples included mercury, cations (metals), anions, alkalinity, TDS, TOC, SVOCs, hardness, and TPH. Results are presented in Table 5-4.

Groundwater analytical results exceeded NPDWRs for arsenic in FYUPZ-01 and FYUPZ-02; beryllium in FYUPZ-01, FYUPZ-04, and FYUSUMP-02; cadmium in FYUPZ-01; chromium in FYUPZ-01, FYUPZ-02, and FUSUMP-02; lead in FYUPZ-01, FYUPZ-02, FYUPZ-03, FYUPZ-04, FYUSUMP-01, and FYUSUMP-02; uranium in FYUPZ-04; fluoride in FYUPZ-02; and nitrate in FYUSP-01. NSDWRs were exceeded for aluminum, iron, and manganese in the piezometer, sump, and seep samples. Zinc exceeded the NSDWR in FYUPZ-01, FYUPZ-03, and FYUSUMP-01. Chloride and sulfate exceeded the NSDWR in FYUPZ-01, FYUPZ-03, and FYUSP-01. VOC and PAH results were all non-detect.

EPA leachate ranges were exceeded for aluminum in six samples and for sulfate in one sample. None of the other parameters exceeded the maximum concentrations reported. Multiple samples were less than the minimum concentrations reported.

Microbial samples were collected on June 22, 2010, May 23, 2011, and August 19, 2011. Because Fort Yukon's landfill is listed for closure, it had been covered with gravel prior to project implementation; therefore, surface water samples from the dump were not collected. All surface water samples were collected less than 50 meters from the dump or between 50 and 5,000 meters from the dump. Additionally, subsurface water samples were collected.

E. coli and *Enterococcus* microbial indictor organisms were found to be present in all of the surface water samples. Only *Enterococcus* microbial indicator organisms were found to be present in the subsurface water samples. The only statistically significant *E. coli* and *Enterococcus* samples were detected in the samples collected from less than 50 meters from the dump site compared to control samples. The EPA standard for *E. coli* was exceeded in 1 sample collected from less than 50 meters from the dump. The EPA standard for *Enterococcus* was exceeded in 2 samples collected from less than 50 meters from the dump. The microbial data is presented in Appendix F.iv.

Analytical results from the Fort Yukon Public Water System (AK2360256) are also provided in Table 5-4 for comparison. None of the concentrations exceed NPDWRs or NSDWRs. Samples from the drinking water were not analyzed for all of the parameters included in this study. Aluminum, chromium, iron, lead, manganese, uranium, and zinc exceeded NPDWRs in the piezometer and/or sump samples, but were not tested for in the drinking water. Chloride and sulfate exceed NSDWRs and were not tested for in the drinking water also. Microbial data was collected for *E. coli* and coliform. Concentrations were reported as zero.

5.5 Allakaket

A total of 5 samples were collected from the three piezometers, AETPZ-01, AETPZ-02, AETPZ-03, and two sumps, AETSUMP-01 and AETSUMP-02, in Allakaket. Analysis for the samples included cations (metals), anions, alkalinity, hardness, and TOC. Results are presented in Table 5-5.

Groundwater analytical results exceeded NPDWRs for beryllium in AEKPZ-02, chromium in AEKPZ-01, lead in all three piezometers, and nitrate in AEKPZ-02. NSDWRs were exceeded for aluminum in the three piezometers and AETSUMP-01, iron in all of the sample locations, manganese in all of the sample locations, and zinc in AEKPZ-02.

EPA leachate ranges were exceeded for aluminum in three samples. None of the other parameters exceeded the maximum concentrations reported. Multiple samples were less than the minimum concentrations reported.

Microbial samples were collected in Summer 2010 and Fall 2011 on July 7, 2010 and August 17, 2011. During the July 7, 2010 event, the landfill was predominantly dry; therefore, standing surface water was only observed less than 50 meters and between 50 and 5,000 meters from the dump. Subsurface water samples were collected during both sampling events from the three piezometers and two sumps.

E. coli and *Enterococcus* microbial indictor organisms were found to be present in all of the surface and subsurface water samples. The only statistically significant *E. coli* and *Enterococcus* samples were detected in the samples collected from dump surface water and samples from less than 50 meters from the dump compared to controls. The EPA standard for *E. coli* was exceeded in 1 sample collected from the dump surface water. The EPA standard for *Enterococcus* was exceeded in 2 samples collected from the dump surface water and 2 samples from less than 50 meters from the dump. The relatively high *E. coli* and *Enterococcus* microbial density for less than 5000 meters from the dump site samples collected on July 7th 2010, potentially was caused by fecal waste resulting from wildlife and the large number of dog yards around the community. The microbial data is presented in Appendix F.v.

Analytical results from the Allakaket Public Water System (AK2300816) and YKSD-Allakaket School (AK2300206) are also provided in Table 5-5 for comparison. Samples exceeded NPDWRs for copper and lead. Samples from the drinking water were not analyzed for all of the parameters included in this study. Aluminum, beryllium, chromium, iron, manganese, and zinc exceeded NPDWRs in the piezometer and/or sump samples, but were not tested for in the drinking water. Microbial data was collected for *E. coli* and coliform. Concentrations were reported as zero.

5.6 Ash Sample Results

Ash from each of the communities was also sampled for metals analysis. Table 5-6 presents metal contaminant results that were detected in ash samples from landfill burn boxes and pits. Each community collected between 1 and 5 representative ash samples during the 3 year project.. The metal concentrations in the ash samples (ranging from non-detect to 2 orders of magnitude) exhibit the wide variety of waste being burned by each community. In general the compounds detected in the ash were the same as those detected in the groundwater; however, a distinct correlation between the ash and groundwater concentrations is not discernable.

Table 5-6: Ash Sample Summary

Metal Contaminant	**Metals Found in Ash Samples**				
	Ekwok (gm/kg)	**Eek (gm/kg)**	**White Mtn (gm/kg)**	**Ft Yukon (gm/kg)**	**Allakaket (gm/kg)**
Aluminum (Al)	29.2, 30.9, 32.8	6.1, 13.1	20.1, 38.9, 51.3, 62.3, 157.1	12.2, 13.2, 15.6, 16.5	65.6
Barium (Ba)	0.2, 0.3, 0.4	0.06, 0.4	0.3, 0.4, 0.4	0.2, 0.3	0.8
Chromium (total, Cr)	0.06	ND	0.04, 0.5	ND	ND
Copper (Cu)	1.6, 2.2	0.3, 2.4	0.3, 0.4, 0.4, 0.8, 2.5	0.2, 0.2, 0.3	0.3
Iron (Fe)	63.5, 67.8, 98.1	4.7, 14.4	4.6, 7.4, 8.0, 10.3, 11.8	8.1, 10.6, 13.2, 16.7	18.7
Lead (Pb)	0.02	ND	0.07, 0.3, 0.4, 0.5	ND	0.3
Manganese (Mn)	0.2, 1.3, 1.4	0.2, 3.3	0.3, 0.3, 0.6, 1.2, 1.6	0.3, 0.3, 0.3, 0.5	1.4
Zinc (Zn)	1.8, 1.8	0.78	0.2, 1.2, 1.5, 1.6, 3.5	0.3, 0.5, 0.5, 1.1	1.8
No. of Samples	**3**	**2**	**5**	**4**	**1**

ND - None Detected

Gm/kg – grams per kilogram.

5.7 Summary

5.7.1 Cation and Anion Samples

Total Metals samples exceeded the NPDWRs for arsenic, beryllium, cadmium, and chromium. Total Metals and Dissolved Metals samples exceeded the NPDWRs for Lead. Uranium exceeded the NPDWR in one sample from Fort Yukon. NSDWRs were exceeded for aluminum, iron, and manganese in both Total Metals and Dissolved Metals samples. Table 5-7 presents a summary count of the number of samples which exceeded either a NPDWR or NSDWR in each of the villages.

Table 5-7: Summary Table of Cation Samples which Exceeded NPDWRs or NSDWRs

Inorganic Cation (μg/L)	EPA Drinking Water MCLs (μg/L)	Ekwok (Total/ Dissolved)	Eek (Total/ Dissolved)	White Mountain (Total/ Dissolved)	Fort Yukon (Total/ Dissolved)	Allakaket (Total/ Dissolved)	Totals (Total/ Dissolved)
Aluminum	50 [1]	10/1	8/3	3/2	18/1	4/0	43/7
Arsenic	10	0/0	4/0	0/0	3/0	0/0	7/0
Beryllium	4	1/0	2/0	0/0	4/0	1/0	8/0
Cadmium	5	0/0	2/0	0/0	1/0	0/0	3/0
Chromium	100	1/0	2/0	0/0	3/0	1/0	7/0
Iron	300 [1]	10/1	8/4	3/2	19/3	5/2	45/12
Lead	15	4/0	3/2	2/0	2/0	3/0	14/2
Manganese	50 [1]	10/0	8/5	2/1	20/7	5/3	45/16
Uranium	30	0/0	0/0	0/0	1/0	0/0	1/0
Zinc	5000 [1]	4/0	2/0	0/0	3/0	1/0	10/0
	Totals:	40/2	39/14	10/5	74/11	20/	180/37

Notes:
[1]: NSDWRs

A total of 20 samples exceeded the EPA Municipal Landfill Leachate Data maximum concentration for aluminum. At least one sample from each site exceeded aluminum maximum reported concentrations. No other results exceeded maximum reported concentrations for cations. Multiple samples were less than the minimum reported concentrations. Table 5-8 presents a summary count of the number of samples which exceeded the maximum reported concentration or were less than the minimum reported concentration for cation samples.

Table 5-8: Summary Table of Cation Samples Compared to EPA Leachate Ranges

Inorganic Cation (µg/L)	EPA 1998 Range of Leachate		Ekwok		Eek		White Mountain		Fort Yukon		Allakaket		Totals	
	Maximum	Minimum	Count Greater than Maximum or Less than Minimum											
			> Max	< Min	> Max	< Min	> Max	< Min	> Max	< Min	> Max	< Min	> Max	< Min
Aluminum	5800	10	5	1	5	2	1	0	6	6	3	1	20	10
Arsenic	982	0.2	0	3	0	0	0	0	0	0	0	0	0	3
Barium	5000	80	0	8	0	6	0	2	0	9	0	4	0	29
Cadmium	150	0.7	0	13	0	10	0	5	0	25	0	8	0	61
Chromium	1900	0.5	0	6	0	4	0	0	0	14	0	3	0	27
Copper	2800	3	0	3	0	7	0	3	0	14	0	5	0	32
Lead	1600	5	0	9	0	8	0	3	0	16	0	5	0	41
Manganese	79000	30	0	2	0	0	0	2	0	1	0	0	0	5
Sodium	2574000	12000	0	11	0	4	0	3	0	3	0	1	0	22
Zinc	350000	30	0	0	0	2	0	2	0	9	0	4	0	17

Anion samples exceeded the NPDWRs for fluoride, nitrate, and nitrite. Anion samples exceeded the NSDWRs for chloride and sulfate. Table 5-9 presents a summary count of the number of samples which exceeded either a NPDWR or NSDWR in each of the villages for the anion samples.

Table 5-9: Summary Table of Anion Samples which Exceeded NPDWRs or NSDWRs

Inorganic Anion (mg/L)	EPA Drinking Water MCLs (mg/L)	Ekwok	Eek	White Mountain	Fort Yukon	Allakaket	Totals
Chloride	250 [1]	0	0	0	5	0	5
Fluoride	4.00	0	0	0	1	0	1
Nitrate	10.00	0	0	0	1	0	1
Nitrite	1.00	0	1	0	0	1	2
Sulfate	250 [1]	0	0	0	7	0	7
	Totals:	0	1	0	14	1	16

Notes:
[1]: NSDWRs

One sample exceeded the EPA Municipal Landfill Leachate Data maximum concentration for sulfate from Fort Yukon. No other results exceeded maximum reported concentration for anions. Multiple samples were less than the minimum reported concentrations. Table 5-10 presents a summary count of the number of samples which exceeded the maximum reported concentrations or were less than the minimum reported concentrations for anion samples.

Table 5-10: Summary Table of Anion Samples Compared to EPA Leachate Ranges

Inorganic Anion (mg/L)	EPA 1998 Range of Leachate		Ekwok		Eek		White Mountain		Fort Yukon		Allakaket		Totals	
	Maximum	Minimum	Count Greater than Maximum or Less than Minimum											
			> Max	< Min	> Max	< Min	> Max	< Min	> Max	< Min	> Max	< Min	> Max	< Min
Chloride	5475.00	31.00	0	6	0	5	0	2	0	2	0	3	0	18
Fluoride	302.00	0.11	0	6	0	4	0	2	0	7	0	0	0	19
Phosphate	117.18	0.29	0	0	0	0	0	0	0	2	0	0	0	2
Sulfate	1400.00	8.00	0	6	0	6	0	2	1	2	0	1	1	17

Mercury samples were collected during the initial sampling at Eek, White Mountain, and Fort Yukon on September 11, 2009, May 11, 2009, and June 23, 2010, respectively. Two groundwater samples were collected from EEKPZ-01 and EEKPZ-02; one surface water sample was collected from the White Mountain drainage; two groundwater samples were collected from FYUPZ-01 and FYUPZ-04; and one surface water sample was collected from FYUSP-01. These samples were submitted to SGS for analysis. All of the samples came back with non-detect concentrations. Mercury was discontinued from sampling following the receipt of these results.

The data provided by ADEC indicates that many of the compounds found in the wells including lead, arsenic, cadmium, chromium, barium, and uranium have been detected at trace levels in the drinking water well samples following treatment (DEC 2012). Detection levels were below NPDWRs for all of these samples except for one lead sample from Allakaket. Due to the considerable distance between the landfills and the community drinking water sources, it is likely that these compounds are naturally occurring. The majority of the ADEC finished drinking water wells samples did not include the analytes measured at the piezometer, sump, and surface water samples in this study. Therefore, a more robust analysis cannot be made. In order to further compare the data, it would be necessary to obtain pre- and post-treatment samples from the drinking water wells for the same list of parameters, and ideally samples at points between the landfills and drinking water intakes.

Where available, CDC Drinking Water from Private Wells and ATSDR ToxFAQs™ are provided in Appendix D for each of the contaminants which exceed either a NPDWR or NSDWR. While samples exceeded NPDWRs and NSDWRs, it is important to note that these samples were taken from water that is not a drinking water source, nor are the piezometers and sumps located near drinking water sources. In order to understand the effects of the landfills on the surrounding surface and groundwater, it will be necessary to further compare the results to background concentrations, as well as to compare the results to the data collected from the drinking water wells in the villages prior to treatment.

Arsenic, beryllium, cadmium, chromium, and lead are all naturally occurring elements in the environment. Exposure to low levels of arsenic for a prolonged duration can cause discoloration of the skin and the appearance of a rash. Inorganic arsenic is considered a known human carcinogen. Ingestion of beryllium has not been reported to cause effects in humans since very little beryllium is absorbed from the stomach and intestines. Beryllium can be harmful if you breathe it. Long term exposure to beryllium can increase the risk of developing lung cancer in people. Long term exposure to low levels of cadmium in water can lead to the buildup of cadmium in the kidneys and possible kidney disease, as well as lung damage and fragile bones. Cadmium is considered a human carcinogen. At high levels, Chromium (VI) can damage the nose and cause cancer; chromium (III) is an essential nutrient. Chromium (VI) is considered a human carcinogen. Lead can damage the nervous system, kidneys, and reproductive system. Lead affects the body similarly whether through breathing or swallowing. Lead is reasonably anticipated to be a human carcinogen.

Fluorides, nitrates, and nitrites are naturally occurring compounds. Low levels of fluoride exposure can help prevent dental cavities. Higher exposure levels overtime can results in more fragile and brittle bones. Tests are inconclusive as to whether or not fluoride is considered a carcinogen. Exposure to high levels of nitrates and nitrites can cause methemoglobinemia which affects hemoglobin in the blood. Nitrates and nitrites are not considered a human carcinogen.

Aluminum, iron, manganese, zinc, chloride, and sulfate exceeded NSDWRs. As previously mentioned, NSDWRs regulate contaminants that may cause cosmetic effects (e.g. skin or tooth discoloration) or aesthetic effects (e.g. taste, odor, color). The NSDWRs are recommended to be followed, but they are non-enforceable. The Alaska Water Quality Criteria Manual for Toxic and Other Deleterious Organic and Inorganic Substances does not list the secondary drinking water regulations in its guidance.

5.7.2 Microbial Samples

The communities' microbial results demonstrated the presence of *E. coli* and *Enterococcus microbial* organisms in all tested surface water samples. For all communities, a significant difference with a 95% confidence level was observed between samples collected from or near the dump compared to the control surface water samples. . The EPA recommended geometric mean for *E. coli* is 126/100 mL. The microbial data which exceeded the recommended geometric mean ranged from 126 to 2512/100 mL. The EPA recommended geometric mean for *Enterococcus* is 33/100 mL. The microbial data which exceeded the recommended geometric mean ranged from 65 to 2512/100 mL. It should be noticed that pathogenic microorganisms are always present in untreated domestic wastewater, and the density observed in all tested samples lies within the typical range found in the United States (Pepper et al., 2006). Based on the results from the subsurface and samples collected from greater than 50 meters downgradient from the dump, no evidence was observed indicating the migration of microbial indicator organisms into the subsurface waters or further than 50 meters downgradient from the dumpsites.

Table 5-11 presents a count of the *E. coli* samples which exceeded the EPA recommended geometric mean for each location and each sample type. A total of 16 samples exceeded the geometric mean. Ten of the exceedances were from surface water samples collected from the landfill site; one was from the subsurface; and five were from less than 50 meters downgradient of the landfill. None of the control or samples collected from greater than 50 meters from the landfill exceeded the recommended geometric mean.

Table 5-11: Summary Table of *E. coli* Results

Sample Location	Ekwok	Eek	White Mountain	Fort Yukon	Allakaket	Totals
Dump	4	3	2	--	1	10
Subsurface	1	0	0	0	0	1
<50 meters	2	0	2	1	0	5
50-5,000 meters	0	0	0	0	0	0
Control	0	0	0	0	0	0
Totals	7	3	4	1	1	16

Notes:
--: Not Sampled

Table 5-12 presents a count of the *Enterococcus* samples which exceeded the EPA recommended geometric mean for each location and each samples type. A total of 23 samples exceeded the geometric mean. Thirteen of the exceedances were from surface water samples collected from the landfill site; two were from the subsurface; and eight were from less than 50 meters downgradient of the landfill. None of the control or samples collected from greater than 50 meters from the landfill exceeded the recommended geometric mean.

Table 5-12: Summary Table of *Enterococcus* Results

Sample Location	Ekwok	Eek	White Mountain	Fort Yukon	Allakaket	Totals
Dump	4	5	2	NS	2	13
Subsurface	1	0	0	0	1	2
<50 meters	3	0	2	2	1	8
50-5,000 meters	0	0	0	0	0	0
Control	0	0	0	0	0	0
Totals	8	5	4	2	4	23

NS: Not Sampled

6.0 Conclusions

Conclusions in this section are derived from the work performed in the five tribal communities that actively participated in this study from June 2009 to May 2012. The study evaluated the fate and effects of leachate contamination and groundwater impact from the uncontrolled open dumping of wastes in rural Alaskan villages. Even though a direct link between landfill leachate and drinking water was not found in this study, both microbial pathogens and the metals (As, Be, Cd, Cr, Pb, U, Al, Fe, Mn and Zn) are contaminants of concern and should be monitored for in both treated drinking water and source waters to manage and reduce potential risk to human health. These concerns also apply to many of the other 178 active Class III landfills in rural Alaska that were often developed without any site assessment, design, or engineering and are unlined. Although Class III landfills are not required to be lined, they must follow best management practices for solid wastes prescribed by ADEC for these types of landfills. While permafrost may function as a “barrier/liner” to retain the leachate and prevent its immediate release into local surface water and/or groundwater, there are increasing concerns that projected changes in climate may result in the melting of the permafrost and cause a sudden increase in the release of environmental contaminants from the dump sites.

Conclusions based upon field activities conducted and analytical studies performed are presented below. Data interpretation limitations are presented in Section 6.1. Recommendations to manage potential risk are presented in Section 6.2.

6.1 Data Interpretation Limitations

The groundwater analytical data was compared to the EPA NPDWRs and NSDWRs MCLs as well as the Alaska Water Quality Criteria Manual for Toxic and Other Deleterious Organic and Inorganic Substances for Drinking Water. The Alaska Solid Waste Program for groundwater states that the specific standards that must be used for assessment monitoring are based on the federal MCLs; however, it also notes that federal MCLs only exist for 7 of the 215 substances that are to be tested under assessment monitoring. For the remainder of the substances, the water quality standard is to be based on background concentrations (i.e. the concentration that normally exists in groundwater in the area). For surface water, the only standards that apply under the Alaska Solid Waste Program are the most stringent standards in 18 AAC 70 and the Alaska Water Quality Criteria Manual for Toxic and Other Deleterious Organic and Inorganic Substances.

While the data was compared to various water quality standards, it is important to understand if the detection levels are significant in comparison to background concentrations. As explained in ADEC’s “Detection vs. Assessment Monitoring at Municipal Landfills” guidance, background concentrations are those concentrations which would typically be found at the site prior to impact from the landfill. This is necessary in order to understand the effects of the landfills on the surrounding surface and groundwater and to develop site specific water quality standards. ADEC's "Guidelines for Sampling, Data Assessment, Determination of Background Conditions, and Use of Statistics" should be used as a reference for developing a Solid Waste Program sampling plan.

The water quality data were also compared to 2-years of post-treatment water quality data provided by ADEC for the drinking water sources in each of the villages. However, the majority of the cations and anions analyzed for in this study were not analyzed by ADEC. There was no evidence that the landfills contaminated the drinking waters in these communities. In order to fully determine if the landfill contaminants are impacting community drinking water supplies, the contaminants should be monitored from the landfill to the drinking water sources. It should also include post-treatment sampling. As mentioned above, to complete such an evaluation, it is necessary to first understand natural background conditions. This extended evaluation was outside the scope of this study.

Additionally, groundwater analytical results from the piezometers may have been affected by the piezometer installation. In the ADEC's *Monitoring Well Guidance* document, it recommends installation with a hollow stem auger (HSA) or direct-push technology (DPT) rig and advancement to the groundwater table where saturated soil conditions are encountered. As the guidance mentions, monitoring wells can be influenced by periodic or seasonal inundation of floodwaters which would require special watertight construction; additional consideration should also be given to monitoring wells installed in frozen ground such that the screen is deeper than the greatest expected depth of thaw. However, the manual installations conducted during this study do not allow for a proper well filter pack surrounding the well screen. Also, because the piezometers were manually installed, they are not necessarily located in saturated conditions representative of the groundwater under and surrounding the landfills.

Generally, with monitoring wells installed in the saturated zone where groundwater recovery allows for it, typically at least three well volumes are purged prior to sampling so that water quality parameters including temperature, pH, conductivity, ORP, DO, and turbidity can be monitored until considered stable. Since the water recovery was marginal in most cases, the samples collected during this investigation were collected as grab samples, field parameters were taken only once prior to sampling. Additionally, while turbidity was not monitored, it was noted that all of the samples collected were turbid and contained sediment. Since these samples were not field filtered and were analyzed for Total Metals, high concentrations of metals would be anticipated. The ADEC Draft Field Sampling Guide notes that high turbidity may cause a high bias for metals in samples. While unfiltered Total Metals samples should be used to compare to the MCLs, if filtered samples can be shown to be more representative, they may be used. Therefore, these grab samples may not be an ideal representation of formation water.

6.2 Recommendations

The research and analytical data collected throughout this effort indicate that the rural landfills and communities will benefit by implementing the following recommendations to manage potential risks as prioritized in the following order:

- Improving solid waste management,
- Establishing water quality monitoring programs, and
- Developing conceptual site models (CSM).

6.2.1 Solid Waste Management

Improving solid waste management by implementing best management practices is a requirement for Class III permitted landfills. As mentioned in Section 2.2, the Solid Waste Program has developed a number of factsheets and guidance documents for rural communities that can be downloaded directly from their website (http://dec.alaska.gov/eh/sw/rural_AK.htm). It is recommended that these communities obtain Class III landfill permits and work rigorously to implement a solid waste collection program, increase site control, manage the incoming waste streams, and increase burn unit monitoring.

6.2.1.1 Solid Waste Collection Program

Each community should establish and/or enhance their solid waste collection program because community personnel and their vehicles carrying the waste to the dumpsite can become receptors and transport mechanisms of contamination by contacting with the waste during the disposal process. When they travel back into their communities after dumping their waste, they may transport any contacted contamination back into their communities.

6.2.1.2 Site Control

Each community should establish and/or enhance site access and control measures. For example, the dump site should have a good fence that controls access and keeps animals and unauthorized personnel out. Appropriate signs should be placed indicating hours of operation and a listing of permitted and non-permitted activities. Ideally once site controls are established, the site only has a single entrance with authorized personnel present to accept and dispose wastes. Uncontrolled dumpsites are harmful to the community as they allow for activities such as 1) open and uncontrolled burning, 2) dumping of waste in inappropriate locations, and 3) improper disposal of harmful and hazardous wastes.

6.2.1.3 Manage the Incoming Waste Streams

Establishing a solid waste collection program and site control allows the community to segregate and manage hazardous wastes such as paints, oils, electronic waste, batteries, etc. Once the waste streams are properly collected and segregated, they can be disposed in appropriate fashion.

Management of incoming waste requires segregation and separate storage facilities for: 1) Household hazardous waste, 2) Appliances for recycling, and 3) Oil drum storage.

6.2.1.4 Burn Units / Controlled Burning

There are some advantages to burning solid waste. The advantages include: 1) Burning reduces the volume of waste that must be disposed; 2) The ash is much less attractive to animals than is raw garbage; 3) The ash does not need to be covered as frequently as raw garbage to prevent litter, odor, or leachate formation; and 4) The ash is less reactive and easier to dispose. However, proper burning is essential to gain the benefits. Improper open burning results in excessive smoke, and burning of hazardous waste can cause more harm to the persons exposed than any of the aforementioned benefits. A burn unit must be enclosed, and only dry waste should be burned so as to not emit black smoke. Ideally, an enclosed burn unit should have an efficient draft, a smoke stack, and be easy to empty. Burning activity should be performed with an attendant on duty with lights and monitors and only when the wind direction is favorable (i.e., away from the village/city). The resulting ash should be disposed properly. Hazardous wastes should never be burned.

6.2.2 Water Quality Monitoring Program

It is also recommended that a water quality monitoring program be established for the rural communities. This program should consist of pre- and post-treatment monitoring of drinking water wells and additional collection of groundwater and surface water data from the installed piezometers, sumps, and surrounding surface waters. The domestic water supply wells should be routinely monitored for chemical and biological contaminants. It is recommended that the pre- and post-treatment samples are analyzed for the same parameters as this study for comparison. As mentioned in Section 6.1, all of the wells, piezometers, and sumps when possible should be sampled by following standard water sampling protocol (e.g. turbidity should be monitored when sampling).

Ideally, background water quality conditions should be established in order to understand if any of the compounds detected in the water from landfill piezometers, sumps, or domestic water supply wells are elevated above background conditions. It should be noted that even if the domestic water supply wells contain compounds at elevated levels above background conditions, it does not necessarily imply that the landfills are directly impacting the wells. As mentioned in the report, monitoring well construction and sampling protocol can directly influence analytical results and bias samples. Additionally, other environmental impacts from the villages could be more directly impacting the well water quality.

Background water quality data may be available from ADEC or through additional research. If not, a background water quality or "control" monitoring well should be installed upgradient of the village and landfill. It is recommended that this monitoring well be installed with the screen intake at the same approximate elevation as the shallow domestic wells. Monitoring well costs vary depending on the type of rig, mobilization and demobilization of equipment, materials, and supplies needed. Average costs solely for rig installation may range from $150 to $160 per linear foot for a mud-rotary or air-rotary drilling rig, respectively.

6.2.3 Conceptual Site Model

If the water quality monitoring program indicates that detected concentrations of monitored compounds are elevated above background concentrations, a CSM should be developed. A CSM summarizes available site information and identifies receptors, environmental media, transportation mechanisms, and routes of exposure. A CSM is used to determine the data types necessary to describe site conditions and quantify receptor exposure and discusses current site conditions, future land use, and exposure pathways.

In order to develop a CSM for a site, the following pathways must be identified:

- Receptors (i.e. potential human and/or representative ecological receptors at the exposure point);
- Environmental media affected (e.g. soil, groundwater, surface water, and air);
- Transport mechanisms (e.g. surface water runoff, groundwater migration, soil leaching, atmospheric dispersion, volatilization, and enclosed space vapor accumulation); and
- Exposure routes (e.g. inhalation, incidental ingestion, and dermal contact).

For the villages potential receptors include local residents, village workers, hunters/recreational users, and trespassers. Surface soil, subsurface soil, surface water, and groundwater are all potentially affected environmental media. Ecological receptors include flora and fauna of the surrounding lands, the local surface water bodies, and the local rivers and creeks. Potential routes for exposure for human and ecological receptors include dermal contact, ingestion, and inhalation of soil particulates, surface water, or groundwater. All pathways until proven otherwise should be considered.

Information from the CSM can be used if further investigations become necessary. A comprehensive site investigation is recommended should funds become available to evaluate all of the potentially affected media. The investigation should include performing a historical records search in order to ascertain the materials and volumes contained within the landfill sites. Should the monitoring program indicate elevated concentrations, a “sentinel” monitoring well should be installed downgradient of the landfill between the landfill and domestic supply wells. Should results from a comprehensive site investigation indicate impacts, a feasibility study should be conducted to determine the best approach to address the impacts.

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Parameters	Water Quality Criteria for Toxics and Other Deleterious Substances: Drinking Water[a]	US EPA Drinking Water MCLs[b]	USEPA 1998 Range of Leachate		Location	EKWPZ-01		EKWPZ-02								
			Maximum	Minimum	Sample Date	5/2/2011	5/2/2011	4/26/2010	4/27/2010	5/18/2010	5/19/2010	7/8/2010	8/11/2010	5/2/2011	5/2/2011	8/23/2011
Inorganic Cation (µg/L)	(µg/L)	(µg/L)	ppb	ppb		Metal (total)	Metal (dissolved)	Metal (total)		Metal (total)			Metal (total)	Metal (total)	Metal (dissolved)	Metal (total)
Aluminum	--	50 [c]	5800	10		5004.24	87.86	4495.58	--	5433.20	--	--	105.92	714.41	5.57	95132.59
Antimony	6	6	--	--		< 1.72	< 1.72	< 0.34	--	< 0.34	--	--	0.37	< 1.72	< 1.72	< 1.72
Arsenic	10	10	982	0.2		< 1.85	< 1.85	< 0.15	--	< 0.15	--	--	< 0.15	< 1.85	< 1.85	< 1.85
Barium	2000	2000	5000	80		57.99	< 1.05	78.39	--	123.04	--	--	8.45	15.18	< 1.05	757.85
Beryllium	4	4	--	--		4.15	1.23	< 0.28	--	0.29	--	--	0.42	2.47	0.24	1.09
Cadmium	5	5	150	0.7		< 0.38	< 0.38	0.08	--	< 0.10	--	--	0.25	< 0.38	< 0.38	< 0.38
Calcium	--	--	--	--		2681.18	194.82	1958.09	--	2239.43	--	--	1274.33	1496.05	1100.80	15624.69
Chromium	100	100	1900	0.5		< 0.29	< 0.29	11.20	--	8.84	--	--	1.02	< 0.29	< 0.29	123.74
Cobalt	--	--	--	--		< 0.93	< 0.93	8.91	--	10.93	--	--	4.91	< 0.93	< 0.93	54.99
Copper	--	1300	2800	3		74.17	< 1.85	44.12	--	23.44	--	--	12.56	71.52	< 1.85	166.15
Iron	--	300 [c]	--	--		96715.08	< 52.48	17915.43	--	9872.37	--	--	58557.83	62442.49	566.70	248165.62
Lead	--	15	1600	5		18.40	< 0.90	2.58	--	2.39	--	--	0.63	< 0.90	< 0.90	32.29
Magnesium	--	--	--	--		748.37	< 30.13	526.66	--	646.97	--	--	310.61	< 30.13	284.03	6005.68
Manganese	--	50 [c]	79000	30		1007.00	7.69	469.55	--	604.51	--	--	326.81	206.73	40.32	2327.58
Molybdenum	--	--	--	--		< 0.60	< 0.60	< 0.13	--	< 0.13	--	--	0.34	< 0.60	< 0.60	< 0.60
Nickel	--	--	--	--		21.22	< 2.04	60.90	--	19.98	--	--	6.38	22.99	4.41	1857.20
Potassium	--	--	--	--		834.25	718.22	365.29	--	427.03	--	--	286.19	< 22.59	880.25	2596.03
Selenium	50	50	--	--		< 0.50	< 0.50	< 0.5	--	< 0.50	--	--	< 0.50	< 0.50	< 0.50	< 0.50
Silicon	--	--	--	--		5633.93	< 167.06	--	--		--	--	--	7085.84	3410.58	59762.45
Silver	--	100 [c]	--	--		< 0.83	< 0.83	< 0.14	--	< 0.14	--	--	< 0.14	< 0.83	< 0.83	< 0.83
Sodium	--	--	2574000	12000		25458.29	43794.59	1939.66	--	1533.19	--	--	4919.00	1912.28	1697.44	8181.79
Thallium	2	2	--	--		< 1.33	< 1.33	< 0.84	--	< 0.84	--	--	< 0.84	< 1.33	< 1.33	< 1.33
Thorium	--	--	--	--		< 1.18	< 1.18	< 0.61	--	< 0.61	--	--	< 0.61	< 1.18	< 1.18	< 1.18
Uranium	30	30	--	--		6.37	< 0.23	< 0.92	--	< 0.92	--	--	< 0.92	2.46	< 0.23	7.32
Vanadium	--	--	--	--		< 1.80	< 1.80	6.71	--	8.60	--	--	< 0.57	< 1.80	< 1.80	70.19
Zinc	--	5000 [c]	350000	30		36405.74	128.43	162.66	--	83.77	--	--	142.51	728.49	80.21	703.40

Parameters	Water Quality Criteria for Toxics and Other Deleterious Substances: Drinking Water[a]	US EPA Drinking Water MCLs[b]	USEPA 1998 Range of Leachate		Location	EKWPZ-01		EKWPZ-02								
			Maximum	Minimum	Sample Date	5/2/2011	5/2/2011	4/26/2010	4/27/2010	5/18/2010	5/19/2010	7/8/2010	8/11/2010	5/2/2011	5/2/2011	8/23/2011
Inorganic Anion (mg/L)	**mg/L**	**mg/L**	**ppm**	**ppm**												
Bromide	--	--	--	--		< 0.07	--	--	--	< 0.08	--	--	< 0.08	< 0.07	--	--
Chloride	--	250 [c]	5475.00	31.00		0.77	--	--	--	< 0.09	--	--	0.98	1.47	--	--
Fluoride	4.00	4.00	302.00	0.11		0.06	--	--	--	< 0.05	--	--	< 0.05	< 0.06	--	--
Nitrate	10.00	10.00	--	--		0.55	--	--	--	< 0.11	--	--	0.50	0.30	--	--
Nitrite	1.00	1.00	--	--		< 0.04	--	--	--	< 0.16	--	--	< 0.16	< 0.04	--	--
Phosphate	--	--	117.18	0.29		< 0.31	--	--	--	< 0.29	--	--	< 0.29	< 0.31	--	--
Sulfate	--	250 [c]	1400.00	8.00		5.26	--	--	--	< 0.36	--	--	1.36	1.07	--	--
Mercury																
Mercury	--	--	--	--		--	--	--	< 0.2	--	--	< 0.2	--	--	--	--
Total Organic Carbon (mg/L)																
TOC	--	--	--	--		--	--	--	--	--	4.16	--	--	--	--	--
Total Petroleum Hydrocarbon (mg/L)																
TPH	--	--	--	--		--	--	--	--	--	--	--	--	--	--	--
Physical Data (Unit)		**(Unit)**														
Alkalinity (mg/L)	--	--	--	--		20	--	--	--	--	--	--	13.10	20	--	20
Total Dissolved Solids (mg/L)	--	--	--	--		--	--	--	--	--	--	--	24.00	--	--	--
Hardness (mg/L)	--	--	--	--		25	--	--	--	--	--	--	--	25	--	25
Field Measurements																
Conductivity (mS/Cm)	--	--	--	--		498	--	--	--	--	--	--	--	435	--	435
pH (pH unit)	--	6.5 - 8.5 [c]	--	--		6.2	--	--	--	--	--	--	--	6.3	--	6
Temperature (C^{o})	--	--	--	--		6.0	--	--	--	--	--	--	--	3.5	--	9.3

Notes:
--: Not analyzed
5004.24 Results Excceds a NPDWR or NSDWR
a: Alaska Department of Environmental Health and Department of Environmental Conservation, Water Quality Standards for Surface Water Monitoring at Landfiles, most stringent standars in 18 AAC 70 and the *Alaska Water Quality Criteria Manual for Toxic and Other Deleterious Organic and Inorganic*
b: United States Drinking Water Maximum Contaminant Levels, National Primary Drinking Water Regulations
c: National Secondary Drinking Water Standards (non-enforceable)
d: Nitrate-Nitrite

Parameters	Water Quality Criteria for Toxics and Other Deleterious Substances: Drinking Water[a]	US EPA Drinking Water MCLs[b]	USEPA 1998 Range of Leachate		Location	EKWPZ-03						SWSD WM NELSON SCHOOL EKWOK AK2260171
			Maximum	Minimum	Sample Date	7/8/2010	8/11/2010	5/2/2011	5/2/2011	7/11/2011	8/23/2011	
Inorganic Cation (µg/L)	(µg/L)	(µg/L)	ppb	ppb		Metal (total)	--	Metal (total)	Metal (dissolved)	Metal (total)	Metal (total)	
Aluminum	--	50 [c]	5800	10		98358.82	--	29607.28	12.35	21156.92	74482.20	--
Antimony	6	6	--	--		0.52	--	< 1.72	< 1.72	< 1.72	< 1.72	0
Arsenic	10	10	982	0.2		1.36	--	< 1.85	< 1.85	< 1.85	< 1.85	2.62
Barium	2000	2000	5000	80		338.70	--	44.78	< 1.05	102.67	220.61	5.3
Beryllium	4	4	--	--		2.55	--	3.23	0.25	1.74	1.17	0
Cadmium	5	5	150	0.7		0.70	--	< 0.38	< 0.38	< 0.38	< 0.38	0
Calcium	--	--	--	--		5876.90	--	1581.66	66.70	4639.46	8470.31	--
Chromium	100	100	1900	0.5		76.00	--	< 0.29	< 0.29	7.82	37.22	1.18
Cobalt	--	--	--	--		15.19	--	< 0.93	< 0.93	4.69	< 0.93	--
Copper	--	1300	2800	3		124.80	--	19.84	< 1.85	22.97	63.90	2010
Iron	--	300 [c]	--	--		282960.46	--	50780.91	149.06	27680.71	178483.56	--
Lead	--	15	1600	5		21.35	--	< 0.90	< 0.90	3.00	21.20	8.22
Magnesium	--	--	--	--		1291.39	--	< 30.13	< 30.13	878.47	1903.58	--
Manganese	--	50 [c]	79000	30		1393.49	--	524.65	24.01	721.98	1075.71	--
Molybdenum	--	--	--	--		0.56	--	< 0.60	< 0.60	< 0.60	< 0.60	--
Nickel	--	--	--	--		74.13	--	< 2.04	< 2.04	25.62	< 2.04	0.864
Potassium	--	--	--	--		905.34	--	811.60	1126.91	390.20	1347.12	--
Selenium	50	50	--	--		< 0.50	--	< 0.50	< 0.50	< 0.50	< 0.50	0
Silicon	--	--	--	--		--	--	12221.92	< 167.06	10412.62	50224.75	--
Silver	--	100 [c]	--	--		0.27	--	< 0.83	< 0.83	< 0.83	< 0.83	--
Sodium	--	--	2574000	12000		4483.06	--	6225.48	4261.68	1214.66	5106.17	--
Thallium	2	2	--	--		< 0.84	--	< 1.33	< 1.33	< 1.33	< 1.33	0
Thorium	--	--	--	--		3.68	--	< 1.18	< 1.18	< 1.18	< 1.18	--
Uranium	30	30	--	--		3.80	--	3.48	< 0.23	1.66	7.82	--
Vanadium	--	--	--	--		48.68	--	27.94	< 1.80	2.20	49.11	--
Zinc	--	5000 [c]	350000	30		5968.78	--	6511.58	165.41	3912.69	12587.05	--

Parameters	Water Quality Criteria for Toxics and Other Deleterious Substances: Drinking Water[a]	US EPA Drinking Water MCLs[b]	USEPA 1998 Range of Leachate		Location	EKWPZ-03						SWSD WM NELSON SCHOOL EKWOK AK2260171
			Maximum	Minimum	Sample Date	7/8/2010	8/11/2010	5/2/2011	5/2/2011	7/11/2011	8/23/2011	
Inorganic Anion (mg/L)	mg/L	mg/L	ppm	ppm								
Bromide	--	--	--	--		< 0.08	--	< 0.07	--	--	--	--
Chloride	--	250 [c]	5475.00	31.00		8.31	--	1.20	--	--	--	--
Fluoride	4.00	4.00	302.00	0.11		< 0.05	--	< 0.06	--	--	--	0.216
Nitrate	10.00	10.00	--	--		< 0.11	--	0.30	--	--	--	0.267[d]
Nitrite	1.00	1.00	--	--		< 0.16	--	< 0.04	--	--	--	--
Phosphate	--	--	117.18	0.29		< 0.29	--	< 0.31	--	--	--	--
Sulfate	--	250 [c]	1400.00	8.00		4.93	--	0.83	--	--	--	--
Mercury												
Mercury	--	--	--	--		--	--	--	--	--	--	0
Total Organic Carbon (mg/L)												
TOC	--	--	--	--		--	23.30	--	--	--	20.85	--
Total Petroleum Hydrocarbon (mg/L)												
TPH	--	--	--	--		--	13.80	--	--	--	--	--
Physical Data (Unit)		(Unit)										
Alkalinity (mg/L)	--	--	--	--		--	--	20	--	--	20	--
Total Dissolved Solids (mg/L)	--	--	--	--		--	--	--	--	--	--	--
Hardness (mg/L)	--	--	--	--		--	--	25	--	--	25	--
Field Measurements												
Conductivity (mS/Cm)	--	--	--	--		--	--	17.9	--	--	569	--
pH (pH unit)	--	6.5 - 8.5 [c]	--	--		--	--	7.5	--	--	7.5	--
Temperature (C^o)	--	--	--	--		--	--	4.8	--	--	8.9	--

Notes:
--: Not analyzed
5004.24 Results Excceds a NPDWR or NSDWR
a: Alaska Department of Environmental Health and Department of Environmental Conservation, Water Quality Standards for Surfa
Landfiles, most stringent standards in 18 AAC 70 and the *Alaska Water Quality Criteria Manual for Toxic and Other Deleterious Org*
b: United States Drinking Water Maximum Contaminant Levels, National Primary Drinking Water Regulations
c: National Secondary Drinking Water Standards (non-enforceable)
d: Nitrate-Nitrite

Parameters	Water Quality Criteria for Toxics and Other Deleterious Substances: Drinking Water[a]	US EPA Drinking Water MCLs[b]	USEPA 1998 Range of Leachate		Location	EEKPZ-01				
			Maximum	Minimum	Sample Date	9/11/2009	9/11/2009	8/15/2011	8/15/2011	9/16/2011
Inorganic Cation (µg/L)	**(µg/L)**	**(µg/L)**	**ppb**	**ppb**		**Metal (total)**	**Metal (dissolved)**	**Metal (total)**	**Metal (dissolved)**	**Metal (total)**
Aluminum	--	50 [c]	5800	10		231000.00	61800.00	409.51	< 1.22	12168.97
Antimony	6	6	--	--		< 0.61	< 0.61	< 1.72	< 1.72	< 1.72
Arsenic	10	10	982	0.2		138.31	16.03	< 0.37	< 0.37	5.53
Barium	2,000	2000	5000	80		1780.00	1490.00	237.64	7.45	455.57
Beryllium	4	4	--	--		8.94	5.17	< 0.01	< 0.01	0.11
Cadmium	5	5	150	0.7		7.51	5.41	< 0.38	< 0.38	< 0.38
Calcium	--	--	--	--		107000.00	87400.00	43012.60	1334.41	25267.58
Chromium	100	100	1900	0.5		436.96	97.73	< 0.29	< 0.29	38.97
Cobalt	--	--	--	--		175.21	95.13	11.32	< 93.00	33.51
Copper	--	1300	2800	3		522.60	275.75	42.96	< 1.85	87.13
Iron	--	300 [c]	--	--		481000.00	262000.00	130770.35	7778.49	404956.67
Lead	--	15	1600	5		152.23	56.59	< 0.9	< 0.9	29.04
Magnesium	--	--	--	--		97200.00	35200.00	25090.96	516.18	9012.84
Manganese	--	50 [c]	79000	30		10300.00	8110.00	2915.81	220.67	4426.69
Molybdenum	--	--	--	--		19.98	0.77	< 0.6	< 0.6	< 0.6
Nickel	--	--	--	--		477.59	232.03	< 2.04	< 2.04	104.04
Potassium	--	--	--	--		13000.00	6640.00	12093.29	134.78	2616.25
Selenium	50	50	--	--		7.50	0.84	< 0.5	< 0.5	< 0.5
Silicon	--	--	--	--		--	--	5669.35	343.77	16450.02
Silver	--	100 [c]	--	--		< 0.75	< 0.75	< 0.83	< 0.83	< 0.83
Sodium	--	--	2574000	12000		32300.00	26500.00	90847.66	3034.05	31721.05
Thallium	2	2	--	--		< 0.43	< 0.43	< 1.33	< 1.33	< 1.33
Thorium	--	--	--	--		35.96	< 1.07	< 1.18	< 1.18	< 1.18
Uranium	30	30	--	--		13.24	3.06	< 0.60	< 0.6	< 0.5
Vanadium	--	--	--	--		758.20	435.55	< 1.80	< 1.8	94.50
Zinc	--	5000 [c]	350000	30		1660.00	1040.00	297.62	13.25	1007.75
Mercury										
Mercury	--	--	--	--		< 0.06	--	--	--	--
Total Organic Carbon (mg/L)										
TOC			--	--		--	--	12.99	--	--

Parameters	Water Quality Criteria for Toxics and Other Deleterious Substances: Drinking Water[a]	US EPA Drinking Water MCLs[b]	USEPA 1998 Range of Leachate		Location	EEKPZ-01				
			Maximum	Minimum	Sample Date	9/11/2009	9/11/2009	8/15/2011	8/15/2011	9/16/2011
Inorganic Anion (mg/L)		**(mg/L)**	**ppm**	**ppm**						
Bromide	--	--	--	--		0.46	--	< 0.07	--	--
Chloride	--	250 [c]	5475.00	31.00		42.34	--	1.44	--	--
Fluoride	4	4.00	302.00	0.11		0.24	--	0.03	--	--
Nitrate	10	10.00	--	--		< 0.19	--	0.16	--	--
Nitrite	1	1.00	--	--		< 0.08	--	< 0.04	--	--
Phosphate	--	--	117.18	0.29		< 0.86	--	< 0.31	--	--
Sulfate	--	250 [c]	1400.00	8.00		0.72	--	1.62	--	--
Physical Data (Unit)		**(Unit)**								
Alkalinity (mg/L)	--	--	--	--		--	--	120	--	--
Hardness (mg/L)	--	--	--	--		--	--	180	--	--
Field Measurements										
Conductivity (mS/Cm)	--	--	--	--		644.0	--	1090	--	--
Dissolved Oxygen (%)	--	--	--	--		16.7	--	--	--	--
ORP (mV)	--	--	--	--		-12.8	--	--	--	--
pH (pH unit)	--	6.5 - 8.5 [1]	--	--		6.5	--	7.4	--	--
Temperature (C°)	--	--	--	--		6.0	--	--	--	--

Notes:
--: Not analyzed
5004.24 Results Excceds a NPDWR or NSDWR

a: Alaska Department of Environmental Health and Department of Environmental Conservation, Water Quality Standards for Surface Water Monitoring at Landfiles, most stringent standars in 18 AAC 70 and the *Alaska Water Quality Criteria Manual for Toxic and Other Deleterious Organic and Inorganic Substances*

b: United States Drinking Water Maximum Contaminant Levels, National Primary Drinking Water Regulations

c: National Secondary Drinking Water Standards (non-enforceable)
d: Nitrate-Nitrite

Parameters	Water Quality Criteria for Toxics and Other Deleterious Substances: Drinking Water[a]	US EPA Drinking Water MCLs[b]	USEPA 1998 Range of Leachate		Location	EEKPZ-02					EEKPZ-03			EEK WATER SYSTEM AK2270281
			Maximum	Minimum	Sample Date	9/11/2009	9/11/2009	8/15/2011	8/15/2011	9/16/2011	8/15/2011	8/15/2011	9/16/2011	
Inorganic Cation (µg/L)	(µg/L)	(µg/L)	ppb	ppb		Metal (total)	Metal (dissolved)	Metal (total)	Metal (dissolved)	Metal (total)	Metal (total)	Metal (dissolved)	Metal (total)	
Aluminum	--	50 [c]	5800	10		81700.00	22800.00	2798.35	< 1.22	615.58	1365.95	1365.95	488.31	--
Antimony	6	6	--	--		< 0.61	< 0.61	< 1.72	< 1.72	< 1.72	< 1.72	< 1.72	< 1.72	--
Arsenic	10	10	982	0.2		41.09	15.48	< 0.37	< 0.37	< 0.37	< 0.37	< 0.37	< 0.37	0.24
Barium	2,000	2000	5000	80		1170.00	905.99	56.26	3.8	43.98	58.62	58.62	93.01	13
Beryllium	4	4	--	--		3.34	1.79	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	--
Cadmium	5	5	150	0.7		< 0.04	1.77	< 0.38	< 0.38	< 0.38	< 0.38	< 0.38	< 0.38	0.251
Calcium	--	--	--	--		40000.00	35300.00	5577.16	3292.9	10871.47	1652.51	1652.51	36268.39	--
Chromium	100	100	1900	0.5		158.00	40.65	5.70	< 0.29	10.15	6.02	6.02	< 0.29	0.488
Cobalt	--	--	--	--		56.80	34.99	10.45	< 0.93	9.72	< 0.93	< 0.93	< 0.93	--
Copper	--	1300	2800	3		157.32	80.02	< 1.85	< 1.85	< 1.85	< 1.85	< 1.85	< 1.85	525
Iron	--	300 [c]	--	--		168000.00	113000.00	85645.23	< 52.48	215266.37	81018.80	81018.80	9559.36	--
Lead	--	15	1600	5		50.47	21.19	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	11.7
Magnesium	--	--	--	--		34100.00	16400.00	502.38	2379.6	1445.02	< 30.13	< 30.13	25513.73	--
Manganese	--	50 [c]	79000	30		2880.00	2520.00	1317.46	92.6	1596.96	1070.05	1070.05	1047.66	--
Molybdenum	--	--	--	--		5.60	< 0.40	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6	--
Nickel	--	--	--	--		188.00	104.20	< 2.04	< 2.04	25.35	< 2.04	< 2.04	< 2.04	--
Potassium	--	--	--	--		6280.00	4700.00	< 22.59	1225.6	406.35	< 22.59	< 22.59	10401.37	--
Selenium	50	50	--	--		< 0.34	0.43	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	0
Silicon	--	--	--	--		--	--	3940.76	171.4	2450.16	< 167.06	< 167.06	< 167.06	--
Silver	--	100 [c]	--	--		< 0.75	< 0.75	< 0.83	< 0.83	< 0.83	< 0.83	< 0.83	< 0.83	--
Sodium	--	--	2574000	12000		32000.00	31400.00	2806.41	9028.7	11710.12	109530.10	109530.10	81545.57	--
Thallium	2	2	--	--		< 0.43	< 0.43	< 1.33	< 1.33	< 1.33	< 1.33	< 1.33	< 1.33	--
Thorium	--	--	--	--		< 1.07	< 1.07	< 1.18	< 1.18	< 1.18	< 1.18	< 1.18	< 1.18	--
Uranium	30	30	--	--		5.00	0.47	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6	--
Vanadium	--	--	--	--		218.00	108.73	< 1.8	< 1.8	< 1.8	< 1.8	< 1.8	< 1.8	--
Zinc	--	5000 [c]	350000	30		640.18	444.31	9584.81	< 1.26	7245.41	1547.20	1547.20	1776.15	--
Mercury														
Mercury	--	--	--	--		< 0.06	--	--	--	--	--	--	--	0
Total Organic Carbon (mg/L)														
TOC			--	--		--	--	4.17	--	--	21.41	--	28.00	--

Parameters	Water Quality Criteria for Toxics and Other Deleterious Substances: Drinking Water[a]	US EPA Drinking Water MCLs[b]	USEPA 1998 Range of Leachate		Location	EEKPZ-02					EEKPZ-03			EEK WATER SYSTEM AK2270281
			Maximum	Minimum	Sample Date	9/11/2009	9/11/2009	8/15/2011	8/15/2011	9/16/2011	8/15/2011	8/15/2011	9/16/2011	
Inorganic Anion (mg/L)		**(mg/L)**	**ppm**	**ppm**										
Bromide	--	--	--	--		< 0.44	--	< 0.07	--	--	< 0.07	--	< 0.07	--
Chloride	--	250 [c]	5475.00	31.00		9.38	--	1.44	--	--	6.54	--	5.22	--
Fluoride	4	4.00	302.00	0.11		0.09	--	0.03	--	--	0.13	--	0.10	0
Nitrate	10	10.00	--	--		< 0.19	--	0.16	--	--	0.59	--	0.08	0.106[d]
Nitrite	1	1.00	--	--		2.42	--	< 0.04	--	--	< 0.04	--	< 0.04	--
Phosphate	--	--	117.18	0.29		< 0.87	--	< 0.31	--	--	< 0.31	--	< 0.31	--
Sulfate	--	250 [c]	1400.00	8.00		0.89	--	1.62	--	--	1.97	--	3.41	--
Physical Data (Unit)		**(Unit)**												
Alkalinity (mg/L)	--	--	--	--		--	--	40	--	--	80	--	--	--
Hardness (mg/L)	--	--	--	--		--	--	25	--	--	50	--	--	-
Field Measurements														
Conductivity (mS/Cm)	--	--	--	--		447.1	--	40	--	710	230	--	--	--
Dissolved Oxygen (%)	--	--	--	--		19.5	--	--	--	--	--	--	--	--
ORP (mV)	--	--	--	--		-19.6	--	--	--	--	--	--	--	--
pH (pH unit)	--	6.5 - 8.5 [1]	--	--		6.5	--	6.8	--	6.9	10	--	--	--
Temperature (C°)	--	--	--	--		3.1	--	--	--	--	--	--	--	--

Notes:
--: Not analyzed
5004.24 Results Excceds a NPDWR or NSDWR

a: Alaska Department of Environmental Health and Department of Environmental Conservation, Water Quality Standards for Surface Water Monitoring at Landfiles, most stringent standars in 18 AAC 70 and the *Alaska Water Quality Criteria Manual for Toxic and Other Deleterious Organic and Inorganic Substances*

b: United States Drinking Water Maximum Contaminant Levels, National Primary Drinking Water Regulations

c: National Secondary Drinking Water Standards (non-enforceable)
d: Nitrate-Nitrite

Parameters	Water Quality Criteria for Toxics and Other Deleterious Substances: Drinking Water[a]	US EPA Drinking Water MCLs[b]	USEPA 1998 Range of Leachate		Location	WM Drainage	WMOSUMP-01		WMOSUMP-02		WHITE MOUNTAIN WATER SYSTEM AK2340507
			Maximum	Minimum	Sample Date	5/21/2009	5/27/2011	5/27/2011	5/27/2011	5/27/2011	
Inorganic Cation (mg/L)	**(µg/L)**	**(µg/L)**	**ppb**	**ppb**		**Metal (total)**	**Metal (total)**	**Metal (dissolved)**	**Metal (total)**	**Metal (dissolved)**	
Aluminum	--	50 [c]	5800	10		13400.00	4938.57	242.31	1487.04	691.57	--
Antimony	6	6	--	--		< 1	< 1.72	< 1.72	< 1.72	< 1.72	--
Arsenic	10	10	982	0.2		< 5	5.89	0.68	1.04	0.56	--
Barium	2,000	2000	5000	80		120.00	119.05	14.39	132.42	16.43	--
Beryllium	4	4	--	--		0.43	1.73	0.07	0.21	0.11	--
Cadmium	5	5	150	0.7		< 0.5	< 0.38	< 0.38	< 0.38	< 0.38	--
Calcium	--	--	--	--		12000.00	126495.76	24856.96	17974.25	7486.95	--
Chromium	100	100	1900	0.5		15.70	9.47	1.12	5.70	1.78	--
Cobalt	--	--	--	--		5.80	< 0.93	< 0.93	1.94	< 0.93	--
Copper	--	1300	2800	3		23.20	3.00	3.00	4.77	< 1.85	--
Iron	--	300 [c]	--	--		15000.00	21769.74	317.54	21934.16	756.46	--
Lead	--	15	1600	5		40.70	16.91	< 0.90	2.66	< 0.90	--
Magnesium	--	--	--	--		7540.00	42631.84	8251.71	17697.42	2819.38	--
Manganese	--	50 [c]	79000	30		15.70	839.88	25.57	210.60	98.96	--
Molybdenum	--	--	--	--		< 10	< 0.60	0.91	0.91	< 0.60	--
Nickel	--	--	--	--		17.50	49.58	5.91	14.44	3.35	--
Potassium	--	--	--	--		2120.00	2611.24	604.56	2443.02	871.66	--
Selenium	50	50	--	--		< 5	< 0.50	0.54	< 0.50	0.55	--
Silicon	--	--	--	--		200.00	9523.64	3934.74	2359.12	1854.14	--
Silver	--	100 [c]	--	--		1.00	< 0.83	< 0.83	< 0.83	< 0.83	--
Sodium	--	--	2574000	12000		2640.00	300238.65	5932.39	25070.45	3248.57	--
Thallium	2	2	--	--		< 1	< 1.33	< 1.33	< 1.33	< 1.33	--
Thorium	--	--	--	--		--	< 1.18	< 1.18	< 1.18	< 1.18	--
Uranium	30	30	--	--		--	25.84	< 0.60	1.54	< 0.60	--
Vanadium	--	--	--	--		25.10	< 1.80	< 1.80	5.07	< 1.80	--
Zinc	--	5000 [c]	350000	30		125.00	107.46	10.17	59.59	9.85	--
Mercury											
Mercury	--	--	--	--		< 0.2	--	--	--	--	--
TPH Silica Gel HEM (mg/L)											
TPH	--	--	--	--		<4.17	--	--	--	--	--

Parameters	Water Quality Criteria for Toxics and Other Deleterious Substances: Drinking Water[a]	US EPA Drinking Water MCLs[b]	USEPA 1998 Range of Leachate		Location	WM Drainage	WMOSUMP-01		WMOSUMP-02		WHITE MOUNTAIN WATER SYSTEM AK2340507
			Maximum	Minimum	Sample Date	5/21/2009	5/27/2011	5/27/2011	5/27/2011	5/27/2011	
Inorganic Anion (mg/L)		**(mg/L)**	**ppm**	**ppm**							
Bromide	--	--	--	--		--	< 0.07	--	< 0.07	--	--
Chloride	--	250 [c]	5475.00	31.00		--	4.08	--	4.39	--	--
Fluoride	4	4.00	302.00	0.11		--	< 0.06	--	< 0.06	--	--
Nitrate	10	10.00	--	--		--	< 0.3	--	< 0.3	--	0.946[d]
Nitrite	1	1.00	--	--		--	< 0.04	--	< 0.04	--	--
Phosphate	--	--	117.18	0.29		--	< 0.31	--	< 0.31	--	--
Sulfate	--	250 [c]	1400.00	8.00		--	3.72	--	1.91	--	--
Field Measurements		**(Unit)**									
Conductivity (mS/Cm)	--	--	--	--		--	198.9	--	72.90	--	--
pH (pH unit)	--	6.5 - 8.5 [1]	--	--		--	8.4	--	8.4	--	--
Temperature (C^o)	--	--	--	--		--	3.7	--	1.5	--	--
Total Organic Carbon (mg/L)											
TOC	--	--	--	--		--	45.18	--	56.25	--	--

Notes:
--: Not analyzed
5004.24 Results Excceds a NPDWR or NSDWR
All VOC results were non-detect. Full results are available in Appendix C.

a: Alaska Department of Environmental Health and Department of Environmental Conservation, Water Quality Standards for Surface Water Monitoring at Landfiles, most stringent standards in 18 AAC 70 and the *Alaska Water Quality Criteria Manual for Toxic and Other Deleterious Organic and Inorganic Substances*

b: United States Drinking Water Maximum Contaminant Levels, National Primary Drinking Water Regulations

c: National Secondary Drinking Water Standards (non-enforceable)

Parameters	Water Quality Criteria for Toxics and Other Deleterious Substances: Drinking Water[a]	US EPA Drinking Water MCLs[b]	USEPA 1998 Range of Leachate		Location	FYUPZ-01					
			Maximum	Minimum	Sample Date	6/23/2010	5/23/2011	5/23/2011	5/26/2011	8/18/2011	8/18/2011
Inorganic Cation (mg/L)	(µg/L)	(µg/L)	ppb	ppb		Metal (total)	Metal (total)	Metal (dissolved)	Metal (total)	Metal (total)	Metal (dissolved)
Aluminum	--	50 [c]	5800	10		1534.39	5229.99	487.29	72.69	35498.40	1.8
Antimony	6	6	--	--		1.71	< 1.72	< 1.72	< 1.72	< 1.72	< 1.72
Arsenic	10	10	982	0.2		15.38	10.13	< 0.37	8.87	< 0.37	< 0.37
Barium	2000	2000	5000	80		648.51	265.50	1037.39	179.22	1339.53	13.2
Beryllium	4	4	--	--		1.22	4.23	0.71	3.79	5.99	< 0.01
Cadmium	5	5	150	0.7		19.76	< 0.38	< 0.38	< 0.38	< 0.38	< 0.38
Calcium	--	--	--	--		446653.32	55528.36	230711.21	236759.17	185964.59	11231.8
Chromium	100	100	1900	0.5		12.82	1061.20	< 0.29	< 0.29	61.51	0.4
Cobalt	--	--	--	--		30.65	71.31	< 0.93	16.09	48.42	< 0.93
Copper	--	1300	2800	3		11.32	371.23	< 1.85	< 1.85	138.49	< 1.85
Iron	--	300 [c]	--	--		28973.08	1879840.84	11470.34	4997.95	117419.23	188.5
Lead	--	15	1600	5		3.06	18.89	< 0.90	< 0.90	27.08	< 0.90
Magnesium	--	--	--	--		155253.65	28450.64	184035.09	105231.59	32727.45	10024.1
Manganese	--	50 [c]	79000	30		10664.72	6710.94	2136.97	7026.99	2909.78	87.9
Molybdenum	--	--	--	--		1.35	7.75	< 0.60	<0.60	< 0.60	< 0.60
Nickel	--	--	--	--		196.28	704.73	52.19	50.46	213.77	3.5
Potassium	--	--	--	--		5245.85	8415.62	71974.64	35066.23	254.32	1735.4
Selenium	50	50	--	--		0.87	< 0.50	< 0.50	<0.50	< 0.50	< 0.50
Silicon	--	--	--	--		--	7406.07	10085.58	8711.29	24232.10	260.2
Silver	--	100 [c]	--	--		< 0.14	< 0.83	< 0.83	<0.83	< 0.83	< 0.83
Sodium	--	--	2574000	12000		21431.15	51261.09	227017.44	89023.37	60043.13	17968.0
Thallium	2	2	--	--		< 0.84	< 1.33	< 1.33	<1.33	< 1.33	< 1.33
Thorium	--	--	--	--		3.82	< 1.18	< 1.18	< 1.18	< 1.18	< 1.18
Uranium	30	30	--	--		3.26	12.56	< 0.23	6.53	7.21	< 0.23
Vanadium	--	--	--	--		20.78	20.66	< 1.80	< 1.80	22.36	< 1.80
Zinc	--	5000 [c]	350000	30		260.02	4369.86	153.78	100.33	5880.40	2.5
Mercury											
Mercury	--	--	--	--		< 0.20	--	--	--	--	--
TPH Silica Gel HEM (mg/L)											
TPH	--	--	--	--		< 9.60	--	--	--	--	--

Parameters	Water Quality Criteria for Toxics and Other Deleterious Substances: Drinking Water[a]	US EPA Drinking Water MCLs[b]	USEPA 1998 Range of Leachate		Location	FYUPZ-01					
			Maximum	Minimum	Sample Date	6/23/2010	5/23/2011	5/23/2011	5/26/2011	8/18/2011	8/18/2011
Inorganic Anion (mg/L)		**(mg/L)**	**ppm**	**ppm**							
Bromide	--	--	--	--		--	0.20	--	0.20	1.92	--
Chloride	--	250 [c]	5475.00	31.00		--	389.60	--	389.60	272.81	--
Fluoride	4	4.00	302.00	0.11		--	0.31	--	0.31	0.07	--
Nitrate	10	10.00	--	--		--	0.17	--	0.17	0.95	--
Nitrite	1	1.00	--	--		--	< 0.04	--	n.a.	0.04	--
Phosphate	--	--	117.18	0.29		--	< 0.31	--	< 0.31	0.31	--
Sulfate	--	250 [c]	1400.00	8.00		--	804.24	--	804.24	16.24	--
Physical Data (Unit)		**(Unit)**									
Alkalinity (mg/L)	--	--	--	--		--	240	--	240	240	--
Hardness (mg/L)	--	--	--	--		--	425	--	425	250	--
Total Dissolved Solids (g/L)	--	--	--	--		--	--	--	--	--	--
Field Measurements											
pH (pH unit)	--	6.5 - 8.5 [1]	--	--		--	7.8	--	7.8	6.7	--
Conductivity (mS/Cm)	--	--	--	--		--	3063	--	3063	1363	--
Temperature (C°)	--	--	--	--		--	14	--	14	--	--
Total Organic Carbon (mg/L)											
TOC	--	--	--	--		--	--	--	--	--	--

Notes:
--: Not analyzed
5004.24 Results Excceds a NPDWR or NSDWR
All VOC and SVOC results were non-detect. Full results are available in Appendix C.

a: Alaska Department of Environmental Health and Department of Environmental Conservation, Water Quality Standards for Surface Water Monitoring at Landfiles, most stringent standars in 18 AAC 70 and the *Alaska Water Quality Criteria Manual for Toxic and Other Deleterious Organic and Inorganic Substances*

b: United States Drinking Water Maximum Contaminant Levels, National Primary Drinking Water Regulations

c: National Secondary Drinking Water Standards (non-enforceable)
d: Samples collected wth Rigid Porous Polyethylene (RPP) passive samplers.

Parameters	Water Quality Criteria for Toxics and Other Deleterious Substances: Drinking Water[a]	US EPA Drinking Water MCLs[b]	USEPA 1998 Range of Leachate		Location	FYUPZ-02					
			Maximum	Minimum	Sample Date	6/23/2010	5/23/2011	5/23/2011	8/18/2011	8/18/2011	9/8/2011
Inorganic Cation (mg/L)	**(µg/L)**	**(µg/L)**	**ppb**	**ppb**		**Metal (total)**	**Metal (total)**	**Metal (dissolved)**	**Metal (total)**	**Metal (dissolved)**	**Metal (total)**
Aluminum	--	50 [c]	5800	10		5828.99	1298.56	13.99	30057.27	< 1.22	11327.67
Antimony	6	6	--	--		1.61	< 1.72	3.45	< 1.72	< 1.72	< 1.72
Arsenic	10	10	982	0.2		10.67	5.41	1.09	6.67	< 0.37	7.09
Barium	2000	2000	5000	80		720.97	485.06	33.40	1340.65	12.0	1667.86
Beryllium	4	4	--	--		1.00	3.96	0.38	3.61	< 0.01	0.54
Cadmium	5	5	150	0.7		0.70	< 0.38	< 0.38	4.66	< 0.38	< 0.38
Calcium	--	--	--	--		131783.65	96328.41	42103.92	250971.47	9332.7	240999.74
Chromium	100	100	1900	0.5		57.49	106.01	1.44	48.36	< 0.29	28.67
Cobalt	--	--	--	--		15.98	19.87	1.23	58.73	< 0.93	14.89
Copper	--	1300	2800	3		25.01	54.49	4.63	198.26	< 1.85	< 1.85
Iron	--	300 [c]	--	--		41747.82	1663372.43	467.94	45455.46	< 52.48	277993.69
Lead	--	15	1600	5		12.18	< 0.90	< 0.90	63.49	< 0.90	12.80
Magnesium	--	--	--	--		124484.90	107187.87	45043.25	56092.09	7108.3	209771.97
Manganese	--	50 [c]	79000	30		1654.33	5445.88	98.74	4884.11	69.4	2492.55
Molybdenum	--	--	--	--		4.68	< 0.60	3.29	< 0.60	< 0.60	< 0.60
Nickel	--	--	--	--		278.09	132.34	15.44	204.11	2.6	74.04
Potassium	--	--	--	--		27933.63	19390.90	16888.37	1180.93	840.6	28449.49
Selenium	50	50	--	--		< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Silicon	--	--	--	--		--	6195.23	2179.59	28607.35	314.0	18832.91
Silver	--	100 [c]	--	--		< 0.14	< 0.83	< 0.83	< 0.83	< 0.83	< 0.83
Sodium	--	--	2574000	12000		184746.35	135350.50	74105.64	10513.45	13747.3	281824.39
Thallium	2	2	--	--		< 0.84	< 1.33	< 1.33	< 1.33	< 1.33	< 1.33
Thorium	--	--	--	--		< 0.61	< 1.18	< 1.18	< 1.18	< 1.18	< 1.18
Uranium	30	30	--	--		10.27	11.28	1.10	< 0.23	< 0.23	6.92
Vanadium	--	--	--	--		39.52	< 1.80	< 1.80	54.42	< 1.80	55.41
Zinc	--	5000 [c]	350000	30		564.20	4065.75	9.25	1283.26	< 1.26	551.53
Mercury											
Mercury	--	--	--	--		--	--	--	--	--	--
TPH Silica Gel HEM (mg/L)											
TPH	--	--	--	--		--	--	--	--	--	--

Parameters	Water Quality Criteria for Toxics and Other Deleterious Substances: Drinking Water[a]	US EPA Drinking Water MCLs[b]	USEPA 1998 Range of Leachate		Location	FYUPZ-02					
			Maximum	Minimum	Sample Date	6/23/2010	5/23/2011	5/23/2011	8/18/2011	8/18/2011	9/8/2011
Inorganic Anion (mg/L)		**(mg/L)**	**ppm**	**ppm**							
Bromide	--	--	--	--		< 0.11	0.28	--	0.81	--	1.04
Chloride	--	250 [c]	5475.00	31.00		52.41	93.29	--	214.38	--	210.63
Fluoride	4	4.00	302.00	0.11		0.27	0.07	--	5.50	--	0.17
Nitrate	10	10.00	--	--		< 0.04	0.16	--	0.47	--	0.19
Nitrite	1	1.00	--	--		< 0.06	< 0.04	--	< 0.04	--	< 0.04
Phosphate	--	--	117.18	0.29		< 0.28	< 0.31	--	< 0.31	--	< 0.31
Sulfate	--	250 [c]	1400.00	8.00		75.07	49.22	--	7.07	--	17.92
Physical Data (Unit)		**(Unit)**									
Alkalinity (mg/L)	--	--	--	--		--	80	--	240	--	--
Hardness (mg/L)	--	--	--	--		--	120	--	250	--	--
Total Dissolved Solids (g/L)	--	--	--	--		--	--	--	--	--	1.07
Field Measurements											
pH (pH unit)	--	6.5 - 8.5 [1]	--	--		--	8.4	--	7.2	--	7.1
Conductivity (mS/Cm)	--	--	--	--		--	176	--	1749	--	2150
Temperature (C°)	--	--	--	--		--	13	--	--	--	--
Total Organic Carbon (mg/L)											
TOC	--	--	--	--		--	--	--	22.62	--	47.39

Notes:
--: Not analyzed
5004.24 Results Exceeds a NPDWR or NSDWR
All VOC and SVOC results were non-detect. Full results are available in Appendix C.

a: Alaska Department of Environmental Health and Department of Environmental Conservation, Water Quality Standards for Surface Water Monitoring at Landfiles, most stringent standars in 18 AAC 70 and the *Alaska Water Quality Criteria Manual for Toxic and Other Deleterious Organic and Inorganic Substances*

b: United States Drinking Water Maximum Contaminant Levels, National Primary Drinking Water Regulations

c: National Secondary Drinking Water Standards (non-enforceable)
d: Samples collected wth Rigid Porous Polyethylene (RPP) passive samplers.

Parameters	Water Quality Criteria for Toxics and Other Deleterious Substances: Drinking Water[a]	US EPA Drinking Water MCLs[b]	USEPA 1998 Range of Leachate		Location	FYUPZ-03				FYUPZ-04				
			Maximum	Minimum	Sample Date	5/23/2011	8/18/2011	8/18/2011	9/8/2011	6/23/2010	5/23/2011	8/18/2011	8/18/2011	9/8/2011
Inorganic Cation (mg/L)	**(µg/L)**	**(µg/L)**	**ppb**	**ppb**		**Metal (total)**	**Metal (total)**	**Metal (dissolved)**	**Metal (total)**	**Metal (total)**	**Metal (total)**	**Metal (total)**	**Metal (dissolved)**	**Metal (total)**
Aluminum	--	50 [c]	5800	10		325.30	37.90	5.2	4195.75	3440.76	3305.28	4106.49	< 1.22	597.42
Antimony	6	6	--	--		< 1.72	< 1.72	< 1.72	< 1.72	1.22	< 1.72	< 1.72	< 1.72	< 1.72
Arsenic	10	10	982	0.2		6.13	7.22	< 0.37	6.15	7.33	5.47	< 0.37	< 0.37	< 0.37
Barium	2000	2000	5000	80		65.36	74.94	5.1	111.37	358.01	199.32	399.32	1.6	119.74
Beryllium	4	4	--	--		3.98	0.46	< 0.01	0.48	0.55	4.26	< 0.01	< 0.01	< 0.01
Cadmium	5	5	150	0.7		< 0.38	< 0.38	< 0.38	< 0.38	0.52	< 0.38	< 0.38	< 0.38	< 0.38
Calcium	--	--	--	--		289725.94	130039.77	10312.8	128900.47	179160.89	123839.82	68096.20	1659.3	41541.42
Chromium	100	100	1900	0.5		14.08	< 0.29	< 0.29	< 0.29	25.95	16.28	18.10	< 0.29	< 0.29
Cobalt	--	--	--	--		18.74	< 0.93	< 0.93	< 0.93	14.19	14.30	12.66	< 0.93	< 0.93
Copper	--	1300	2800	3		54.76	< 1.85	< 1.85	< 1.85	19.81	43.89	59.38	< 1.85	< 1.85
Iron	--	300 [c]	--	--		47135.07	5462.26	< 52.48	54737.37	76903.67	155745.08	239572.27	< 52.48	44873.50
Lead	--	15	1600	5		< 0.90	< 0.90	< 0.90	38.69	13.52	15.07	19.71	< 0.90	< 0.90
Magnesium	--	--	--	--		113039.31	32310.20	3522.7	42811.01	157066.85	183252.66	112497.02	3971.3	100278.26
Manganese	--	50 [c]	79000	30		2546.61	1848.22	52.5	1246.85	1816.35	1553.21	2029.73	2.1	409.89
Molybdenum	--	--	--	--		16.94	< 0.60	0.91	7.20	4.39	6.26	< 0.60	2.7	< 0.60
Nickel	--	--	--	--		165.03	24.56	< 2.04	< 2.04	132.29	77.37	< 2.04	< 2.04	< 2.04
Potassium	--	--	--	--		8825.08	6725.95	180.3	4804.81	42639.43	8164.84	4680.46	349.5	4051.36
Selenium	50	50	--	--		< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Silicon	--	--	--	--		5635.39	6070.64	< 167.06	10705.68		7901.21	9478.91	< 167.06	< 167.06
Silver	--	100 [c]	--	--		< 0.83	< 0.83	< 0.83	< 0.83	< 0.14	< 0.83	< 0.83	< 0.83	< 0.83
Sodium	--	--	2574000	12000		658495.48	135335.96	24122.5	316925.56	181616.05	162069.20	58720.19	6181.4	43215.77
Thallium	2	2	--	--		< 1.33	< 1.33	< 1.33	< 1.33	< 0.84	< 1.33	< 1.33	< 1.33	< 1.33
Thorium	--	--	--	--		< 1.18	< 1.18	< 1.18	11.97	1.05	< 1.18	< 1.18	< 1.18	< 1.18
Uranium	30	30	--	--		9.04	< 0.23	1.2	16.90	37.72	11.50	10.60	< 0.23	< 0.23
Vanadium	--	--	--	--		< 1.80	< 1.80	< 1.80	< 1.80	23.62	18.04	< 1.80	< 1.80	< 1.80
Zinc	--	5000 [c]	350000	30		922.45	< 1.26	< 1.26	5506.78	503.68	4116.88	433.57	< 1.26	376.36
Mercury														
Mercury	--	--	--	--		--	--	--	--	< 0.20	--	--	--	--
TPH Silica Gel HEM (mg/L)														
TPH	--	--	--	--		--	--	--	--	< 9.60	--	--	--	--

Parameters	Water Quality Criteria for Toxics and Other Deleterious Substances: Drinking Water[a]	US EPA Drinking Water MCLs[b]	USEPA 1998 Range of Leachate		Location	FYUPZ-03				FYUPZ-04				
			Maximum	Minimum	Sample Date	5/23/2011	8/18/2011	8/18/2011	9/8/2011	6/23/2010	5/23/2011	8/18/2011	8/18/2011	9/8/2011
Inorganic Anion (mg/L)		**(mg/L)**	**ppm**	**ppm**										
Bromide	--	--	--	--		< 0.07	< 0.07	--	< 0.07	--	--	< 0.07	--	0.13
Chloride	--	250 [c]	5475.00	31.00		99.33	524.87	--	125.92	--	--	28.06	--	43.47
Fluoride	4	4.00	302.00	0.11		0.12	0.36	--	0.42	--	--	0.25	--	0.42
Nitrate	10	10.00	--	--		< 0.30	0.74	--	0.31	--	--	0.62	--	0.20
Nitrite	1	1.00	--	--		<0.04	< 0.04	--	< 0.04	--	--	< 0.04	--	< 0.04
Phosphate	--	--	117.18	0.29		< 0.31	< 0.31	--	< 0.31	--	--	< 0.31	--	< 0.31
Sulfate	--	250 [c]	1400.00	8.00		438.41	1573.21	--	331.42	--	--	35.56	--	27.49
Physical Data (Unit)		**(Unit)**												
Alkalinity (mg/L)	--	--	--	--		40	120	--	--	399.00	--	240.0	--	--
Hardness (mg/L)	--	--	--	--		120	180	--	--	--	--	425	--	--
Total Dissolved Solids (g/L)	--	--	--	--		--	--	--	0.74	676.00	--	--	--	0.42
Field Measurements														
pH (pH unit)	--	6.5 - 8.5 [1]	--	--		7.2	7.5	--	7.4	--	--	7.8	--	8.7
Conductivity (mS/Cm)	--	--	--	--		1071	1237	--	1480	--	--	688	--	850
Temperature (C°)	--	--	--	--		14	--	--	--	--	--	--	--	6.5
Total Organic Carbon (mg/L)														
TOC	--	--	--	--		--	111.6	--	48.69	59.40	--	56.48	--	42.4

Notes:
--: Not analyzed
5004.24 Results Excceds a NPDWR or NSDWR
All VOC and SVOC results were non-detect. Full results are available in Appendix C.

a: Alaska Department of Environmental Health and Department of Environmental Conservation, Water Quality Standards for Surface Water Monitoring at Landfiles, most stringent standards in 18 AAC 70 and the *Alaska Water Quality Criteria Manual for Toxic and Other Deleterious Organic and Inorganic Substances*

b: United States Drinking Water Maximum Contaminant Levels, National Primary Drinking Water Regulations

c: National Secondary Drinking Water Standards (non-enforceable)
d: Samples collected wth Rigid Porous Polyethylene (RPP) passive samplers.

Parameters	Water Quality Criteria for Toxics and Other Deleterious Substances: Drinking Water[a]	US EPA Drinking Water MCLs[b]	USEPA 1998 Range of Leachate		Location	FYUSUMP-01			FYUSUMP-02			FYUSP-01	FT. YUKON PUBLIC WATER SYSTEM AK2360256
			Maximum	Minimum	Sample Date	8/18/2011[d]	8/18/2011[d]	9/8/2011	8/18/2011[d]	8/18/2011[d]	9/8/2011	6/23/2010	
Inorganic Cation (mg/L)	(µg/L)	(µg/L)	ppb	ppb		Metal (total)	Metal (dissolved)	Metal (total)	Metal (total)	Metal (dissolved)	Metal (total)	Metal (total)	
Aluminum	--	50 [c]	5800	10		82134.15	< 1.22	456.18	46841.05	< 1.22	22.11	127.48	--
Antimony	6	6	--	--		< 1.72	< 1.72	< 1.72	< 1.72	< 1.72	1.86	2.99	0
Arsenic	10	10	982	0.2		< 0.37	< 0.37	< 0.37	5.21	< 0.37	2.54	0.36	0.606
Barium	2000	2000	5000	80		234.04	32.14	961.97	310.32	13.9	163.87	291.64	--
Beryllium	4	4	--	--		2.87	< 0.01	< 0.01	5.30	< 0.01	< 0.01	< 0.28	0
Cadmium	5	5	150	0.7		< 0.38	< 0.38	< 0.38	< 0.38	< 0.38	< 0.38	< 0.07	--
Calcium	--	--	--	--		9242.60	14607.31	221078.06	332585.46	16932.9	147413.82	< 16.38	--
Chromium	100	100	1900	0.5		33.01	< 0.29	< 0.29	121.23	< 0.29	< 0.29	< 0.11	--
Cobalt	--	--	--	--		9.56	< 0.93	< 0.93	54.80	< 0.93	4.85	2.05	--
Copper	--	1300	2800	3		52.02	< 1.85	< 1.85	116.23	< 1.85	3.15	< 0.31	--
Iron	--	300 [c]	--	--		180035.14	565.68	10169.23	40872.93	251.8	2210.70	< 11.51	--
Lead	--	15	1600	5		19.45	< 0.90	< 0.90	27.04	< 0.90	< 0.90	4.76	--
Magnesium	--	--	--	--		2445.06	18203.50	171282.62	91494.59	11528.7	89476.39	142323.73	--
Manganese	--	50 [c]	79000	30		1150.20	76.00	2031.37	2378.50	95.0	4999.23	1359.42	--
Molybdenum	--	--	--	--		< 0.60	< 0.60	< 0.60	< 0.60	< 0.60	3.41	2.29	--
Nickel	--	--	--	--		52.67	3.47	< 2.04	383.76	3.2	20.01	32.34	2.57
Potassium	--	--	--	--		1465.80	5476.06	70119.11	1018.28	11946.1	44333.62	55609.40	--
Selenium	50	50	--	--		< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	--
Silicon	--	--	--	--		50011.03	753.35	9079.80	33726.82	419.4	5676.04		--
Silver	--	100 [c]	--	--		< 0.83	< 0.83	< 0.83	< 0.83	< 0.83	< 0.83	< 0.14	--
Sodium	--	--	2574000	12000		5818.88	22573.65	208796.99	21720.92	15248.0	87044.58	298936.86	--
Thallium	2	2	--	--		< 1.33	< 1.33	< 1.33	< 1.33	< 1.33	< 1.33	< 0.84	0
Thorium	--	--	--	--		< 1.18	< 1.18	< 1.18	< 1.18	< 1.18	< 1.18	< 0.61	--
Uranium	30	30	--	--		8.41	0.28	< 0.23	22.59	0.8	2.63	< 0.23	--
Vanadium	--	--	--	--		49.35	< 1.80	< 1.80	81.09	< 1.80	< 1.80	< 0.57	--
Zinc	--	5000 [c]	350000	30		11882.55	2.12	156.59	1391.24	< 1.26	14.94	47.05	--
Mercury													
Mercury	--	--	--	--		--	--	--	--	--	--	< 0.20	--
TPH Silica Gel HEM (mg/L)													
TPH	--	--	--	--		--	--	--	--	--	--	< 9.60	--

Parameters	Water Quality Criteria for Toxics and Other Deleterious Substances: Drinking Water[a]	US EPA Drinking Water MCLs[b]	USEPA 1998 Range of Leachate		Location	FYUSUMP-01			FYUSUMP-02			FYUSP-01	FT. YUKON PUBLIC WATER SYSTEM AK2360256
			Maximum	Minimum	Sample Date	8/18/2011[d]	8/18/2011[d]	9/8/2011	8/18/2011[d]	8/18/2011[d]	9/8/2011	6/23/2010	
Inorganic Anion (mg/L)		(mg/L)	ppm	ppm									
Bromide	--	--	--	--		1.59	--	0.80	1.68	--	< 0.07	12.50	--
Chloride	--	250 [c]	5475.00	31.00		223.41	--	201.53	188.66	--	6.89	710.97	--
Fluoride	4	4.00	302.00	0.11		0.08	--	< 0.06	0.10	--	< 0.06	0.07	--
Nitrate	10	10.00	--	--		0.20	--	24.04	0.58	--	< 0.30	5.44	0.176[d]
Nitrite	1	1.00	--	--		< 0.04	--	< 0.04	< 0.04	--	< 0.04	< 0.06	--
Phosphate	--	--	117.18	0.29		< 0.31	--	< 0.31	< 0.31	--	< 0.31	< 0.28	--
Sulfate	--	250 [c]	1400.00	8.00		22.13	--	70.31	131.52	--	1.78	408.71	--
Physical Data (Unit)		(Unit)											
Alkalinity (mg/L)	--	--	--	--		240	--	--	240	--	--	318.00	--
Hardness (mg/L)	--	--	--	--		425	--	--	425	--	--	--	--
Total Dissolved Solids (g/L)	--	--	--	--		--	--	1.01	--	--	0.95	2330.00	--
Field Measurements													
pH (pH unit)	--	6.5 - 8.5 [1]	--	--		8.60	--	8.0	7.9	--	8.2	--	--
Conductivity (mS/Cm)	--	--	--	--		1990	--	1980	1812	--	1890	--	--
Temperature (C^{o})	--	--	--	--		6	--	10	7.1	--	8.00	--	--
Total Organic Carbon (mg/L)													
TOC	--	--	--	--		30.91	--	27.08	--	--	--	22.20	--

Notes:
--: Not analyzed
5004.24 Results Excceds a NPDWR or NSDWR
All VOC and SVOC results were non-detect. Full results are available in Appendix C.

a: Alaska Department of Environmental Health and Department of Environmental Conservation, Water Quality Standards for Surface Water Monitoring at Landfiles, most stringent standars in 18 AAC 70 and the *Alaska Water Quality Criteria Manual for Toxic and Other Deleterious Organic and Inorganic Substances*

b: United States Drinking Water Maximum Contaminant Levels, National Primary Drinking Water Regulations

c: National Secondary Drinking Water Standards (non-enforceable)
d: Samples collected wth Rigid Porous Polyethylene (RPP) passive samplers.

Parameters	Water Quality Criteria for Toxics and Other Deleterious Substances: Drinking Water[a]	US EPA Drinking Water MCLs[b]	USEPA 1998 Range of Leachate		Location	AETPZ-01	AETPZ-02		AETPZ-03	
			Maximum	Minimum	Sample Date	8/17/2011	8/17/2011	8/17/2011	8/17/2011	8/17/2011
Inorganic Cation (µg/L)	**(µg/L)**	**(µg/L)**	**ppb**	**ppb**		**Metal (total)**	**Metal (total)**	**Metal (dissolved)**	**Metal (total)**	**Metal (dissolved)**
Aluminum	--	50 [c]	5800	10		44156.48	32828.21	22.5	28499.56	< 1.22
Antimony	6	6	--	--		< 1.72	< 1.72	< 1.72	< 1.72	< 1.72
Arsenic	10	10	982	0.2		3.94	< 0.37	0.7	5.57	< 0.37
Barium	2000	2000	5000	80		283.87	1189.85	79.3	1243.83	84.8
Beryllium	4	4	--	--		3.61	4.41	< 0.01	2.17	< 0.01
Cadmium	5	5	150	0.7		< 0.38	< 0.38	< 0.38	< 0.38	< 0.38
Calcium	--	--	--	--		329397.58	203982.94	135025.5	286858.71	127680.2
Chromium	100	100	1900	0.5		134.18	67.26	1.1	69.15	4.0
Cobalt	--	--	--	--		52.11	44.49	1.7	55.79	< 0.93
Copper	--	1300	2800	3		129.06	175.69	< 1.85	281.82	< 1.85
Iron	--	300 [c]	--	--		37845.92	113452.99	1915.7	49729.81	< 52.48
Lead	--	15	1600	5		28.10	26.77	< 0.9	63.21	< 0.9
Magnesium	--	--	--	--		85046.89	30484.23	44460.2	52650.04	41868.6
Manganese	--	50 [c]	79000	30		2351.01	2787.10	450.2	4898.39	1761.2
Molybdenum	--	--	--	--		< 0.60	< 0.6	4.3	< 0.6	< 0.6
Nickel	--	--	--	--		323.24	152.75	40.6	143.18	30.2
Potassium	--	--	--	--		1031.61	265.64	333.6	1199.47	7441.1
Selenium	50	50	--	--		< 0.50	< 0.5	LOD	< 0.5	< 0.5
Silicon	--	--	--	--		32778.48	21997.05	1469.4	33193.59	2696.6
Silver	--	100 [c]	--	--		< 0.83	< 0.83	< 0.83	< 0.83	< 0.83
Sodium	--	--	2574000	12000		20074.99	55687.54	14859.1	9957.41	16153.4
Thallium	2	2	--	--		< 1.33	< 1.33	< 1.33	< 1.33	< 1.33
Thorium	--	--	--	--		< 1.18	< 1.18	< 1.18	< 1.18	< 1.18
Uranium	30	30	--	--		21.58	6.29	7.8	< 0.23	< 0.23
Vanadium	--	--	--	--		82.63	25.22	< 1.8	50.41	< 1.80
Zinc	--	5000 [c]	350000	30		1439.76	6374.14	9.3	1353.60	< 1.26
Mercury										
Mercury	--	--	--	--		--	--	--	--	--

Parameters	Water Quality Criteria for Toxics and Other Deleterious Substances: Drinking Water[a]	US EPA Drinking Water MCLs[b]	USEPA 1998 Range of Leachate		Location	AETPZ-01	AETPZ-02		AETPZ-03	
			Maximum	Minimum	Sample Date	8/17/2011	8/17/2011	8/17/2011	8/17/2011	8/17/2011
Inorganic Anion (mg/L)		**(mg/L)**	**ppm**	**ppm**						
Bromide	--	--	--	--		< 0.07	<0.07	--	< 0.07	--
Chloride	--	250 [c]	5475.00	31.00		10.18	19.70	--	6.07	--
Fluoride	4	4.00	302.00	0.11		0.13	0.40	--	0.12	--
Nitrate	10	10.00	--	--		< 0.3	0.21	--	< 0.3	--
Nitrite	1.00	1.00	--	--		< 0.04	11.52	--	< 0.04	--
Phosphate	--	--	117.18	0.29		< 0.31	<0.31	--	< 0.31	--
Sulfate	--	250 [c]	1400.00	8.00		246.30	65.08	--	6.94	--
Physical Data (Unit)		**(Unit)**								
Alkalinity (mg/L)	--	--	--	--		240	180	--	240	--
Hardness (mg/L)	--	--	--	--		240	120	--	425	--
Field Measurements										
Conductivity (mS/Cm)	--	--	--	--		899	439.3	--	484.8	--
pH (pH unit)	--	6.5 - 8.5 [1]	--	--		7.4	7.4	--	7.2	--
Temperature (C^o)	--	--	--	--		17.6	17.9	--	13.1	--
Total Organic Carbon (mg/L)										
TOC	--	--	--	--		34.46	71.25	--	195.04	--

Notes:
--: Not analyzed
5004.24 Results Exceeds a NPDWR or NSDWR

a: Alaska Department of Environmental Health and Department of Environmental Conservation, Water Quality Standards for Surface Water Monitoring at Landfiles, most stringent standars in 18 AAC 70 and the *Alaska Water Quality Criteria Manual for Toxic and Other Deleterious Organic and Inorganic Substances*

b: United States Drinking Water Maximum Contaminant Levels, National Primary Drinking Water Regulations

c: National Secondary Drinking Water Standards (non-enforceable)

Parameters	Water Quality Criteria for Toxics and Other Deleterious Substances: Drinking Water[a]	US EPA Drinking Water MCLs[b]	USEPA 1998 Range of Leachate		Location	AETSUMP-01	AETSUMP-02		ALLAKAKET PUBLIC WATER SYSTEM AK2300816	YKSD - ALLAKAKET SCHOOL AK2300206
			Maximum	Minimum	Sample Date	6/17/2011	8/17/2011	8/17/2011		
Inorganic Cation (µg/L)	**(µg/L)**	**(µg/L)**	**ppb**	**ppb**		**Metal (total)**	**Metal (total)**	**Metal (dissolved)**		
Aluminum	--	50 [c]	5800	10		165.94	43.52	19.2	--	--
Antimony	6	6	--	--		< 1.72	< 1.72	< 1.72	0	--
Arsenic	10	10	982	0.2		8.23	6.79	< 0.37	0.249	0.405
Barium	2000	2000	5000	80		53.48	66.35	62.8	123	--
Beryllium	4	4	--	--		3.82	< 0.01	< 0.01	0	--
Cadmium	5	5	150	0.7		< 0.38	< 0.38	< 0.38	0	--
Calcium	--	--	--	--		82793.84	125315.41	133383.0	--	105
Chromium	100	100	1900	0.5		< 0.29	< 0.29	< 0.29	0.875	--
Cobalt	--	--	--	--		< 0.93	< 0.93	< 0.93	--	--
Copper	--	1300	2800	3		< 1.85	< 1.85	< 1.85	848	6260
Iron	--	300 [c]	--	--		3235.71	5007.01	2720.9	--	--
Lead	--	15	1600	5		< 0.9	< 0.9	< 0.9	8.97	20.5
Magnesium	--	--	--	--		19531.16	29527.53	33111.4	--	--
Manganese	--	50 [c]	79000	30		1715.01	1778.51	1945.4	--	--
Molybdenum	--	--	--	--		< 0.6	< 0.6	< 0.6	--	--
Nickel	--	--	--	--		< 2.04	< 2.04	21.8	2.24	--
Potassium	--	--	--	--		8302.98	6545.68	7165.6	--	--
Selenium	50	50	--	--		< 0.5	< 0.5	< 0.5	0	--
Silicon	--	--	--	--		6654.41	5700.76	5357.5	--	--
Silver	--	100 [c]	--	--		< 0.83	< 0.83	< 0.83	--	--
Sodium	--	--	2574000	12000		71645.35	124046.75	139455.9	--	--
Thallium	2	2	--	--		< 1.33	< 1.33	< 1.33	0	--
Thorium	--	--	--	--		< 1.18	< 1.18	< 1.18	--	--
Uranium	30	30	--	--		6.47	< 0.23	< 0.23	--	--
Vanadium	--	--	--	--		< 1.8	< 1.8	< 1.8	--	--
Zinc	--	5000 [c]	350000	30		112.95	< 1.26	< 1.26	--	--
Mercury										
Mercury	--	--	--	--		--	--	--	0	--

Parameters	Water Quality Criteria for Toxics and Other Deleterious Substances: Drinking Water[a]	US EPA Drinking Water MCLs[b]	USEPA 1998 Range of Leachate		Location	AETSUMP-01	AETSUMP-02		ALLAKAKET PUBLIC WATER SYSTEM AK2300816	YKSD - ALLAKAKET SCHOOL AK2300206
			Maximum	Minimum	Sample Date	6/17/2011	8/17/2011	8/17/2011		
Inorganic Anion (mg/L)		**(mg/L)**	**ppm**	**ppm**						
Bromide	--	--	--	--		< 0.07	< 0.07	--	--	--
Chloride	--	250 [c]	5475.00	31.00		44.89	109.79	--	--	--
Fluoride	4	4.00	302.00	0.11		0.35	2.27	--	0.249	--
Nitrate	10	10.00	--	--		< 0.3	< 0.3	--	0[d]	0[d]
Nitrite	1.00	1.00	--	--		< 0.04	< 0.04	--	--	--
Phosphate	--	--	117.18	0.29		< 0.31	< 0.31	--	--	--
Sulfate	--	250 [c]	1400.00	8.00		16.49	8.64	--	--	--
Physical Data (Unit)		**(Unit)**								
Alkalinity (mg/L)	--	--	--	--		--	180	--	--	331
Hardness (mg/L)	--	--	--	--		--	120	--	--	--
Field Measurements										
Conductivity (mS/Cm)	--	--	--	--		449.2	922	--	--	609
pH (pH unit)	--	6.5 - 8.5 [1]	--	--		7.2	7.8	--	--	--
Temperature (C^o)	--	--	--	--		18.6	14.6	--	--	--
Total Organic Carbon (mg/L)										
TOC	--	--	--	--		51.68	57.00	--	--	--

Notes:
--: Not analyzed
5004.24 Results Excceds a NPDWR or NSDWR

a: Alaska Department of Environmental Health and Department of Environmental Conservation, Water Quality Standards for Surface Water Monitoring at Landfiles, most stringent standards in 18 AAC 70 and the *Alaska Water Quality Criteria Manual for Toxic and Other Deleterious Organic and Inorganic Substances*

b: United States Drinking Water Maximum Contaminant Levels, National Primary Drinking Water Regulations

c: National Secondary Drinking Water Standards (non-enforceable)

OFFICE	DATE	DESIGNED BY	DRAWN BY	CHECKED BY	APPROVED BY	DRAWING NUMBER
Cincinnati, OH	5/10/12	--	JIS	KB	--	s-142829-4/12-2w

(Solinst, 2012)

Shaw Environmental, Inc.

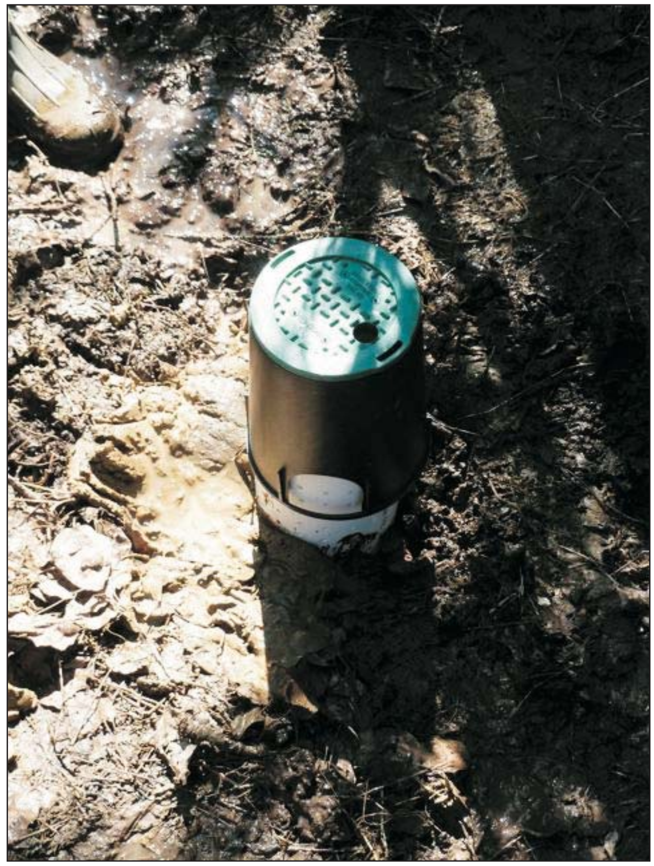
U.S. EPA

Figure 1-1

Piezometer installation procedure using a manual slide hammer.

OFFICE	DATE	DESIGNED BY	DRAWN BY	CHECKED BY	APPROVED BY	DRAWING NUMBER
Cincinnati, OH	5/10/12	--	JJS	KB	--	s-142829-4/12-2w

(Shaw, 2011)



(Shaw, 2011)

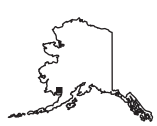
Shaw® Shaw Environmental, Inc.

U.S. EPA

Figure 1-2
Sump well design.

OFFICE: Cincinnati, OH | DATE: 4/23/12 | DESIGNED BY: -- | DRAWN BY: JJS | CHECKED BY: KB | APPROVED BY: -- | DRAWING NUMBER: S-142829-4/12-2W

N



QUADRANGLE LOCATION

0.0 | 0.5 | 1.0 miles

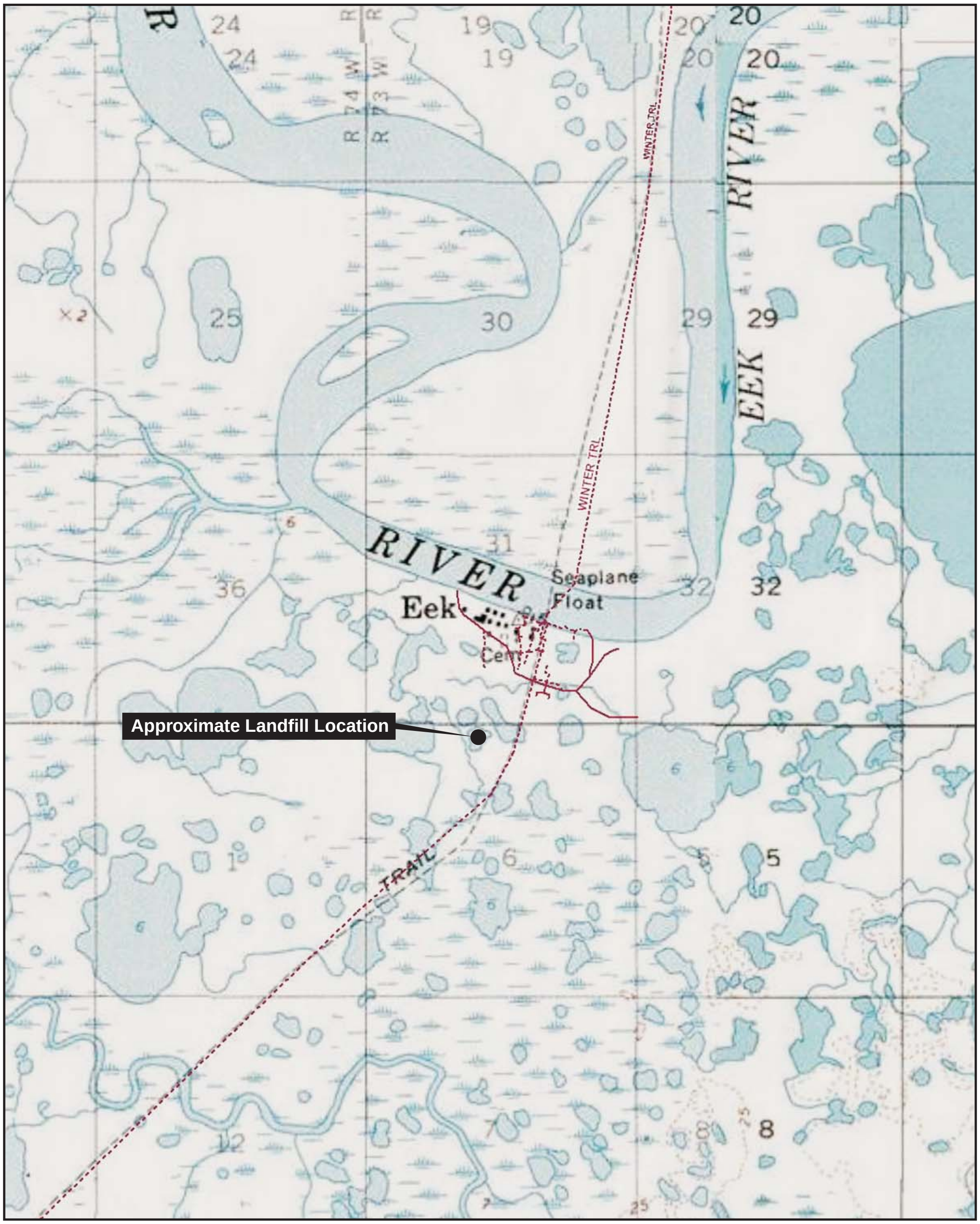
0.0 | 0.5 | 1.0 | 1.5 km

Shaw® Shaw Environmental, Inc.

U.S. EPA

Figure 3-1
Site Location Map

EKWOK, ALASKA



N

QUADRANGLE LOCATION

0.0	0.5	1.0	miles
0.0	0.5	1.0	1.5 km

Shaw® Shaw Environmental, Inc.

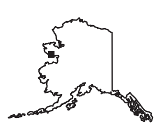
U.S. EPA

Figure 3-2
Site Location Map

EEK, ALASKA

OFFICE	DATE	DESIGNED BY	DRAWN BY	CHECKED BY	APPROVED BY	DRAWING NUMBER
Cincinnati, OH	4/23/12	--	JJS	KB	--	s-142829-4/12-2w

N



QUADRANGLE LOCATION

0.0	0.5	1.0	miles

0.0	0.5	1.0	1.5	km

Shaw® Shaw Environmental, Inc.

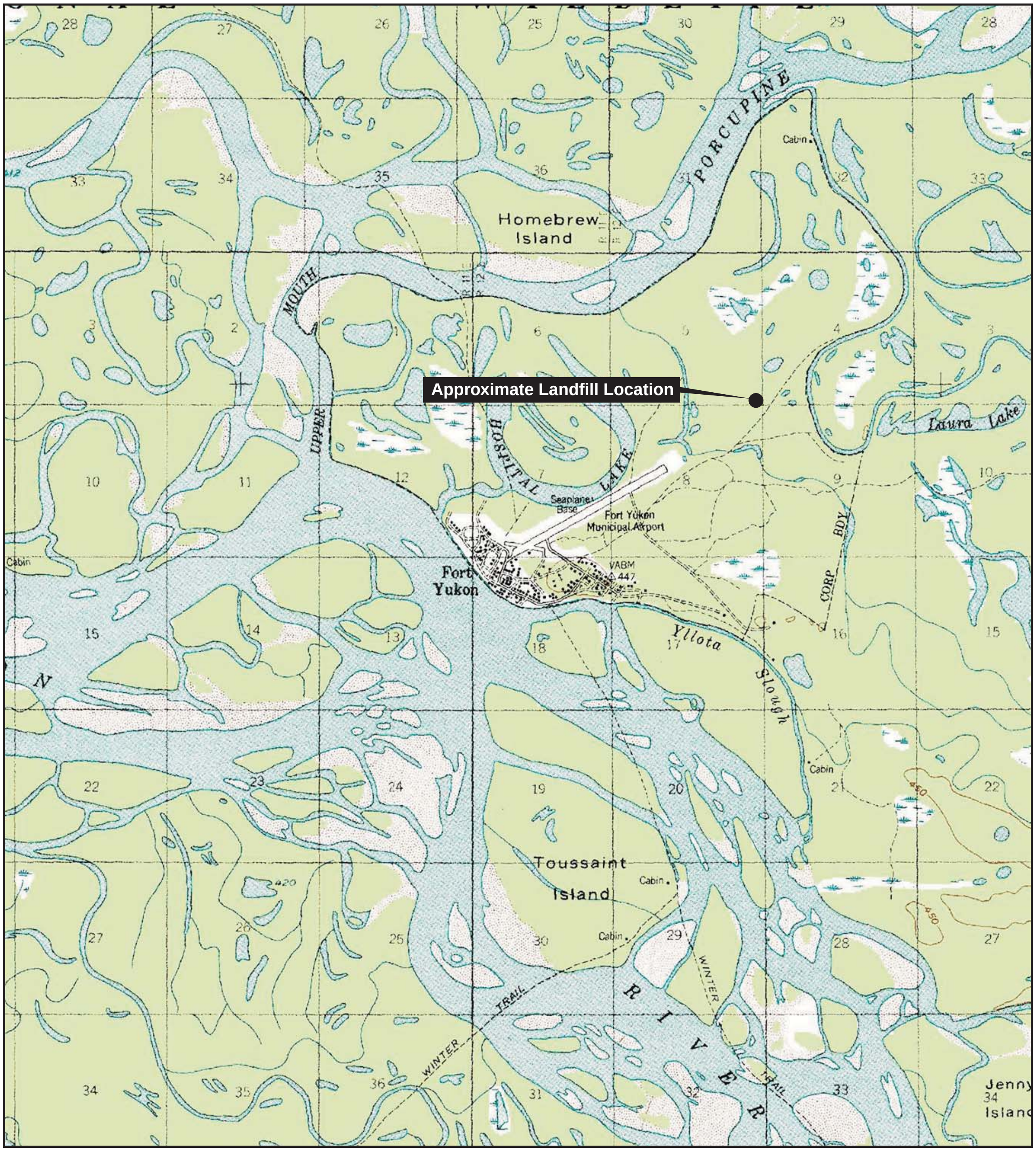
U.S. EPA

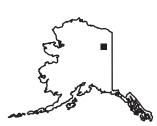
Figure 3-3
Site Location Map

WHITE MOUNTAIN, ALASKA

OFFICE	DATE	DESIGNED BY	DRAWN BY	CHECKED BY	APPROVED BY	DRAWING NUMBER
Cincinnati, OH	4/23/12	--	JIS	KB	--	s-142829-4/12-2w

OFFICE	DATE	DESIGNED BY	DRAWN BY	CHECKED BY	APPROVED BY	DRAWING NUMBER
Cincinnati, OH	4/23/12	--	JJS	KB	--	s-142829-4/12-1w




QUADRANGLE LOCATION

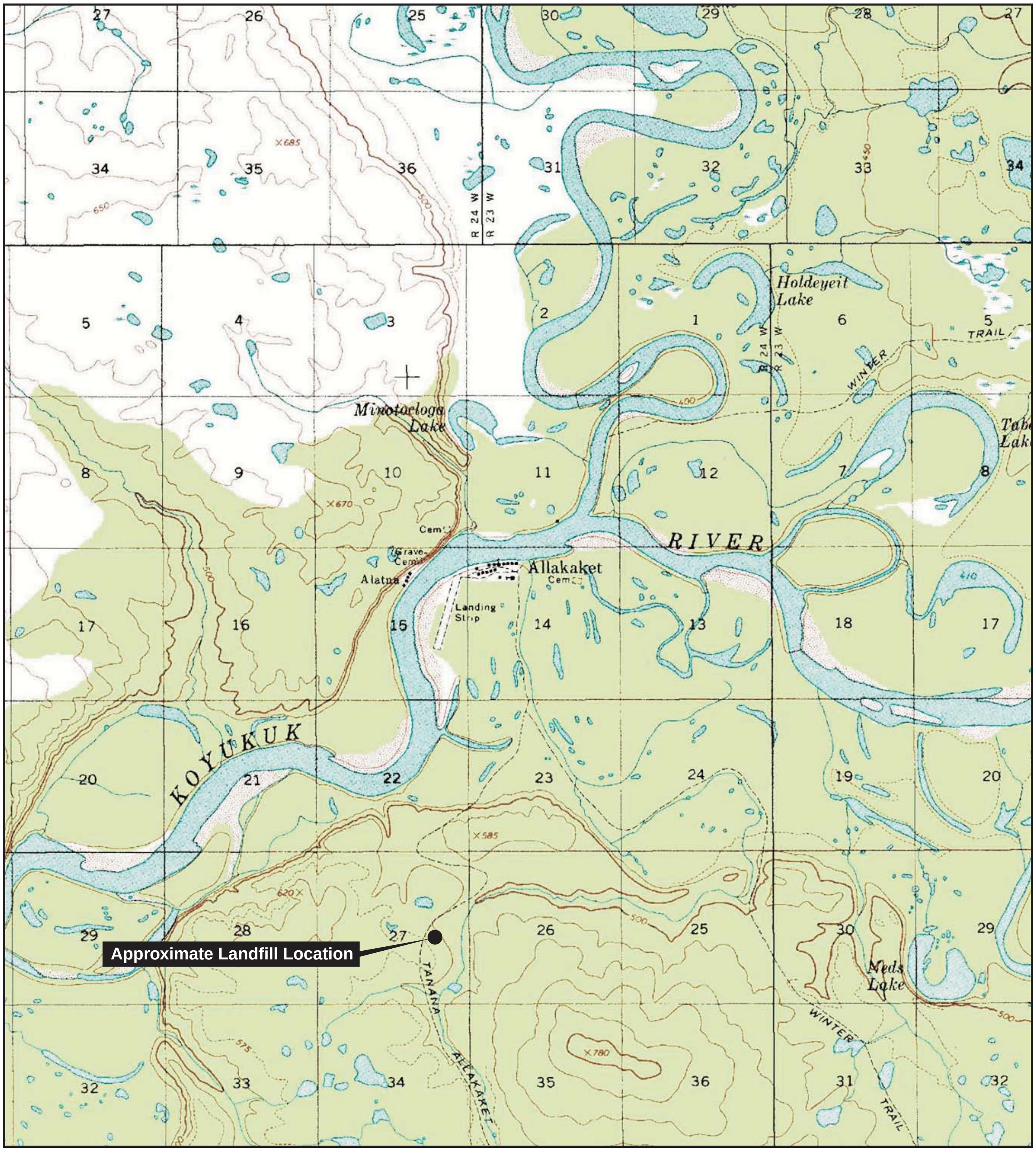
Shaw Environmental, Inc.

U.S. EPA

Figure 3-4
Site Location Map

FORT YUKON, ALASKA

OFFICE	DATE	DESIGNED BY	DRAWN BY	CHECKED BY	APPROVED BY	DRAWING NUMBER
Cincinnati, OH	4/23/12	--	JIS	KB	--	S-142829-4/12-2W



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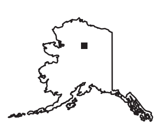

QUADRANGLE LOCATION

MILES

0 1 2

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U.S. EPA

Figure 3-5

Site Location Map

ALLAKAKET, ALASKA

Legend

- Drinking Water Wells (Approx.)
- Piezometer
- Surface Water Sample
- Landfill Boundary

Reference:
Aerial photo by Alaska Mapped and the Statewide Digital Mapping Initiative.

Coordinate System: NAD 1983 State Plane Alaska 6 FIPS 5006 Feet

Note:
Approximate Distance Between Landfill and Drinking Water Wekks = 4,000 Feet

Feet

0 350 700 1,400

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EPA

Figure 4-1
Ekwok Site Map with Drinking Water Wells, Landfill, Piezometers, and Surface Water Sampling Locations

DRAWING NUMBER	142829-03.mxd
APPROVED BY	SP
CHECKED BY	KB
DRAWN BY	MSN
DESIGNED BY	--
DATE	5/22/12
OFFICE	Cincinnati, OH

User: srinivas.panguluri Path: C:\CAD-GIS\AcadGIS 2012\142829 WA 07\GIS_Documents\Project_Maps\Ekwok.mxd Date: 6/3/2012 Time: 7:41:41 PM

Legend

- Drinking Water Well
- Piezometer
- Surface Water Sample
- Landfill Boundary

Note:
Approximate Distance Between Landfill and Drinking Water Well = 1,100 feet

Reference:
Aerial photo by Alaska Mapped and the Statewide Digital Mapping Initiative.

Map Coordinate System: NAD 1983 State Plane Alaska 7 FIPS 5007 Feet

Feet
0 200 400 800

Shaw Shaw Environmental, Inc.

EPA

Figure 4-2
Eek Site Map with Drinking Water Well Landfill, Piezometers, and Surface Water Sampling Locations

OFFICE	Cincinnati, OH
DATE	5/22/12
DESIGNED BY	--
DRAWN BY	MSN
CHECKED BY	KB
APPROVED BY	SP
DRAWING NUMBER	142829-02.mxd

User: srinivas.panguluri Path: C:\CAD-GIS\AcadGIS 2012\142829 WA 07\GIS_Documents\Project_Maps\Eek.mxd Date: 6/3/2012 Time: 6:37:46 PM

Legend

- Water Wells (Approx.)
- Piezometer
- Surface Water Sample
- Sump Wells
- Landfill Boundary

Reference:
Aerial photo by Alaska Mapped and the Statewide Digital Mapping Initiative.

Coordinate System: NAD 1983 State Plane Alaska 7 FIPS 5007 Feet

Note:
Approximate Distance Between Landfill and Drinking Water Wells is = 1,700 Feet

Feet
0 150 300 600

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EPA

Figure 4-3
White Mountain Site Map with Drinking Water Wells, Landfill, Piezometer, Sump, and Surface Water Sampling Locations

DRAWING NUMBER	142829-05.mxd
APPROVED BY	SP
CHECKED BY	KB
DRAWN BY	MSN
DESIGNED BY	--
DATE	5/22/12
OFFICE	Cincinnati, OH

Legend
- Drinking Water Intake
- Piezometer
- Sump
- Seep
- Surface Water Sample
- Landfill Boundary

Reference:
Aerial photo by Alaska Mapped and the Statewide Digital Mapping Initiative.

Coordinate System: NAD 1983 StatePlane Alaska 3 FIPS 5003 Feet

Note:
Distance Between Landfill and the Drinking Water Intake = 8,100 Feet

Feet
0 750 1,500 3,000

Shaw® Shaw Environmental, Inc.

EPA

Figure 4-4
Fort Yukon Site Map with Drinking Water Intake, Piezometers, Sump, Seep, and Surface Water SampleLocations

OFFICE	DATE	DESIGNED BY	DRAWN BY	CHECKED BY	APPROVED BY	DRAWING NUMBER
Cincinnati, OH	5/22/12	--	MSN	KB	SP	142829-04.mxd

User: srinivas.panguluri Path: C:\CAD-GIS\AcadGIS 2012\142829 WA 07\GIS_Documents\Project_Maps\FortYukon.mxd Date: 6/3/2012 Time: 8:41:28 PM

Legend

- Drinking Water Intake
- Piezometer
- Sump
- Surface Water Sample
- Landfill Boundary

Note:
Distance between landfill and the drinking water intake = 7,116 feet

Reference:
Aerial photo by Alaska Mapped and the
Statewide Digital Mapping Initiative.

Coordinate System: NAD 1983 State Plane Alaska 5 FIPS 5005 Feet

N

Feet
0 500 1,000 2,000

Shaw® Shaw Environmental, Inc.

EPA

Figure 4-5
Allakaket Site Map with Drinking Water Intake, Landfill, Piezometer, Sump, and Surface Water Sampling Locations

OFFICE	DATE	DESIGNED BY	DRAWN BY	CHECKED BY	APPROVED BY	DRAWING NUMBER
Cincinnati, OH	5/22/12	--	MSN	KB	SP	142829-01.mxd

User: srinivas.panguluri Path: C:\CAD-GIS\AcadGIS 2012\142829 WA 07\GIS_Documents\Project_Maps\Allakaket.mxd Date: 6/3/2012 Time: 3:58:35 PM

APPENDIX A
RARE SITE BACKGROUND INFORMATION

APPENDIX A.i.
EKWOK RARE SITE BACKGROUND INFORMATION

To: Joe Sarcone

From: Lorraine King
Environmental Coordinator

Date: 11/10/08

Re: Survey form

pgs: 3

R.A.R.E. Opportunity

Regional Applied Research Effort, U.S. Environmental Protection Agency

The EPA, Office of Research and Development and the EPA, Alaska Operations Office are partnering to look at how contaminants in leachate from open dumps may harm the environment especially drinking water sources. The EPA resources for the project are limited but we think this can be a good start in looking at the relationship between dump site leachate and impacts to our environment. There is the opportunity for EPA to partner with five villages on the project.

Five different types of dump site conditions are needed for the project: 1) a dump site in dug up tundra; 2) a dump site mostly on top of the tundra; 3) a dump site in a tundra pond; 4) a dump site in ground that is not tundra where there is a short distance (twenty-five feet or less) to ground water; and 4) a dump site in ground that is not tundra where there is a longer distance (twenty-five feet or more) to ground water.

If you think your village may be interested in participating in the project please complete this form and return it to either Michelle Davis or Joe Sarcone of the EPA, Alaska Operations Office. Our fax number is (907) 271-3424. Thanks.

Name of Village: Ekwok

Contact Person: Lorraine King

Email address: king2lorraine@yahoo.com

Telephone number: (907) 464-3300

IGAP program: yes X no ___

Owner/operator of dump site (for example: the city government):
City of Ekwok

Owner of the land the dump site is located on (for example: the corporation):
Ekwok Natives Limited

Age of the dump site:
20+ years

Distance of the dump site to the village:

Distance of the dump site to a drinking water source (this could be the source of water for your watering point/washeteria or it could be a traditional water source such as river, tundra pond, spring, or ice): The distance of the dump site to a drinking water source is about 1/4 mile.

Distance of dump from a source of subsistence (for example, a river or slough or a berry picking area): Distance from a stream is 1/8 ~~feet~~ mile from the dump.

Type of dump site condition, Please circle one:

1) dump site in dug up tundra;

2) dump site mostly on top of the tundra;

3) dump site in a tundra pond;

4) dump site in ground that is not tundra where there is a short distance (twenty-five feet or less) to ground water;

5) dump site in ground that is not tundra where there is a longer distance (twenty-five feet or more) to ground water.

6) other (please describe)

Additional information you would like for us to know:
Our dump site has been in existance for approx. 20+
Years and is ready to be relocated. It would
be great to find out if this ~~[illegible]~~ dump has/is
affecting our drinking water, due to the fact that
our dump is above our community with a lot
of low wells below it. Thank you for this
opportunity.

Additional information requested for the RARE (Regional Applied Research Effort) project field assessment. (7/27/09)

It would be very helpful if your Tribe could provide the RARE technical team with information to help them understand conditions at your landfill. This information will help us determine the extent of the field work to be performed at each site. It is especially important for us to have as much understanding as possible of the hydrology (water flow) at each dump site. How does water move on, through and under the site? Answers to these questions will give us a better understanding of the hydrology. We would like to request:

- **Photos of your site.** (digital camera images are best for to the engineers and scientists working on the project). We would like at least 4-5 photos, one from each side of the site. We recommend that you send batches of 4-5 pictures at a time, due to server limitations. Also, please put a note on each photo that gives us some information about where they were taken, and which way water may flow from that location. **Please e-mail these to Ted Jacobson @ tjacobson@ruralcap.com**

Then, fill out rest of this worksheet and fax it attention Ted Jacobsen at (800) 478-6343. If you have transmission problems, call him at (907) 865-7363. Please feel free to attach other information, or additional pages that may help us to better understand site conditions.

- Is there standing water in the dump site? The open dump is always covered with garbage and has gotten worse since the last year therefore, it is not noted if there is standing water in the dump site. (trench)

- Is the standing water present year round or seasonally such as just at break-up? It is noted that there is puddles on a seasonal bases after a thaw and after a heavy rainfall during the spring and summer.

- Does the dump site flood? About how often? Our dump site doesn't flood.

- When there is water in the site does it flow over the top of the ground and through the site (sheet flow) or does it stand in puddles or ponds in the site, or both? It is difficult to tell if there is water in the trench. We are unable to see the bottom of the trench because of overflow of garbage in it When the ground thaws, there are puddles of water around the site where there's been four wheelers and truck imprints left in the mud around the inside parameters of the unfenced dump site.

- If you were to dig a hole at the dump site, how deep would you have go before you hit ground water? You would have to dig between 20-32 feet before you hit ground water.

- If there is permafrost under the site, how deep would you have to dig before you hit permafrost? There is no permafrost here.

- About how large is the dump site (use the measure you are most familiar with to make this estimate such acres, square feet, square meters). 70 yards by 40 yards

- How old is your dump? Our dump site is about 30+ years old

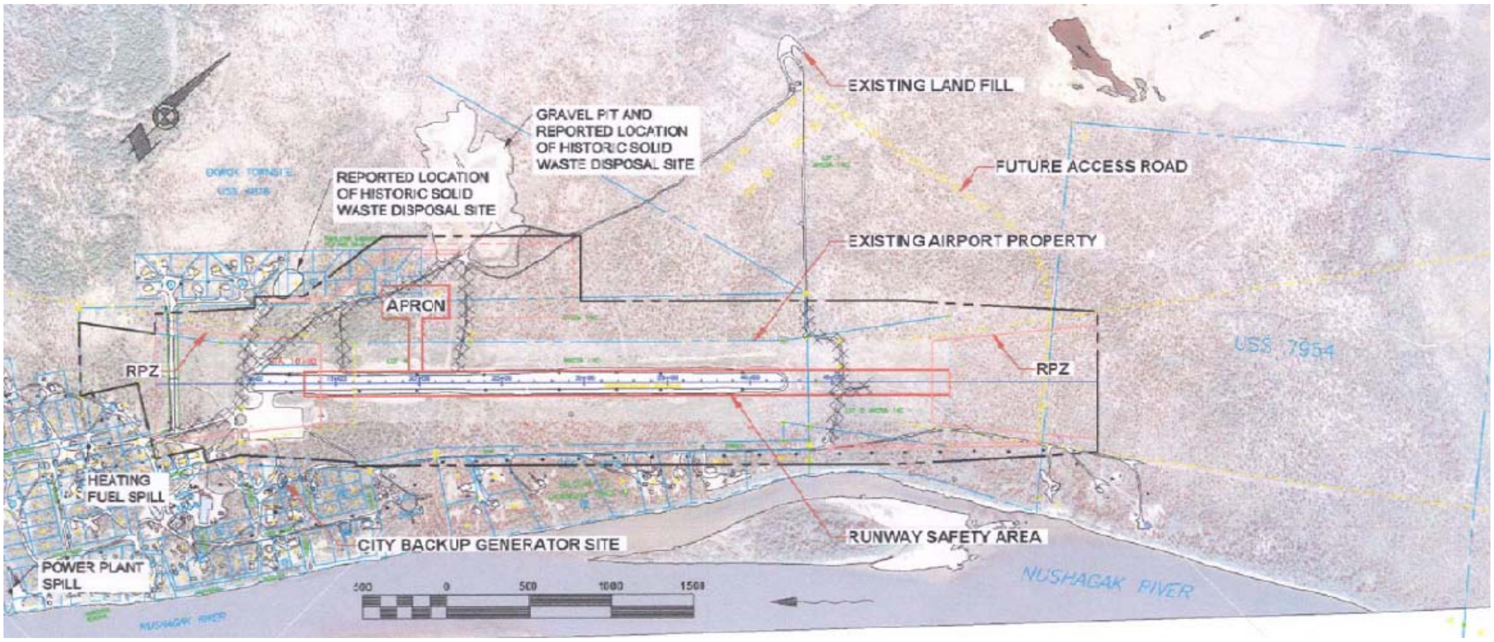
- About how deep is it? About 10 feet deep

On a separate page, please draw a rough sketch of your dump site and give the dimensions, show any surface water rivers, sloughs, or ponds that may be near by, indicate north-south east-west, and draw an arrow or arrows in the direction(s) you think that water flows over or under the dump site. Please fax this worksheet and map with the name of your village, a contact person and telephone number to Ted Jacobson at **(800) 478-6343**. Please feel free to call either Ted or Michelle Davis **(907 271-3434)** if you have questions.

Thank you!

RARE Village Information

Ekwok, AK (KEK)



Ekwok map showing historical and current waste disposal sites.

Contact: TBD

City of Ekwok: (907) 464-3336
Email: cityofekwok@yahoo.com

Landfill: Class 3; open dump; approximately 1.5 miles NW of airstrip; unpermitted; collection service provided
Community water: Provided by individual wells
Sewage systems: both piped septic and piped sewage systems are used
Access: Coastal; air
Local Transportation: Skiffs, ATVs, Snowmachines

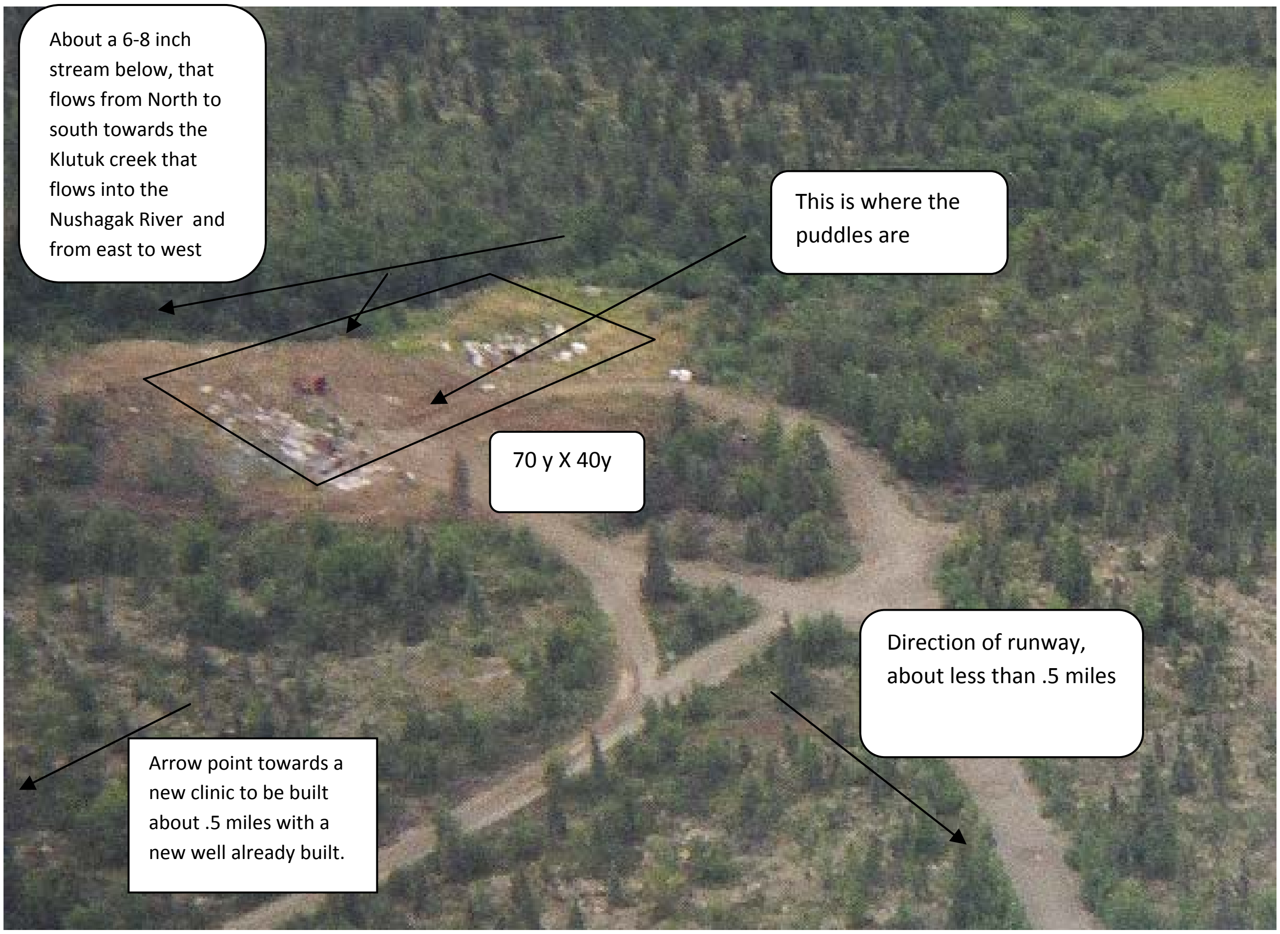
Sources: http://www.commerce.state.ak.us/dca/profiles/profile-maps.htm; http://www.commerce.state.ak.us/dca/commdb/CF_CIS.htm
Last Updated July 23rd, 2009

Ekwok dump

April 29, 2009, spring thaw and stream below dump
Taken from dump site looking down a small hill (see aerial photo)

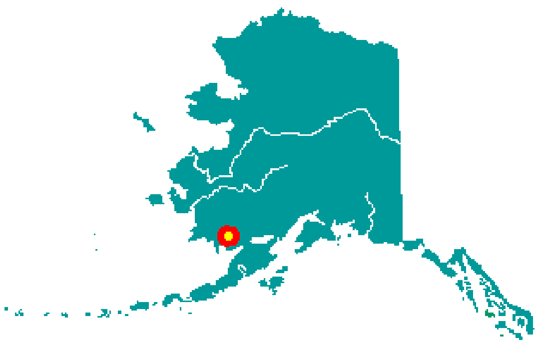
June 4, 2009, puddles after it rained
Taken standing northeast looking northwest

Aerial Photo of Ekwok Dump



The dump Lat/Long is 59 21’09”N; 157 28’42”W

Alaska Community Database Community Information Summaries (CIS)



Ekwok

(ECK-wock)

For Photos of Ekwok click here

For a Map of Ekwok click here

Current Population:	115 (2011 Alaska Department of Labor Estimate)
Incorporation Type:	2nd Class City
Located In:	Dillingham Census Area
Taxes:	Sales: None, Property: None, Special: None

Location and Climate

Ekwok is located along the Nushagak River, 43 miles northeast of Dillingham and 285 miles southwest of Anchorage. The community lies at approximately 59.349720° North Latitude and -157.475280° West Longitude. (Sec. 35, T009S, R049W, Seward Meridian.) Ekwok is located in the Bristol Bay Recording District. The area encompasses 16.0 sq. miles of land and 1.4 sq. miles of water.

Topographic map of Ekwok area

TopoZone.com

Ekwok is in a climatic transition zone. The primary influence is maritime, although a continental climate also affects the weather. Average summer temperatures range from 30 to 66 °F; winter temperatures average from 4 to 30 °F. Precipitation averages 20 to 35 inches each year. Extremely strong winds are common during winter months. Fog is prevalent during summer months. The river is ice-free from June through mid-November.

History, Culture and Demographics

Ekwok means "end of the bluff" and is the oldest continuously-occupied Yup'ik Eskimo village on the river. During the 1800s, the settlement was used in the spring and summer as a fish camp and in the fall as a base for berry picking. By 1923, it was the largest settlement along the river. In 1930, a BIA school was constructed. Mail was delivered by dog sled from Dillingham until a post office opened in Ekwok in 1941. Many of the earliest homes in Ekwok were located in a low flat area near the riverbank. After a severe flood in the early 1960s, villagers relocated to the current location on higher ground. The city was incorporated in 1974.

A federally-recognized tribe is located in the community -- the Ekwok Village. Ekwok is a Yup'ik Eskimo village with a fishing and subsistence lifestyle.

According to Census 2010, there were 51 housing units in the community and 37 were occupied. Its population was 90.4 percent American Indian or Alaska Native; 5.2 percent white; 4.4 percent of the local residents had multi-racial backgrounds. Additionally, 2.6 percent of the population was of Hispanic decent.

Facilities, Utilities, Schools and Health Care

Individual wells provide water for the majority of the community. 20 HUD homes have individual wells and a piped septic system. The city operates a piped sewage system with a sewage lift station, which connects to 16 additional residences. The remaining homes use septic systems or a flush/haul system; a sewage pumper is available. Thirty-six of 42 homes have complete plumbing. Refuse collection services are provided. Electricity is provided by Ekwok Electric. There is one school located in the community, attended by 16 students. Local hospitals or health clinics include Ekwok Clinic. Emergency Services have coastal and air access. Emergency service is provided by a health aide. Auxiliary health care is provided by Ekwok First Responders (907-464-3322).

Economy

A few residents trap. The entire population depends on subsistence activities for various food sources. Salmon, pike, moose, caribou, duck, and berries are harvested. Summer gardens are also popular, because families do not leave the village to fish for subsistence purposes. Most residents are not interested in participating in a cash economy. In 2010, 3 residents held commercial fishing permits in Ekwok. The village corporation owns a fishing lodge two miles downriver. Gravel is mined near the community.

The 2006-2010 American Community Survey (ACS) estimated 68[1] residents as employed. The public sector employed 26.5%[1] of all workers. The local unemployment rate was 8.1%[1]. The percentage of workers not in labor force was 40.8%[1]. The ACS surveys established that average median household income (in 2010 inflation-adjusted dollars) was $71,875 (MOE +/-$52,756)[1]. The per capita income (in 2010 inflation-adjusted dollars) was $23,636 (MOE +/-$5,116)[1]. About 17.2%[1] of all residents had incomes below the poverty level.

[1] All ACS statistics are published with their repective margin of error (MOE). Some of the statistics here are calculated from the original ACS data. The MOE was unable to be carried through the calculations.

For additional ACS information please click here.

For current Local Labor Market Information please click here

Transportation

Air transport is most frequently used to reach Ekwok. Regular and charter flights are available from Dillingham. The state-owned 3,300' long by 75' wide gravel runway was rebuilt and lengthened in 2005. Float planes land on the Nushagak River. Cargo is brought in during ice-free months from Dillingham by Coastal Marine Transport barge service. There are no docking facilities, but a barge off-loading area exists. Skiffs, ATVs, and snowmachines are used for local transportation to other villages.

Organizations with Local Offices

City - City of Ekwok
P.O. Box 49
Ekwok, AK 99580-0049
Phone 907-464-3311
Fax 907-464-3328
E-mail cityofekwok@yahoo.com

Electric Utility - City of Ekwok
P.O. Box 49
Ekwok, AK 99580-0049
Phone 907-464-3311
Fax 907-464-3328
E-mail cityofekwok@yahoo.com

Tribe - federally recognized - Ekwok Village
P.O. Box 70
Ekwok, AK 99580
Phone 907-464-3336
Fax 907-464-3378
E-mail ekwokvillagecouncil@starband.net
Web http://www.bbna.com

Village Corporation - Ekwok Natives Limited
P.O. Box 1189
Dillingham, AK 99576
Phone 907-464-3317
Fax 907-464-3305

Regional Organizations

School District - Southwest Region School District
P.O. Box 90
Dillingham, AK 99576
Phone 907-842-5287
Fax 907-842-5428
E-mail piazzad@swrsd.org
Web http://www.swrsd.org

Regional Native Corporation - Bristol Bay Native Corporation
111 W 16th Ave, Suite 400
Anchorage, AK 99501-6299
Phone 907-278-3602
Fax 907-276-3924
E-mail jasonmetrokin@bbnc.net
Web http://www.bbnc.net

Regional Native Health Corporation - Bristol Bay Area Health Corporation
P.O. Box 130
Dillingham, AK 99576
Phone 907-842-5201
Fax 907-842-9251
E-mail rclark@bbahc.org
Web http://www.bbahc.org

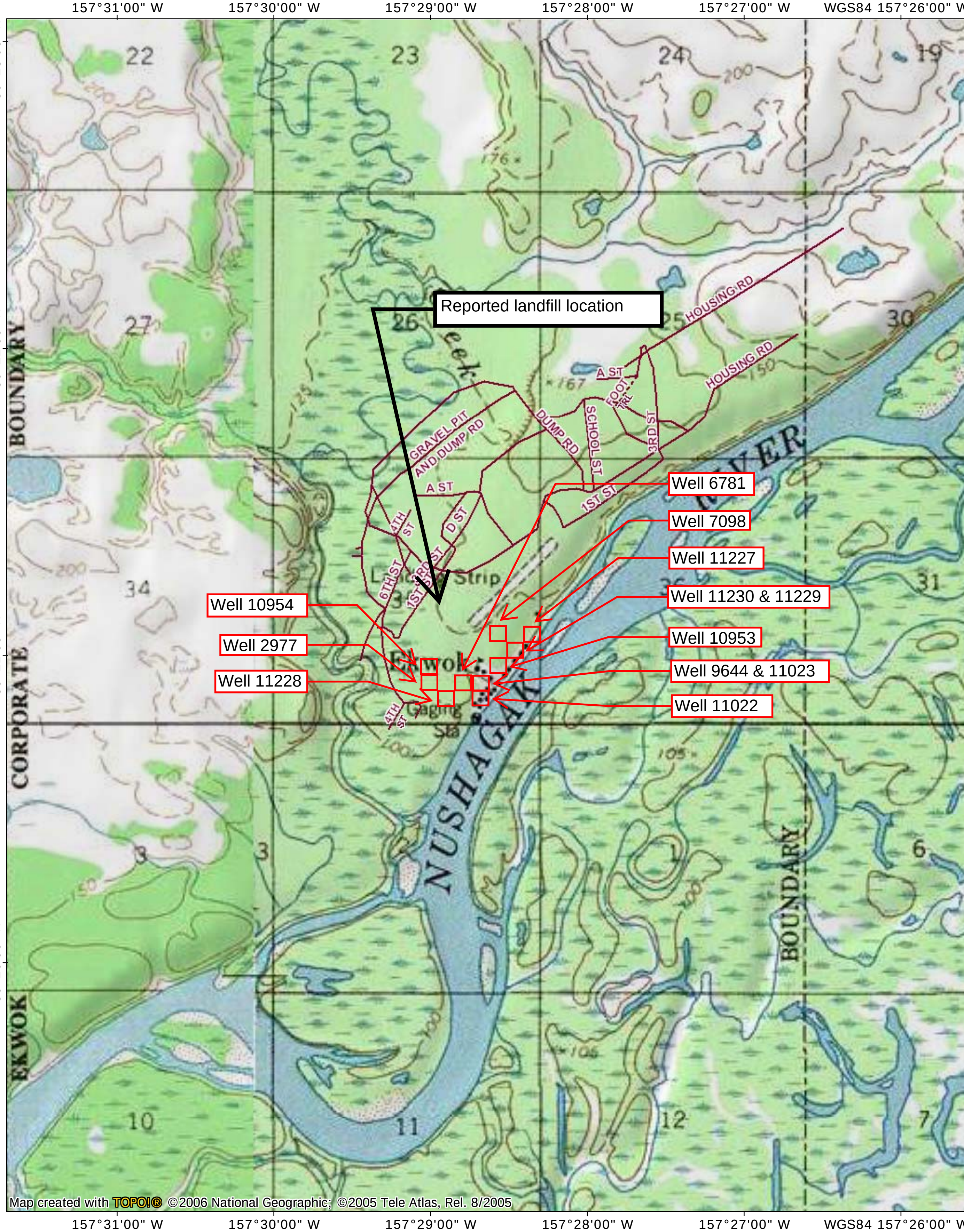
Native Housing Authority - Bristol Bay Housing Authority
P.O. Box 50
Dillingham, AK 99576
Phone 907-842-5956
Fax 907-842-2784
E-mail dmcclure@bbha.org
Web http://www.bbha.org

Regional Development - Southwest Alaska Municipal Conference
3300 Arctic Blvd., Suite 203
Anchorage, 99503
Phone 907-562-7380
Fax 907-562-0438
E-mail avarner@swamc.org
Web http://www.swamc.org

Economic Development - CDQ Group - Bristol Bay Economic Development Association
P.O. Box 1464
Dillingham, AK 99576-1464
Phone 907-842-4370
Fax 907-842-4336
E-mail sockeye1@nushtel.net
Web http://www.bbedc.com

Town	Well Log File Number	Well Name/Property Description	Owner	Date of Completion	Total Depth (ft)	Purpose	Screened Interval (ft)	Static Water Level (ft)	Permafrost Depth	Type of Soil (to Static Water Level)	Driller	Meridian Quadrant	Township	Range	Section	Section Parts	Approximate elevation from Google Earth (ft)	Landfill approximate elevation from Google Earth (ft)
Ekwok	24636	USS 3864 Ekwok School 1	US Public Health Service, Division of Indian Health	8/15/1974	65	Public	None	26	None documented	0-8' clay 8-35' silt, sand & gravel	Sheldon/Baldwin	SC	9	49	35	-	Unknown (assumed to be less than 129)	129
Ekwok	24635	USS 3864 Ekwok School 2	US Public Health Service, Division of Indian Health	9/28/1974	75	Public	30-75	28	None documented	0-15' mud & clay 15-30' sand & gravel	Sheldon	SC	9	49	35	-	Unknown (assumed to be less than 129)	129
Ekwok	24631	USS 3864 Ekwok School 3	US Public Health Service, Division of Indian Health	7/4/1974	81	Public	27-81	27	None documented	0-27' mud & sand	Henry Horner	SC	9	49	35	-	Unknown (assumed to be less than 129)	129
Ekwok	2977	USS 4878 L03/4 B1 Ekwok	Kawaglia, Mary	9/14/1784	70	Domestic	Unknown	10 (estimate)	None documented	0-16' gravel	Unknown	SC	9	49	35	DCBD	Unknown (assumed to be less than 129)	129
Ekwok	7098	USS 4878 Tr A L01 B08 Ekwok	Nelson, Tom	9/1/1984	77	Domestic	Unknown	Unknown	None documented	0-11' brown silt 11-24' gravel	Unknown	SC	9	49	35	DACA	114	129
Ekwok	11022	USS 4878 Tr A L01 B11 Ekwok	Walcott, Mickia Sr	9/20/1984	60	Domestic	Unknown	14 (estimate)	None documented	0-14' gravel	Unknown	SC	9	49	35	DDCB	94	129
Ekwok	11229	USS 4878 Tr A L02 B07 Ekwok	Yakluk, Mary	9/9/1984	75	Domestic	None	32 (estimate)	None documented	0-12' brown sand 12-24' sand & gravel 24-70 gray clay & sand	Unknown	SC	9	49	35	DADC	108	129
Ekwok	9644	USS 4878 Tr A L02 B11 Ekwok	Lease, Steve	9/20/1984	60	Domestic	Unknown	13 (estimate)	None documented	0-14' gravel	Unknown	SC	9	49	35	DDBC	94	129
Ekwok	11228	USS 4878 Tr A L03 B02 Ekwok	Acovak, Evan	9/24/1984	69	Domestic	Unknown	14 (estimate)	None documented	0-18' gravel	Unknown	SC	9	49	35	DCDB	Unknown (assumed to be less than 129)	129
Ekwok	11227	USS 4878 Tr A L03 B10 Ekwok	Larson, Mary	9/9/1984	28	Domestic	None	22 (estimate)	None documented	0-11' brown sand 11-28' gravel	Unknown	SC	9	49	35	DADA	91	129
Ekwok	11023	USS 4878 Tr A L04 B05 Ekwok	Larson, Andy	9/19/1984	58	Domestic	Unknown	10 (estimate)	None documented	0-16' sand & gravel	Unknown	SC	9	49	35	DDBC	98	129
Ekwok	10953	USS 4878 Tr A L04 B06 Ekwok	Nelson, Alex Sr	8/30/1984	78	Domestic	Unknown	30 (estimate)	None documented	0-13' brown silt 13-28' gravel & brown clay 28-69' gray clay & sand	Unknown	SC	9	49	35	DDBA	96	129
Ekwok	10954	USS 4878 Tr A L08 B01 Ekwok	Acovak, Michael	9/11/1984	74	Domestic	Unknown	17 (estimate)	None documented	0-4' brown silt 4-21' gravel	Unknown	SC	9	49	35	DCBA	117	129
Ekwok	11230	USS 4878 Tr A L08 B11 Ekwok	Hurley, Fred	8/29/1984	77	Domestic	Unknown	31 (estimate)	None documented	0-12' brown silt & sand 12-26' gravel 26-59' gray clay & sand	Unknown	SC	9	49	35	DADC	92	129
Ekwok	6781	USS 4878 Tr A L11 B03 Ekwok	Walcott, Mikea	9/18/1984	59	Domestic	None	10 (estimate)	None documented	0-16' gravel	Unknown	SC	9	49	35	DCAD	102	129

TOPO! map printed on 07/27/09 from "UNTITLED.TPO"



NATIONAL GEOGRAPHIC

0.0 0.5 1.0 miles

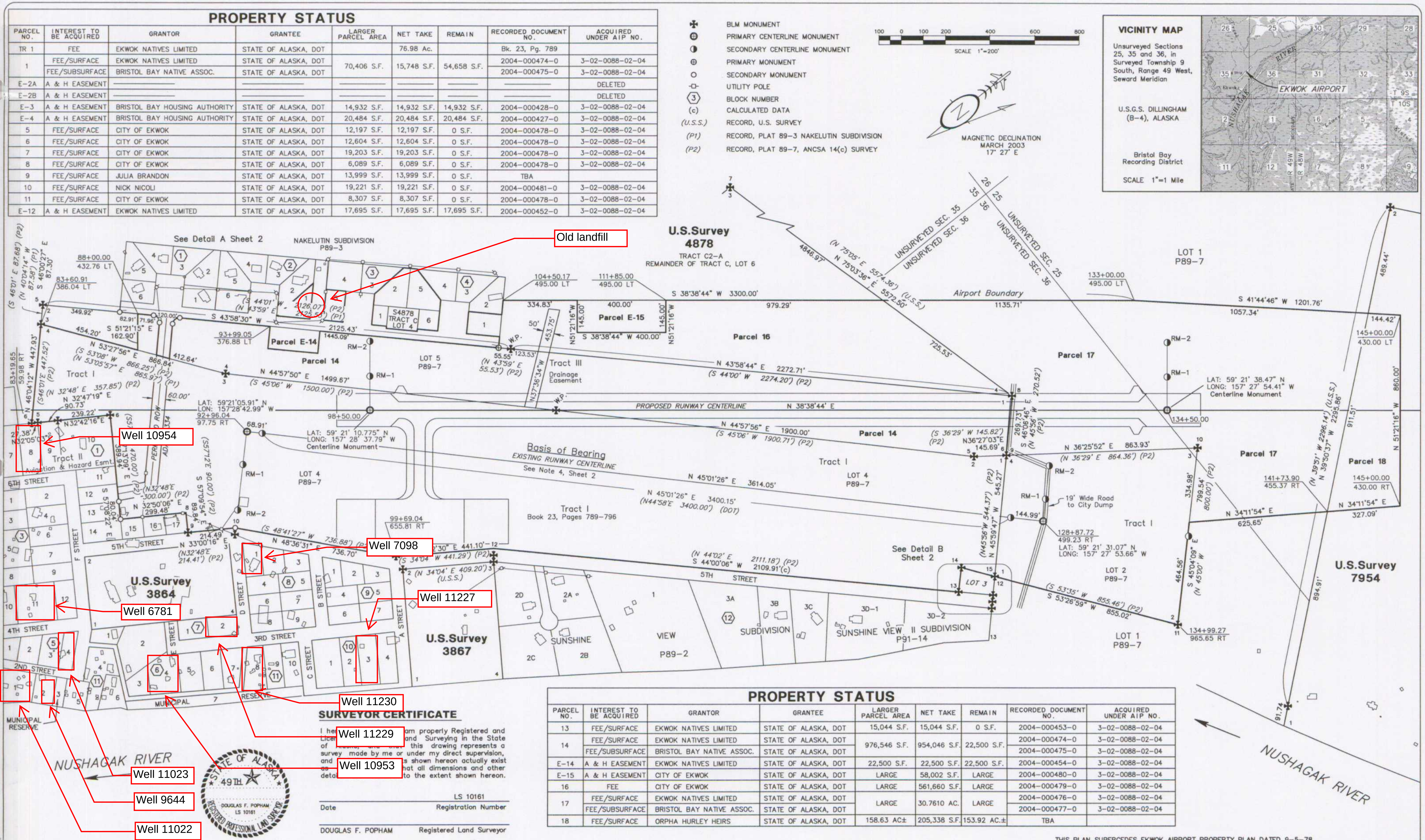
0.0 0.5 1.0 1.5 km

TN MN 16°

07/27/09

PROPERTY STATUS

PARCEL NO.	INTEREST TO BE ACQUIRED	GRANTOR	GRANTEE	LARGER PARCEL AREA	NET TAKE	REMAIN	RECORDED DOCUMENT NO.	ACQUIRED UNDER AIP NO.
TR 1	FEE	EKWOK NATIVES LIMITED	STATE OF ALASKA, DOT		76.98 Ac.		Bk. 23, Pg. 789	
1	FEE/SURFACE	EKWOK NATIVES LIMITED	STATE OF ALASKA, DOT	70,406 S.F.	15,748 S.F.	54,658 S.F.	2004–000474–0	3–02–0088–02–04
	FEE/SUBSURFACE	BRISTOL BAY NATIVE ASSOC.	STATE OF ALASKA, DOT				2004–000475–0	3–02–0088–02–04
E–2A	A & H EASEMENT	———	———	———	———	———	———	DELETED
E–2B	A & H EASEMENT	———	———	———	———	———	———	DELETED
E–3	A & H EASEMENT	BRISTOL BAY HOUSING AUTHORITY	STATE OF ALASKA, DOT	14,932 S.F.	14,932 S.F.	14,932 S.F.	2004–000428–0	3–02–0088–02–04
E–4	A & H EASEMENT	BRISTOL BAY HOUSING AUTHORITY	STATE OF ALASKA, DOT	20,484 S.F.	20,484 S.F.	20,484 S.F.	2004–000427–0	3–02–0088–02–04
5	FEE/SURFACE	CITY OF EKWOK	STATE OF ALASKA, DOT	12,197 S.F.	12,197 S.F.	0 S.F.	2004–000478–0	3–02–0088–02–04
6	FEE/SURFACE	CITY OF EKWOK	STATE OF ALASKA, DOT	12,604 S.F.	12,604 S.F.	0 S.F.	2004–000478–0	3–02–0088–02–04
7	FEE/SURFACE	CITY OF EKWOK	STATE OF ALASKA, DOT	19,203 S.F.	19,203 S.F.	0 S.F.	2004–000478–0	3–02–0088–02–04
8	FEE/SURFACE	CITY OF EKWOK	STATE OF ALASKA, DOT	6,089 S.F.	6,089 S.F.	0 S.F.	2004–000478–0	3–02–0088–02–04
9	FEE/SURFACE	JULIA BRANDON	STATE OF ALASKA, DOT	13,999 S.F.	13,999 S.F.	0 S.F.	TBA	
10	FEE/SURFACE	NICK NICOLI	STATE OF ALASKA, DOT	19,221 S.F.	19,221 S.F.	0 S.F.	2004–000481–0	3–02–0088–02–04
11	FEE/SURFACE	CITY OF EKWOK	STATE OF ALASKA, DOT	8,307 S.F.	8,307 S.F.	0 S.F.	2004–000478–0	3–02–0088–02–04
E–12	A & H EASEMENT	EKWOK NATIVES LIMITED	STATE OF ALASKA, DOT	17,695 S.F.	17,695 S.F.	17,695 S.F.	2004–000452–0	3–02–0088–02–04



PROPERTY STATUS

PARCEL NO.	INTEREST TO BE ACQUIRED	GRANTOR	GRANTEE	LARGER PARCEL AREA	NET TAKE	REMAIN	RECORDED DOCUMENT NO.	ACQUIRED UNDER AIP NO.
13	FEE/SURFACE	EKWOK NATIVES LIMITED	STATE OF ALASKA, DOT	15,044 S.F.	15,044 S.F.	0 S.F.	2004–000453–0	3–02–0088–02–04
14	FEE/SURFACE	EKWOK NATIVES LIMITED	STATE OF ALASKA, DOT	976,546 S.F.	954,046 S.F.	22,500 S.F.	2004–000474–0	3–02–0088–02–04
	FEE/SUBSURFACE	BRISTOL BAY NATIVE ASSOC.	STATE OF ALASKA, DOT				2004–000475–0	3–02–0088–02–04
E–14	A & H EASEMENT	EKWOK NATIVES LIMITED	STATE OF ALASKA, DOT	22,500 S.F.	22,500 S.F.	22,500 S.F.	2004–000454–0	3–02–0088–02–04
E–15	A & H EASEMENT	CITY OF EKWOK	STATE OF ALASKA, DOT	LARGE	58,002 S.F.	LARGE	2004–000480–0	3–02–0088–02–04
16	FEE	CITY OF EKWOK	STATE OF ALASKA, DOT	LARGE	561,660 S.F.	LARGE	2004–000479–0	3–02–0088–02–04
17	FEE/SURFACE	EKWOK NATIVES LIMITED	STATE OF ALASKA, DOT	LARGE	30.7610 AC.	LARGE	2004–000476–0	3–02–0088–02–04
	FEE/SUBSURFACE	BRISTOL BAY NATIVE ASSOC.	STATE OF ALASKA, DOT				2004–000477–0	3–02–0088–02–04
18	FEE/SURFACE	ORPHA HURLEY HEIRS	STATE OF ALASKA, DOT	158.63 AC±	205,338 S.F.	153.92 AC.±	TBA	

THIS PLAN SUPERCEDES EKWOK AIRPORT PROPERTY PLAN DATED 9–5–78

AIRPORT LAYOUT PLAN CONDITIONAL APPROVAL SUBJECT TO ALP APPROVAL LETTER DATED ______

By: ______ DATE: ______
FAA, AIRPORTS DIVISION
ALASKAN REGION, AAL–600

F.A.A. AIRSPACE REVIEW NUMBER: 03AAL–173–NRA

BY	DATE	REVISIONS

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION AND PUBLIC FACILITIES
CENTRAL REGION

APPROVED: STEPHEN M. RYAN, P.E. DESIGN SECTION CHIEF
APPROVED: DON BAXTER, P.E. PROJECT MANAGER

DATE 7–27–04
DESIGN
DRAWN
CHECKED DFP

EKWOK AIRPORT

AIRPORT PROPERTY PLAN

SHEET 1 OF 2

FILE: Y:\JDF\2002\02-109\EAD03\dwg\
DATE: 10–22–03

24636

WELL LOG

U.S. PUBLIC HEALTH SERVICE, DIVISION OF INDIAN HEALTH

LOCATION EKWOK - SCHOOL WELL #1 DATE STARTED 8-15-74

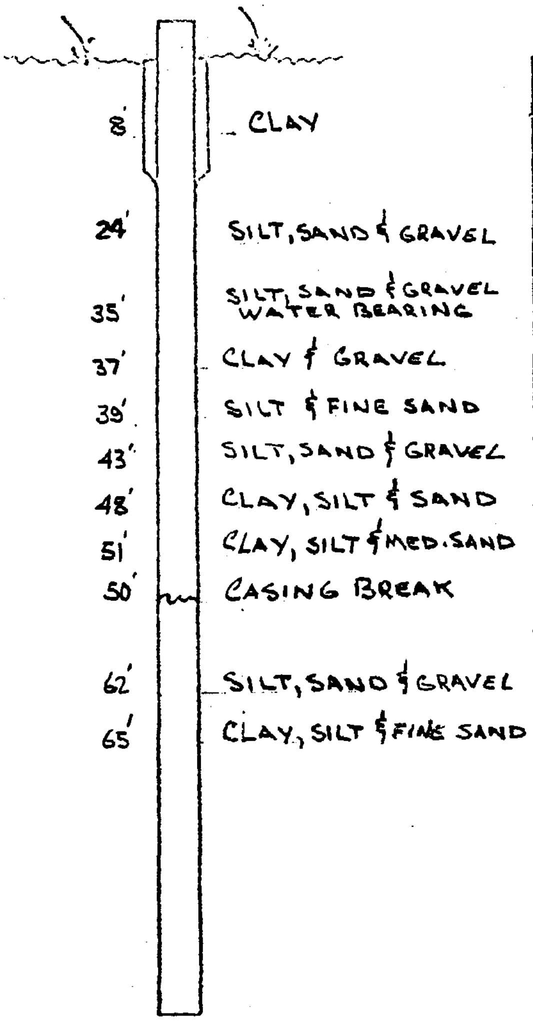
USS 3864 per PHS database MAM

DATE COMPLETED 8-21-74 DRILLER SHELDON & BALDWIN

TOTAL DEPTH OF WELL 65' FT. CASING INSTALLED 65' DIAMETER 6"

GROUT NONE SCREEN SIZE NONE MFG. — LENGTH —

STATIC WATER LEVEL 26' HRS. PUMPED ____ @ ____ GPM DRAWDOWN ____ FT.



DATE	DEPTH FROM-TO	FORMATION
	0-8'	TAN CLAY
	8'-24'	TAN SILT, SAND & GRAVEL
	24'-35'	TAN SILT, SAND & GRAVEL WATER BEARING
	35'-37'	GRAY CLAY & GRAVEL
	37'-39'	TAN & GREY SILT & FINE SAND
	39'-43'	TAN & GREY SILT, SAND & GRAVEL
	43'-48'	BLUE GREY CLAY, SILT & FINE SAND
	48'-51'	BLUE GREY CLAY, SILT & MEDIUM SAND (WATER BEARING)
	51'-62'	BLUE GREY SILT, SAND & GRAVEL
	62'-65'	BLUE GREY CLAY, SILT & FINE SAND

SPECIAL NOTES:

CASING BREAK AT 50' - DRLLING TO 65' TO EXPLORE
WATER AT 35' HAS BAD SULFUR SMELL & IS NOT
ENOUGH TO PRODUCE 10 G.P.M.

LOCAL NO. SC 9-49-35

SITE ID ____

24635

WELL LOG

U.S. PUBLIC HEALTH SERVICE, DIVISION OF INDIAN HEALTH

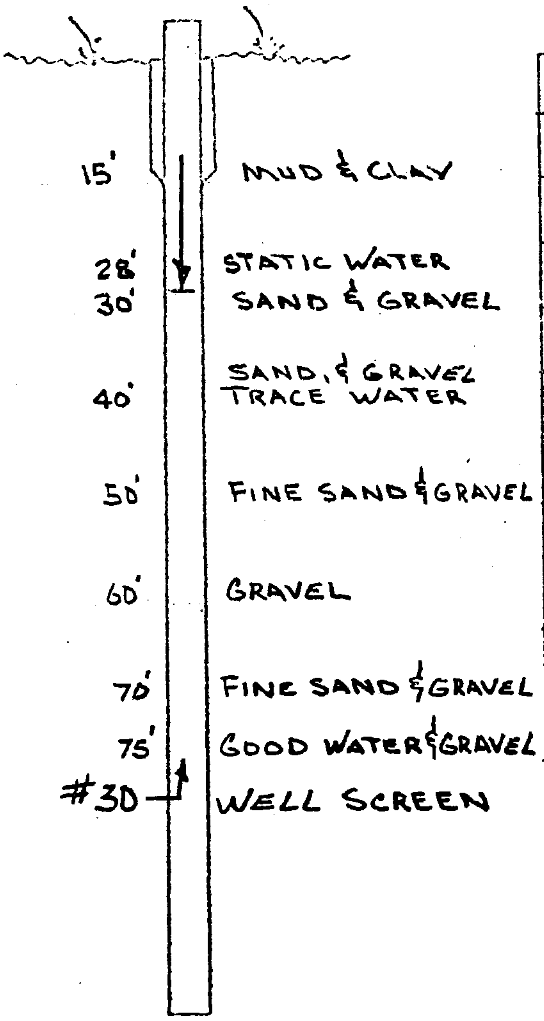
LOCATION EKWOK SCHOOL WELL #2 DATE STARTED 8-22-74
USS 3864 per PHS database MAM

DATE COMPLETED 9-28-74 DRILLER SHELDON

TOTAL DEPTH OF WELL 75' FT. CASING INSTALLED 75' DIAMETER 6"

GROUT NONE SCREEN SIZE #30 MFG. JOHNSON LENGTH 5FT.

STATIC WATER LEVEL 28' HRS. PUMPED 8 @ 10 GPM DRAWDOWN 38 FT.
OPEN HOLE TEST PUMPING



DATE	DEPTH FROM-TO	FORMATION
	0-15'	MUD & SAND
	15'-30'	SAND & GRAVEL
	30'-40'	SAND, GRAVEL & TRACE WATER
	40'-50'	FINE SAND & GRAVEL
	50'-60'	GRAVEL
	60'-70'	FINE SAND & GRAVEL
	75'	GOOD WATER & GRAVEL

SPECIAL NOTES:

PERFORATIONS - 16 HOLE'S FROM 51'-54' 3/8" HOLE'S WITH SCREEN - 15 GPM W/23' DRAWDOWN FULL RECOVERY IN 3 MIN. FOUND SPLIT CASING AT 51', ROCK COMMING IN CASING, PUSH SCREEN TO 54'. CAN'T DRILL BELOW 57'. PERFORATE 31'-39', BROWN SAND & WATER - TO MUCH SAND TO PUMP. SLIPPED IN SLOTTED CASING TO 51', STOPPED ROCKS, BUT SILT & SAND STILL ENTERING CASING.

LOCAL NO. SC 9-49-35
SITE ID

24631

WELL LOG

U.S. PUBLIC HEALTH SERVICE, DIVISION OF INDIAN HEALTH

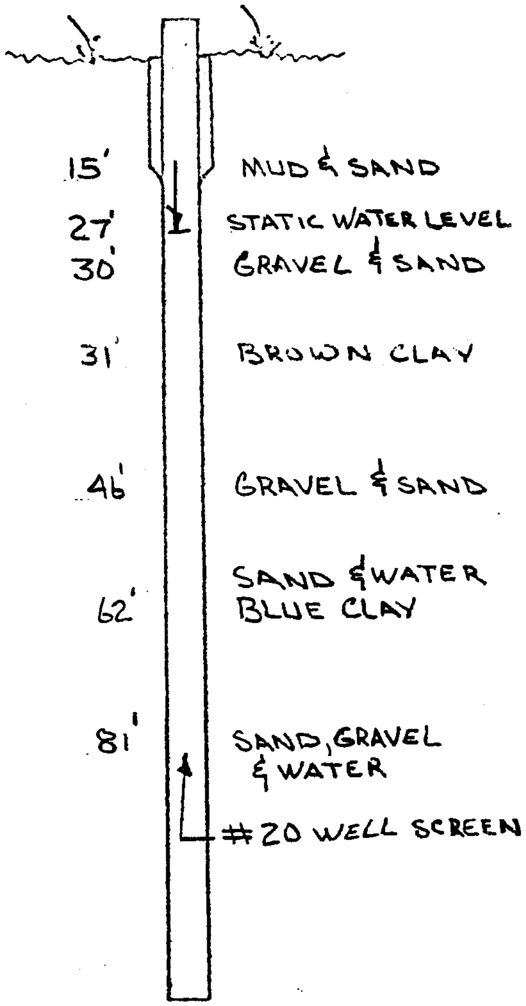
LOCATION EKWOK SCHOOL WELL #3 DATE STARTED 6-12-75
USS 3864 per PHS database mam

DATE COMPLETED 7-4-74 DRILLER HENRY HORNER

TOTAL DEPTH OF WELL 81' FT. CASING INSTALLED 80' DIAMETER 6"

GROUT NONE SCREEN SIZE 20 MFG. JOHNSON LENGTH 5' (#20@21')

STATIC WATER LEVEL 27' HRS. PUMPED 8 @ 20 GPM DRAWDOWN 17 FT.



DATE	DEPTH FROM-TO	FORMATION
	0'-15'	MUD & SAND
	15'-30'	GRAVEL & SAND
	30'-31'	BROWN CLAY
	31'-46'	GRAVEL & SAND
	46'-62'	BLUE CLAY, SAND & WATER
	62'-81'	SAND, GRAVEL & WATER

SPECIAL NOTES:

THIS WELL IS PRESENTLY BEING USED AS THE SCHOOLS WATER SOURCE

LOCAL NO. SC 9-49-35

SITE ID

24631

CHEMICAL & GEOLOGICAL LABORATORIES OF ALASKA, INC.

TELEPHONE (907) 279-4014 P.O.BOX 4-1276 ANCHORAGE, ALASKA 99509 4649 BUSINESS PARK BLVD.

WATER ANALYSIS REPORT

OPERATOR Alaska Area Native Health Service **DATE** July 28, 1975 **LAB NO.** 3346
WELL NO. School Well **LOCATION** Ekwak
FIELD **FORMATION**
COUNTY **INTERVAL**
STATE Alaska **SAMPLE FROM** Potable Water

REMARKS & CONCLUSIONS: Turbidity, JTU.............. 28.5 (Sand and Silt)
Color, units................ 12

Cations	mg/l	meq/l	Anions	mg/l	meq/l
Sodium	29.	1.30	Sulfate	----	----
Potassium	6.	0.15	Chloride	8.	.23
Calcium	1.	0.05	Carbonate	0	----
Magnesium	2.	0.16	Bicarbonate	87.	1.43
Iron	---	----	Hydroxide	----	----
Total Cations		1.66	Total Anions		1.66

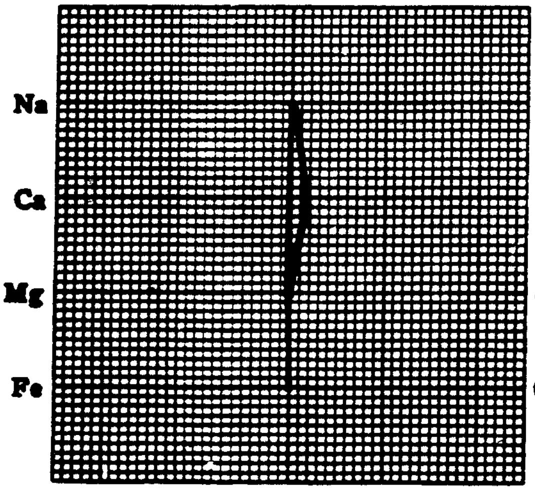
Total dissolved solids, mg/l 89
NaCl equivalent, mg/l ...... ---
Observed pH 6.4

Specific resistance @ 68°F.:
Observed .... 12.0 ohm-meters
Calculated .... ---- ohm-meters

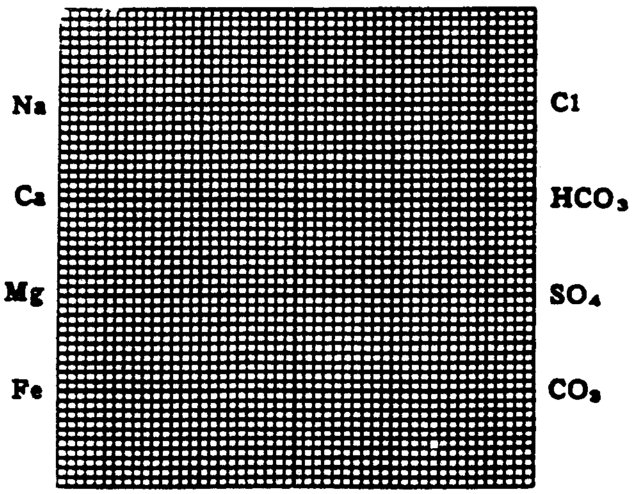
WATER ANALYSIS PATTERN

Sample above described

Scale MEQ per Unit



Cl 10
HCO₃ 1
SO₄ 1
CO₃ 1



SC 9-49-35

(Na value in above graphs includes Na, K, and Li)
NOTE: Mg/l=Milligrams per liter Meq/l= Milligram equivalents per liter
Sodium chloride equivalent=by Dunlap & Hawthorne calculation from components

2977

Mary Kowaglia   Sept 14/84

6' to 16' gravel

16' to 65' Gray clay & Sand

65' to 70' Sand & gravel

60ft standing water

Lots 3/4, Block 1 (on the common boundary line at southern point)

well w/in $SE^4 NW^4 SW^4 SE^4$ prot. Sec 35, T9S, R49W, SM

N13 - 0592056.9
W33 - 1572852.6

USS 4878 ?

LAS 3179

[redacted]

[redacted] 85

SC 9-49-35 DCBD 15
592058157284901

7098

Tom Nelson Sept 1/84

0' to 11' Brown silt

11' to 24' Gravel

24' to 41' Brown sand

41' to 67' Gray sand + clay

67' to 70' Gravel + Sand

70' to 77' Gravel + some sand

approx 15+ gal per min
standing water

well w/in D Street outside
boundary of
Lot 1, Block 8, Tract "A",
USS 4878, Townsite of Ekwok
well w/in NE4 SW4 NE4 SE4 1 proto Sec. 35,
T9S, R49W, S.M.

N 27-0592106.1
W 13-1572827.1

SC 9-49-35 DACA

LAS 3180

11022

~~Tiva~~ Mickie Wolcott, Sr. Sept 20/84

0' to 14' gravel
14' to 25' gray sand
25' to 58' gray clay
58' to 60' gravel + sand

46' standing water

LAS 3170
N - 0592054.4 — NW 1/4 SW 1/4 SE 1/4 SE 1/4 SEC 35, T 9 S, R 49 W., SM
W - 1572829.6 — LOT 1, BLOCK 11, TRACT 'A', U.S.S. 4878
Townsite of Ekwok
cc: DGGS

LAS 3170

cc: DGGS 11/85

SC9-49-35 DDC 81-4
592054157283001

11229

Mary Ujukluk Sept 9/84

0' to 12' Brown sand
12' to 24' sand & gravel
24' to 70' Gray clay & sand
70' to 75' Small gravel & Rock

approx 15 gal min.
43 ft standing water

No Screen

well located just outside of lots NW corner in 3rd Street:
Lot 2, Block 7, Tract "A", USS 4878,
Townsite of Ekwok
well w/in SW4 SE4 NE4 SE4 Sec. 35, T9S, R49W, SM
N22-0592102.8
W09-1572822.0

[redacted] [redacted] 11/85

SC 9-47-35 DADC 1-
59 21 04 157 28 19 01

9644

Steve Loose Sept 20/84

0' to 14' gravel
14' to 22' gray sand
22' to 55' gray clay
55' to 60' gravel

approx 20 gal per min
47' standing water

Lot 2, Block 11, TRACT "A", USS 4878,
Townsite of Ekwok
well w/in SW4 NW4 SE4 SE4 protracted Sec 35, T9S, R49WSM
N 11 - 0592055.6
W 18 - 1572828.4

LAS 3177

SC 9-49-35 DDBC

11228

Evans Acoak Sept 24 1984

0' to 18' gravel
18' to 28' gray sand
28' to 62' gray clay
62' to 69' sand & gravel

55' standing water

Lot 3, Block 2, Tract "A", USS 4878,
Townsite of Ekwok
well w/in NW4 SE4 SW4 SE4 prot. Sec. 35, T9S, R49W, SM.
N 09 — 0592054.4
W26 — 1572843.6

[redacted] [redacted] 11/85

SC 9-47-35 ccco ,
592055 157284H01

11227

Mary Larson Sept 9/84

6' to 11' brown sand
11' to 28' gravel

no screen

left standing water

Lot 3, Block 10, Tract "A", USS 4878,
Townsite of Ekwok prot.
well w/in NE¼SE¼ NE¼SE¼ Sec. 35,
T9S, R49W, SM

N 28 - 0592106.7
W01 - 1572811.8

SC 9-49-35 DAAA 1-1
5921071572811401

[redacted] [redacted]11/85

11023

Andi Larson Sept 19/84

0' to 16' sand + gravel
16' to 45' gray clay
45' to 52' gray sand + clay
52' to 58' Sand + small gravel

48' standing water

Lot 4, Block 5, Tract "A", USS 4878,
Townsite of Ekwok, $SE^4 SE^4$ prot. Sec. 35, T9S, R49W, SM
well w/in $SW^4 NW^4 SE^4 SE^4$ prot. Sec 35
N13 - 0592056.9
W15 - 1572829.6

[redacted] 3175 DGGS

592058157282001

10953

[redacted]

Nelson, Alex, Sr. Aug 30/84

0' to 13' Brown silt
13' to 28' Gravel clay - brown
28' to 69' Gray clay + sand
69' to 78' Small gravel - 1" + sand

58' standing water
approx 15+ gal per min

Lot 4, Block 6, Tract "A", U.S.S 4878,
Townsite of Ekwok
well w/in NE4 NW4 SE4 SE4 protracted Sec. 35, T9S, R49W, S.M.

N17 - 0592100.2
W13 - 1572823.3

[redacted]

[redacted]

SC 9-49-35 DDDA 1
592100157282301

10954

Acovak
Mike Acovak Sept 11/84

0' to 4', brown silt
4' to 21' gravel
21' to 70' Sand & clay
70' to 74' Sand & gravel

57 ft standing water

Lot 8, Block 1, Tract "A", USS 4878, Townsite of Ekwok,
well w/in NE4 NW4 SW4 SE4 protracted Sec. 35, T9S, R49W, SM.
N19 – 0592100.8
W32 – 1572851.3

SC 9-49-35 DCBA 1-1
592101157285101

[redacted] [redacted]1/85

11230

Hurley, Fred

Aug 29/1984

0' to 12' Brown silt + sand
12' to 26' Gravel
26' to 59' Gray clay + sand
59' to 68' Sand
68' to 78' Large gravel & coarse sand

46' Standing water
approx 15+ gal per min
pumped - 10 hrs

Lot 8, Block 11, Tract "A",
USS 4878, Townsite of Ekwok,
Well w/in SW¼ SE¼ NE¼ SE¼ protracted Sec. 35,
T9S, R49W, SM

N 24-0592104.1
W07-1572819.5

SC 9-49-35 DADC [illegible]-8
592104 1572819[illegible]

[redacted] 11/6/85

UAS 0504

6781

Mikea Walcott

Sept 18/8~~4~~3

0' to 16' gravel
16' to 49' sand & clay
49' to 59' gravel

49' standing water

no screen

Lot 11, Blk 3, Tract "A", USS 4878,
Townsite of Ekwok.
well is w/in SE4 NE4 SW4 SE4 prot. Sec. 35,
T9S, R49W, SM.
N 12-0592056.3
W21-1572837.3

LAS 3181

[redacted]/85

SC9-49-35 DCAD

APPENDIX A.ii.
EEK RARE SITE BACKGROUND INFORMATION

R.A.R.E. Opportunity

Regional Applied Research Effort, U.S. Environmental Protection Agency

The EPA, Office of Research and Development and the EPA, Alaska Operations Office are partnering to look at how contaminants in leachate from open dumps may harm the environment especially drinking water sources. The EPA resources for the project are limited but we think this can be a good start in looking at the relationship between dump site leachate and impacts to our environment. There is the opportunity for EPA to partner with five villages on the project.

Five different types of dump site conditions are needed for the project: 1) a dump site in dug up tundra; 2) a dump site mostly on top of the tundra; 3) a dump site in a tundra pond; 4) a dump site in ground that is not tundra where there is a short distance (twenty-five feet or less) to ground water; and 4) a dump site in ground that is not tundra where there is a longer distance (twenty-five feet or more) to ground water.

If you think your village may be interested in participating in the project please complete this form and return it to either Michelle Davis or Joe Sarcone of the EPA, Alaska Operations Office. Our fax number is (907) 271-3424. Thanks.

Name of Village: Gee

Contact Person: NICK CARTER

Email address: NICK_A_CARTER@YAHOO.com

Telephone number: 536-7208

IGAP program: yes ✓ no ___

Owner/operator of dump site (for example: the city government): City

Owner of the land the dump site is located on (for example: the corporation): City

Age of the dump site: 33 yrs

Distance of the dump site to the village: 700-1000 FT

Distance of the dump site to a drinking water source (this could be the source of water for your watering point/washeteria or it could be a traditional water source such as river, tundra pond, spring, or ice): 1700 FT (WG?)

Distance of dump from a source of subsistence (for example, a river or slough or a berry picking area): Close

Type of dump site condition, Please circle one:

1) dump site in dug up tundra;

2) dump site mostly on top of the tundra;

3) dump site in a tundra pond;

4) dump site in ground that is not tundra where there is a short distance (twenty-five feet or less) to ground water;

5) dump site in ground that is not tundra where there is a longer distance (twenty-five feet or more) to ground water.

6) other (please describe)

Additional information you would like for us to know:

THE PIPED WATER & SEWER SYSTEM SLATED TO BEGIN CONSTRUCTION IN THE NEAR FUTURE - THE VILLAGE HAD HOPED FOR THE PROJECT TO INCLUDE CLEANING-UP THE TWO PONDS - WILL NOT BE CLEANED. A NEW SEWAGE LAGOON WOULD BE BUILT. GIVEN THE IMMEDIATE PROXIMITY OF A STREAM THAT IS INCHING ITS WAY TO THE TWO PONDS AND THE VILLAGES KNOWLEDGE OF THE LEACHATE INTO THIS STREAM THAT FEEDS INTO THE RIVER SOUTH OF EEK, IS THE REASON FOR THIS INTEREST.

FAX

Native Village of Eek
PO Box 89
Eek, AK 99578
907.536.5128
etcgov@yahoo.com

To: Ted Jacobson
Fax number: 800.478.6343

From: Nick Carter
Fax number: 907.536.5711

Date: 8/4/2009

Regarding: RARE

Phone number for follow-up: 907.536.5208

Comments:

Photo 1: is the ramp quickly constructed by the City personnel, not nearly the one I had hoped for, but still something to drive 4 wheelers on.

Photo 2: is the burnbox with disturbed tundra following the removal of the boardwalk. With the rain, it would become more obvious not to remove surface material in this area.

Photo 3: is the solid waste site where stuff is being dozed to.

Photo 4: didn't turn out too well but it's where the water flows through from the dumpsite or leachate, leading to the meandering creek just off of this site. If you could go into Google Earth and find Eek, you will get the better picture what this is.

Additional information requested for the RARE (Regional Applied Research Effort) project field assessment. (7/27/09)

It would be very helpful if your Tribe could provide the RARE technical team with information to help them understand conditions at your landfill. This information will help us determine the extent of the field work to be performed at each site. It is especially important for us to have as much understanding as possible of the hydrology (water flow) at each dump site. How does water move on, through and under the site? Answers to these questions will give us a better understanding of the hydrology. We would like to request:

- **Photos of your site.** (digital camera images are best for to the engineers and scientists working on the project). We would like at least 4-5 photos, one from each side of the site. We recommend that you send batches of 4-5 pictures at a time, due to server limitations. Also, please put a note on each photo that gives us some information about where they were taken, and which way water may flow from that location. **Please e-mail these to Ted Jacobson @ tjacobson@ruralcap.com**

Then, fill out rest of this worksheet and fax it attention Ted Jacobsen at (800) 478-6343. If you have transmission problems, call him at (907) 865-7363. Please feel free to attach other information, or additional pages that may help us to better understand site conditions.

- Is there standing water in the dump site? Yes

- Is the standing water present year round or seasonally such as just at break-up? It is there year round

- Does the dump site flood? About how often? No

- When there is water in the site does it flow over the top of the ground and through the site (sheet flow) or does it stand in puddles or ponds in the site, or both? The water in the pond does not overflow even during any rain season. There is a stream inching its way towards the site and beyond that subsistence activities occur and waterfowl and fish are present.

- If you were to dig a hole at the dump site, how deep would you have go before you hit ground water? There has been wells dug in the past and after two have been capped immediately after completion, we had told the last contractor not to sink its money even then. However, they had these very expensive personnel they described they had, they went ahead and sunk a bunch of money, capped that too and walked away - what's down there you don't want to use at all, even at 300 feet.

- If there is permafrost under the site, how deep would you have to dig before you hit permafrost? About two feet at the moment.

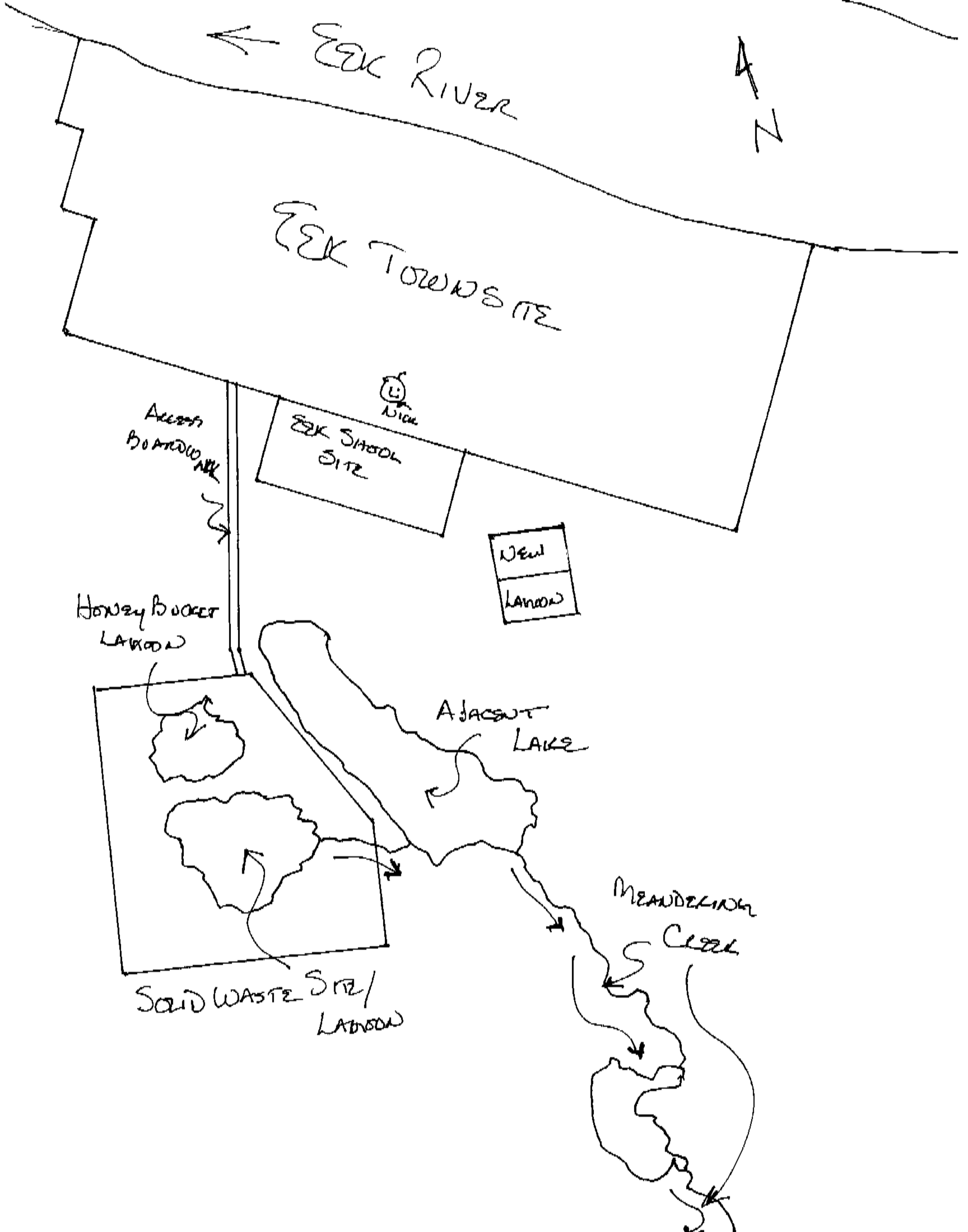
- About how large is the dump site (use the measure you are most familiar with to make this estimate such acres, square feet, square meters). 18.61 acres

- How old is your dump? Site is being used 33 years to date.

- About how deep is it? Two natural ponds, not very deep. Perhaps five feet at the most.

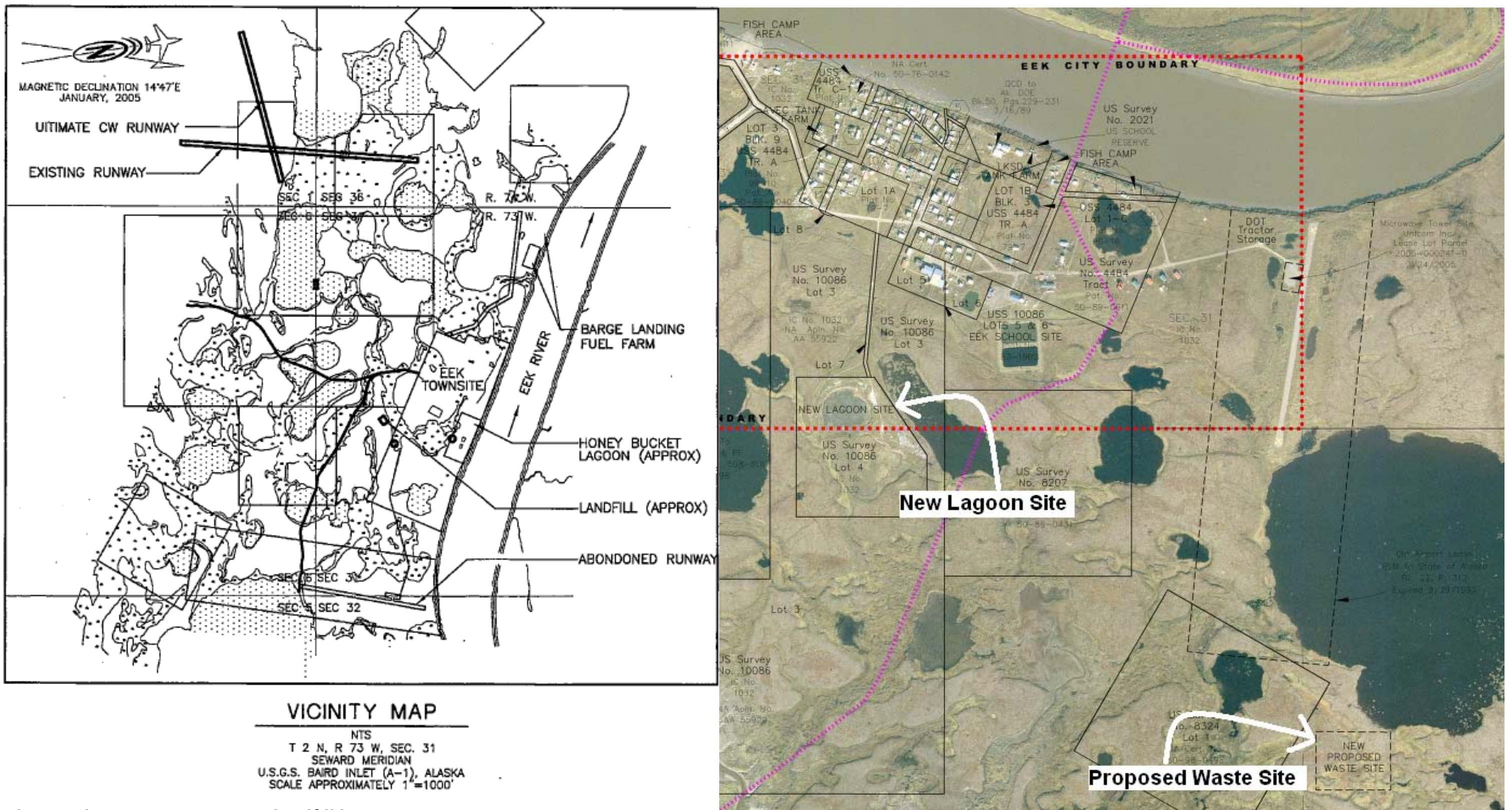
On a separate page, please draw a rough sketch of your dump site and give the dimensions, show any surface water rivers, sloughs, or ponds that may be near by, indicate north-south east-west, and draw an arrow or arrows in the direction(s) you think that water flows over or under the dump site. Please fax this worksheet and map with the name of your village, a contact person and telephone number to Ted Jacobson at **(800) 478-6343**. Please feel free to call either Ted or Michelle Davis **(907 271-3434)** if you have questions.

Thank you!



FEB-17-2005 07:13 From:EEK TRAD CNCL To:Fax P.3/3

Eek, AK (EEK)



Eek map showing approximate landfill location.

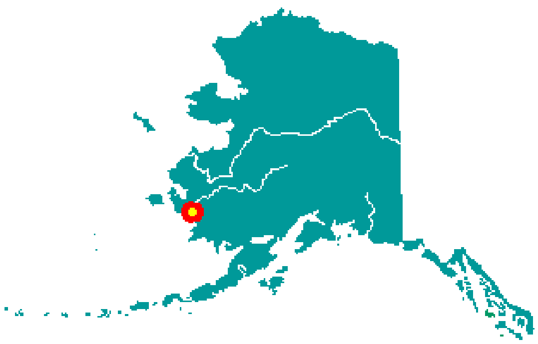
<u>Contact:</u> Nick Carter; (907) 536-5128

<u>Eek City Office:</u> (907) 536-5129
<u>Email:</u> cityofeek@yahoo.com

<u>Landfill:</u> Class 3; unpermitted
<u>Community water:</u> derived from Eek River; treated and stored in tanks
<u>Sewage systems:</u> Honeybuckets collected by the City and disposed of in a sewage lagoon
<u>Access:</u> Coastal; air
<u>Local Transportation:</u> Skiffs, fishing boats, Snowmachines

Sources: http://www.commerce.state.ak.us/dca/profiles/profile-maps.htm; http://www.commerce.state.ak.us/dca/commdb/CF_CIS.htm
Last Updated July 23rd, 2009

Alaska Community Database Community Information Summaries (CIS)



Eek

(EEK)

For a Map of Eek click here

Current Population:	318 (2011 Alaska Department of Labor Estimate)
Incorporation Type:	2nd Class City
Located In:	Bethel Census Area
Taxes:	Sales: 2%, Property: None, Special: None

Location and Climate

Eek lies on the south bank of the Eek River, 12 miles east of the mouth of the Kuskokwim River. It is 35 air miles south of Bethel and 420 miles west of Anchorage. The community lies at approximately 60.218890° North Latitude and -162.024440° West Longitude. (Sec. 31, T002N, R073W, Seward Meridian.) Eek is located in the Bethel Recording District. The area encompasses 0.9 sq. miles of land and 0.1 sq. miles of water.

Topographic map of Eek area

TopoZone.com

Eek is located in a marine climate. Annual precipitation averages 22 inches, with an annual average of 43 inches of snowfall. Summer temperatures average 41 to 57 °F; winter temperatures average 6 to 24 °F.

History, Culture and Demographics

The village was originally located on the Apokok River. It moved to its present location in the 1930s when constant flooding and erosion forced a relocation. A BIA school and a Moravian church were constructed at the new site. A post office was established in 1949. The city was incorporated in 1970.

A federally-recognized tribe is located in the community -- the Native Village of Eek. Eek is a traditional Yup'ik Eskimo village with a subsistence lifestyle and salmon is a dominant food source. All five Pacific salmon species spawn in the Eek River. The sale and importation of alcohol is banned in the village.

According to Census 2010, there were 101 housing units in the community and 91 were occupied. Its population was 97.6 percent American Indian or Alaska Native; 2.4 percent white; Additionally, 1 percent of the population was of Hispanic decent.

Facilities, Utilities, Schools and Health Care

The city and village have formed a joint utility commission. Water is derived from Eek River and is treated and stored in a tank at the washeteria. A few homes have tanks that provide running water to the kitchen, but houses do not have additional plumbing. Rain catchment systems and ice melt are also used for drinking water. Honeybuckets are collected by the city and disposed of in a sewage lagoon. Electricity is provided by AVEC. There is one school located in the community, attended by 89 students. Local hospitals or health clinics include Eek Health Clinic. Emergency Services have coastal and air access. Emergency service is provided by a health aide

Economy

Eek's economy is primarily subsistence and commercial fishing-based. A few full-time positions are available at the school, city, and village office. All families participate in subsistence fishing. In 2010, 41 residents held commercial fishing permits.

The 2006-2010 American Community Survey (ACS) estimated 58[1] residents as employed. The public sector employed 39.7%[1] of all workers. The local unemployment rate was 31.0%[1]. The percentage of workers not in labor force was 48.8%[1]. The ACS surveys established that average median household income (in 2010 inflation-adjusted dollars) was $17,350 (MOE +/-$12,212)[1]. The per capita income (in 2010 inflation-adjusted dollars) was $10,626 (MOE +/-$3,410)[1]. About 27.9%[1] of all residents had incomes below the poverty level.

[1] All ACS statistics are published with their repective margin of error (MOE). Some of the statistics here are calculated from the original ACS data. The MOE was unable to be carried through the calculations.

For additional ACS information please click here.

For current Local Labor Market Information please click here

Transportation

A state-owned 3,243' long by 60' wide gravel airstrip provides chartered and private air access. A seaplane base is also available on the Eek River. Fishing boats, skiffs, and snowmachines are used for local transportation to Bethel and other villages. There is a one-mile gravel road in the city. Winter trails are marked to Quinhagak (39 mi), Eek Island (15 mi), and the Kwethluk River (45 mi). Barges deliver fuel and supplies during the summer months. A dock is available.

Organizations with Local Offices

City - City of Eek
P.O. Box 9
Eek, AK 99578
Phone 907-536-5129
Fax 907-536-5711
E-mail cityofeek@yahoo.com

Electric Utility - Alaska Village Electric Cooperative
4831 Eagle St.
Anchorage, AK 99503
Phone 907-561-1818
Fax 907-562-4086
E-mail 907-562-4086

Tribe - federally recognized - Native Village of Eek
P.O. Box 89
Eek, AK 99578
Phone 907-536-5128
Fax 907-536-5711
E-mail etcgov@yahoo.com

Village Corporation - Iqfijouaq Company
P.O. Box 49
Eek, AK 99578
Phone 907-536-5211
Fax 907-536-5733

Regional Organizations

School District - Lower Kuskokwim School District
P.O. Box 305
Bethel, AK 99559-0305
Phone 907-543-4810
Fax 907-543-4904
E-mail gary_baldwin@lksd.org
Web http://www.lksd.org

Regional Native Corporation - Calista Corporation

301 Calista Court # A
Anchorage, AK 99518-3000
Phone 907-279-5516
Fax 907-272-5060
E-mail calista@calistacorp.com
Web http://www.calistacorp.com

Regional Native Health Corporation - Yukon-Kuskokwim Health Corporation
P.O. Box 528
Bethel, AK 99559
Phone 907-543-6020
Fax 907-543-6006
E-mail gene_peltola@ykhc.org
Web http://www.ykhc.org/

Regional Native Non-Profit - Association of Village Council Presidents
P.O. Box 219
Bethel, AK 99559
Phone 907-543-3521
Fax 907-543-3596
E-mail mnaneng@avcp.org
Web http://www.avcp.org

Native Housing Authority - AVCP Regional Housing Authority
P.O. Box 767
Bethel, AK 99559
Phone 907-543-3121
Fax 907-543-3933
E-mail ron@avcphousing.org
Web http://www.avcphousing.org

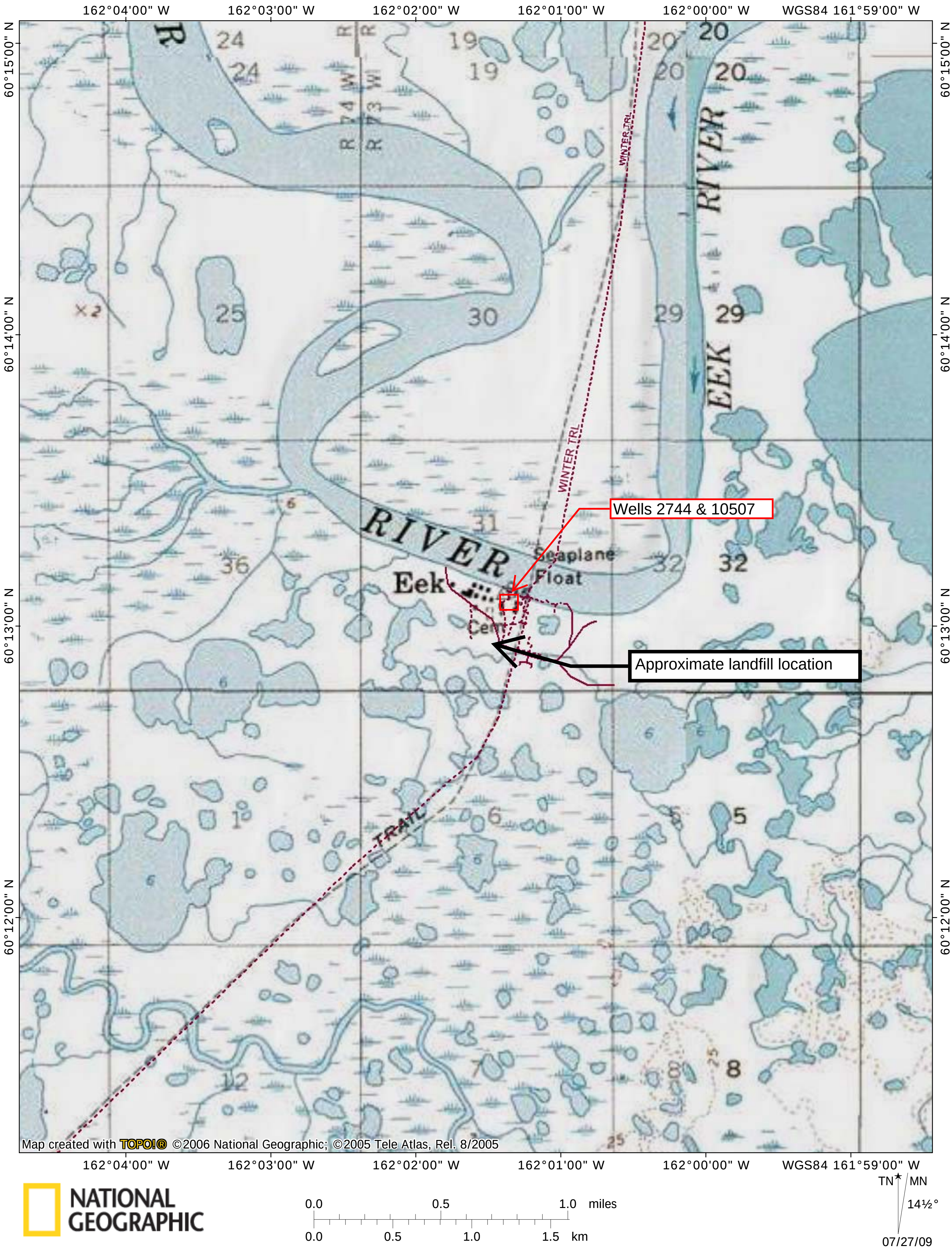
Regional Development - Lower Kuskokwim Economic Development Council
P.O. Box 2021
Bethel, 99559
Phone 907-543-5967
Fax 907-543-3130
E-mail carl_berger@ddc-alaska.org
Web http://www.lkedc.org/

Economic Development - CDQ Group - Coastal Villages Region Fund
711 H Street, Suite 200
Anchorage, AK 99501-3461
Phone 907-278-5151
Fax 907-278-5150
E-mail morgen_c@coastalvillages.org
Web http://www.coastalvillages.org/

RARE Project Well Log Summary

Town	Well Log File Number	Well Name/Property Description	Owner	Date of Completion	Total Depth (ft)	Purpose	Screened Interval (ft)	Static Water Level (ft)	Permafrost Depth	Type of Soil (to Static Water Level)	Driller	Meridian Quadrant	Township	Range	Section	Section Parts	Approximate elevation from Google Earth (ft)	Landfill approximate elevation from Google Earth (ft)
Eek	2744	Eek BIA School Well	US Bureau of Indian Affairs, Eek	10/3/1962	251	Public	20-250	18	Intermittent frozen layers from surface to 235 feet	0-18' frozen sand and silt	Vick Faulk/H. Hult/A. Ruff/R. Longbothom	SB	2	73	31	DBCA	11	13
Eek	10507	Eek BIA School Well 2	US Bureau of Indian Affairs, Eek	10/14/1979	245	Public	232-245	23	Intermittent frozen layers from surface to 232 feet	0-59' frozen blue clay	Estabrook/Appleton	SB	2	73	31	DBCA	11	13

TOPO! map printed on 07/27/09 from "UNTITLED.TPO"



NATIONAL GEOGRAPHIC

SURVEYED TOWNSHIP 2 NORTH, RANGE 73 WEST OF THE SEWARD MERIDIAN, ALASKA

STATUS OF PUBLIC DOMAIN
LAND AND MINERAL TITLES

MTP
SUPP SEC 31

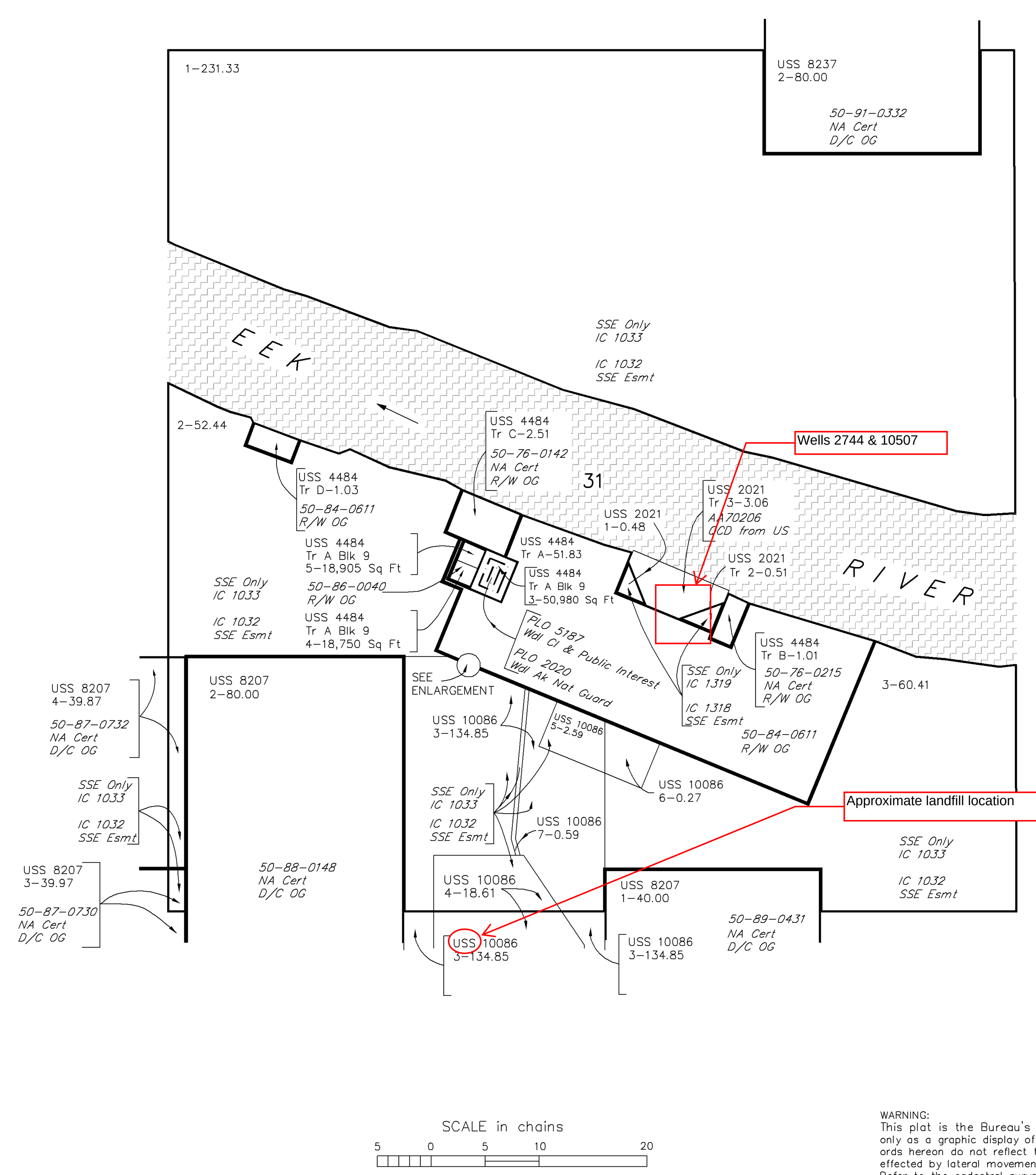
NO 2

FOR ORDERS EFFECTING DISPOSAL OR USE OF UN-IDENTIFIED LANDS WITHDRAWN FOR CLASSIFICATION MINERALS, WATER AND/OR OTHER PUBLIC PURPOSES REFER TO INDEX OF MISCELLANEOUS DOCUMENTS.

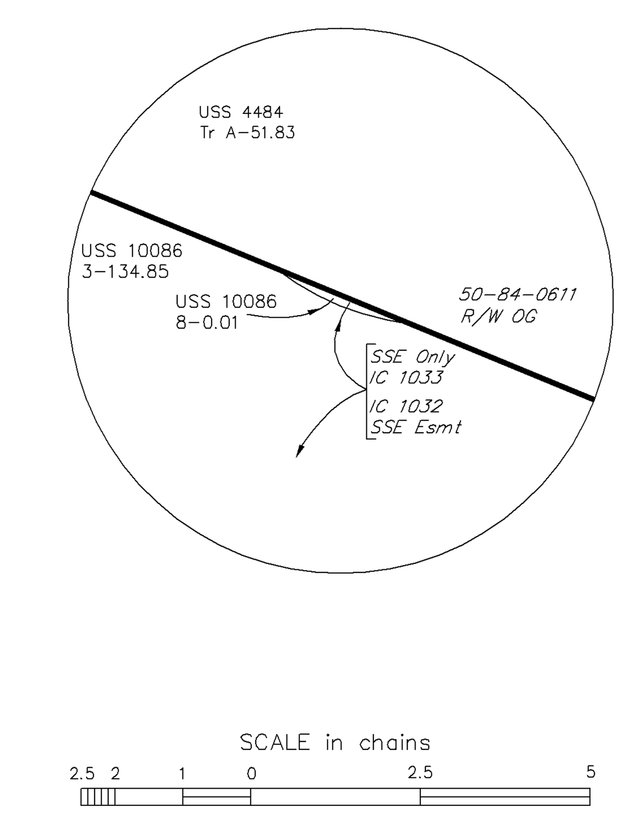
PL 92-203 Wdl F14854 Lds W/I F14854-A, F14854-A2

PLO 5184 Wdl CI affect Lds/Interests not conveyed

PL 96-487 Wdl Yukon Delta NWR entire Tp



ENLARGEMENT DIAGRAM



WARNING:
This plat is the Bureau's Record of Title, and should be used only as a graphic display of the township survey data. Records hereon do not reflect title changes which may have been effected by lateral movements of rivers or other bodies of water. Refer to the cadastral surveys for official survey information.

NO 2

CURRENT TO	
1-10-2008	

Sew Mer
T 2 N
R 73 W

ACAD

Att. - Russ. Donelson Const Supt. This information in File

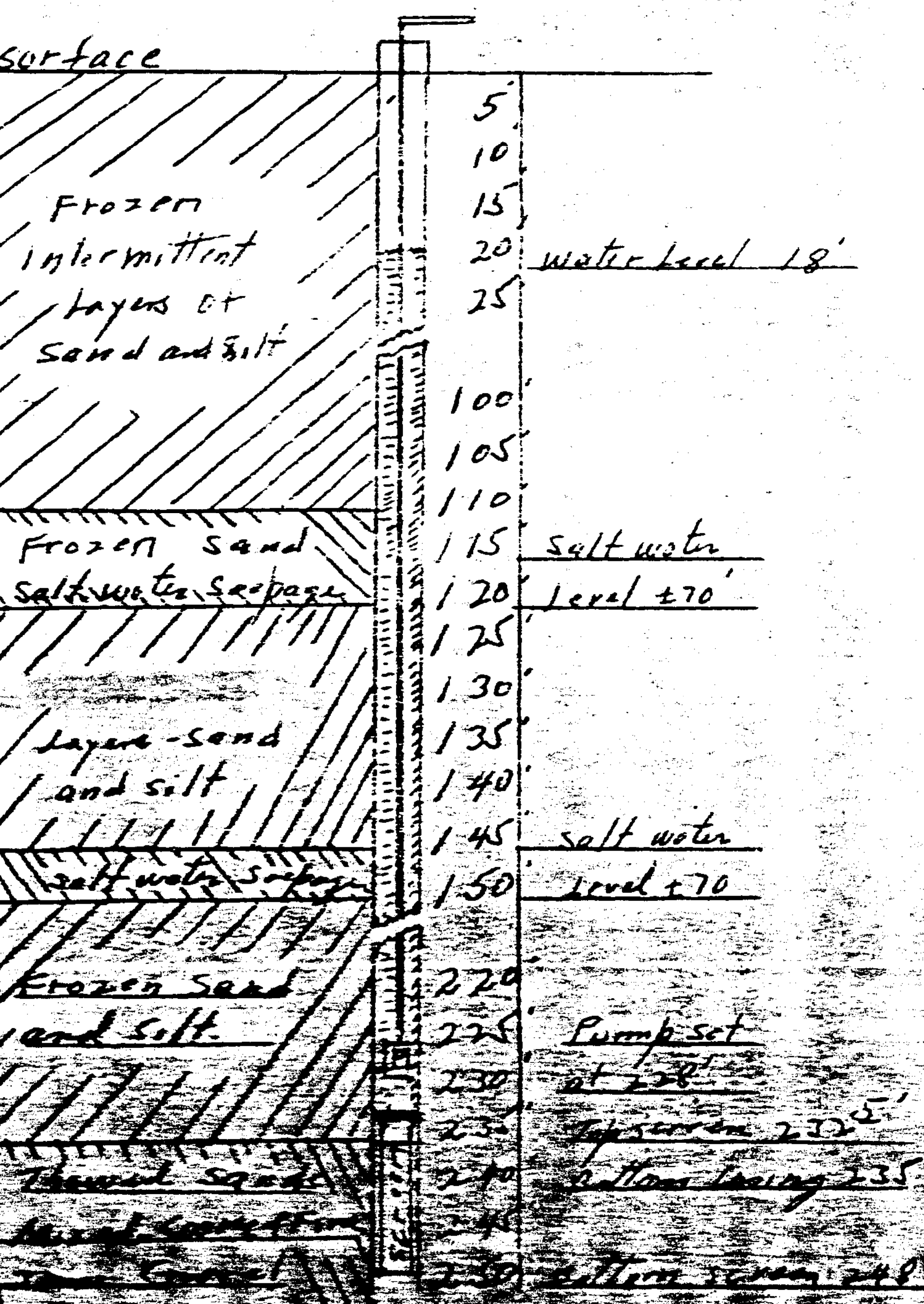
M. M. Custard
Const Supt.
Anchorage Alaska

2744
Anchorage Alaska
Oct 3rd 1962

EEK WATER WELL

Mob. 6/19/62 to 6/20/62 (Goodnews Bay)
Drilling 6/20 7/20/62 (to EEK)
Remodel Drill 7/20 - 8/6/62
Drilling 8/6 to 8/31/62
Shut Down 8/31 to 9/19 for (No drillers available)
Drilling 9/20 to 10/3/62 well Completed

Scale
Horiz - 1 sq = 4"
Vertical - 1 sq = 5'



Screen
4" Johnson Stainless
3 - 5 ft. - 10 slot
Total Length - 16'8"

Pump setting

225' of 1" galv. +
3' for pump = 228'
Intake is - 227'

Water

Taste - Fair
Color - Nearly Clear
Chlorine - 640 P.P.M.

Drillers - 1. Vick Faulk Jr.
2. H. Ault
3. A. Ruff
4. R. Longbottom

Pump was installed & left running continuously 2 months. Later Teacher Reported Better Water

Sam Patten
Foreman

5B 2 73 31 DRC7/1

2744
2GW

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

Bethel

WATER ANALYSIS

Location EEK County
Source Well Depth (ft) 245 Diam (in.)
Cased to (ft) Date drilled Point of coll. Discharge
Owner Bureau of Indian Affairs
Treatment Use
WBF Sand WL 21 Yield 6
Temp (°F) 33 Appear. when coll. light yellow
Collected 5/31/67 By Roy Longbotham
Remarks

	ppm	epm		ppm	epm
Silica (SiO_2)	35		Bicarbonate (HCO_3)	848	13.90
Aluminum (Al)	------		Carbonate (CO_3)	0	0.00
Iron (Fe)	1.06				
Carbon Dioxide (CO_2)	42		Sulfate (SO_4)	0.0	0.00
			Chloride (Cl)	320	8.90
			Fluoride (F)	0.5	0.03
Calcium (Ca)	24	1.20			
Magnesium (Mg)	18	1.50	Nitrate (NO_3)	1.3	0.02
Sodium (Na)	480	20.88			
Potassium (K)	6.6	0.17			
Total		23.75	Total		22.85

	ppm		
		Specific conductance (micromhos at 25° C)	2080
Dissolved solids: Calculated	1302	pH	7.5
Residue on evaporation at 180°C			
Hardness as $CaCO_3$	135	Color	400
Noncarbonate	0		

SB 2-73-31 DBCA 1-1

Lab. No. Col 10216 Field No. Project Bureau of Indian Affairs

10507

WELL LOG

U.S. PUBLIC HEALTH SERVICE, DIVISION OF INDIAN HEALTH

TION EEK, ALASKA DATE STARTED 9/4/79

E COMPLETED 10/14/79 DRILLER ESTABROOK /APPLETON

TOTAL DEPTH OF WELL 245' FT. CASING INSTALLED 248' 4" DIAMETER 6"

GROUT 180 lb CEMENT SCREEN SIZE 10 SLOT/5 FT MFG. JOHNSO LENGTH 5'

STATIC WATER LEVEL 23' 3" HRS. PUMPED 48 @ 16 GPM DRAWDOWN ______ FT.

DEPTH | HOLE DIAMETER | CASING DIAMETER | FORMATION

GROUND LEVEL

STATIC 23'

FROZEN LUE CLAY 59'

110' SALT WATER SEEPAGE

FROZEN PEA GRAVEL 205-206

232' PEA GRAVEL AQUIFER

BOTTOM 245

SOIL DATA TO 15 FT.

FEET THAWED ______

BOTTOM OF FROST & MATERIAL 232'

SEASONAL OR PERMA FROST ______

impossible! see preceding page

WATER DATA FIELD TEST

TASTE GOOD

APPEARANCE FRESH

AFTER 24 HOURS ______

IRON ______

CHLORIDES ______

TDS CLEAR AFTER 30 MIN. PUMP

PUMP TEST 23' 3" STATIC LEVEL

PUMPING LEVEL ______ @ ______ GPM

AFTER ______ HRS.

HIGHEST RECOMMENDED PUMP RATE

WILL STATIC LEVEL CHANGE WITH

TIDES NO OR FROST NO

??

DEVELOP PROCEDURE SURGE BLOCK / PLUNGER

ESTIMATED MAN HOURS FOR DRILLING ______ HOURS FOR TOTAL JOB ______

CREW ESTABROOK /APPLETON

*8 FT WEST OF JR HIGH

SB 2-73-31 DBCA 2-1

10507

CHEMICAL & GEOLOGICAL LABORATORIES OF ALASKA, INC.

P.O. BOX 4-1276
Anchorage, Alaska 99509

TELEPHONE (907)-279-4014
274-3364

ANCHORAGE INDUSTRIAL CENTER
5633 B Street

ANALYTICAL REPORT

ER Alaska Area Native Health Service SAMPLE LOCATION: Eek, Alaska

OLLECTED 10/20/79 TIME COLLECTED: ---

D BY appleton SOURCE well/bia/contract

S Very saline water with high alkalinity, Iron and Manganese.

FOR LAB USE ONLY	
RECVD.BY SE	LAB # 1954
DATE RECEIVED	10-23-79
DATE COMPLETED	10-26-79
DATE REPORTED	10-29-79
SIGNED	Stephen C. Ede

	mg/l		mg/l		mg/l
ilver	<0.05	[]P,Phosphorous	2.4	[]Cyanide	
luminum	0.14	[]Pb,Lead	<0.05	[]Sulfate	5
rsenic		[]Pt,Platinum		[]Phenol	
old		[]Sb,Antimony	<0.05	[]Total Dissolved Solids	1230
ron	0.14	[]Se,Selenium		[]Total Volatile Solids	
arium	0.28	[]Si,Silicon	11	[]Suspended Solids	
ismuth	0.39	[]Sn,Tin		[]Volatile Suspended Solids	
alcium	16	[]Sr,Strontium	0.17	[]Hardness as $CaCO_3$	85
admium	<0.01	[]Ti,Titanium	<0.05	[]Alkalinity as $CaCO_3$	680
obalt	<0.05	[]W,Tungsten	<0.05	[]	
romium	<0.05	[]V,Vanadium	<0.05	[]	
pper	<0.05	[]Zn,Zinc	0.42	[]	
on	1.6	[]Zr,Zirconium	<0.05	[]	
				* * * * * *	
rcury		[]Ammonia Nitrogen-N		[]mmhos Conductivity	1850
assium	5.8	[]Kjedahl Nitrogen-N		[]pH Units	7.5
gnesium	10	[]Nitrate-N		[]Turbidity NTU	
nganese	0.06	[]Nitrite-N		[]Color Units	
lybdenum		[]Phosphorus (Ortho)-P		[]T.Coliform/100ml	

SB 2-73-31 DBCA 2-1

APPENDIX A.iii.
WHITE MOUNTAIN RARE SITE BACKGROUND INFORMATION

R.A.R.E. Opportunity

Regional Applied Research Effort, U.S. Environmental Protection Agency

The EPA, Office of Research and Development and the EPA, Alaska Operations Office are partnering to look at how contaminants in leachate from open dumps may harm the environment especially drinking water sources. The EPA resources for the project are limited but we think this can be a good start in looking at the relationship between dump site leachate and impacts to our environment. There is the opportunity for EPA to partner with five villages on the project.

Five different types of dump site conditions are needed for the project: 1) a dump site in dug up tundra; 2) a dump site mostly on top of the tundra; 3) a dump site in a tundra pond; 4) a dump site in ground that is not tundra where there is a short distance (twenty-five feet or less) to ground water; and 4) a dump site in ground that is not tundra where there is a longer distance (twenty-five feet or more) to ground water.

If you think your village may be interested in participating in the project please complete this form and return it to either Michelle Davis or Joe Sarcone of the EPA, Alaska Operations Office. Our fax number is (907) 271-3424. Thanks.

Name of Village: Native Village of White Mountain

Contact Person: Eric Morris

Email address: emorris@ak.net

Telephone number: 907 638 3651

IGAP program: yes ✓ no ___

Owner/operator of dump site (for example: the city government): City

Owner of the land the dump site is located on (for example: the corporation): WMO Native Corporation
no cost lease to City pending 14(c)3. transfer

Age of the dump site: opened 1981

Distance of the dump site to the village: 1/4 mile

Distance of the dump site to a drinking water source (this could be the source of water for your watering point/washeteria or it could be a traditional water source such as river, tundra pond, spring, or ice): 1000 ft to the river
2000 ft to the well

Distance of dump from a source of subsistence (for example, a river or slough or a berry picking area):
1000 ft to the river
1000 ft to berry trails

Type of dump site condition, Please circle one:

1) dump site in dug up tundra;

2) dump site mostly on top of the tundra;

3) dump site in a tundra pond;

4) dump site in ground that is not tundra where there is a short distance (twenty-five feet or less) to ground water;

5) dump site in ground that is not tundra where there is a longer distance (twenty-five feet or more) to ground water.

6) other (please describe)

Additional information you would like for us to know:

Dump is located on a hillside between 75 and 100 feet of elevation in a spring melt catchbasin. Water is only present in the natural drainage channel during break-up.

Additional information requested for the RARE (Regional Applied Research Effort) project field assessment. (7/27/09)

It would be very helpful if your Tribe could provide the RARE technical team with information to help them understand conditions at your landfill. This information will help us determine the extent of the field work to be performed at each site. It is especially important for us to have as much understanding as possible of the hydrology (water flow) at each dump site. How does water move on, through and under the site? Answers to these questions will give us a better understanding of the hydrology. We would like to request: Native Village of White Mountain
Eric Morris 907 638 3651

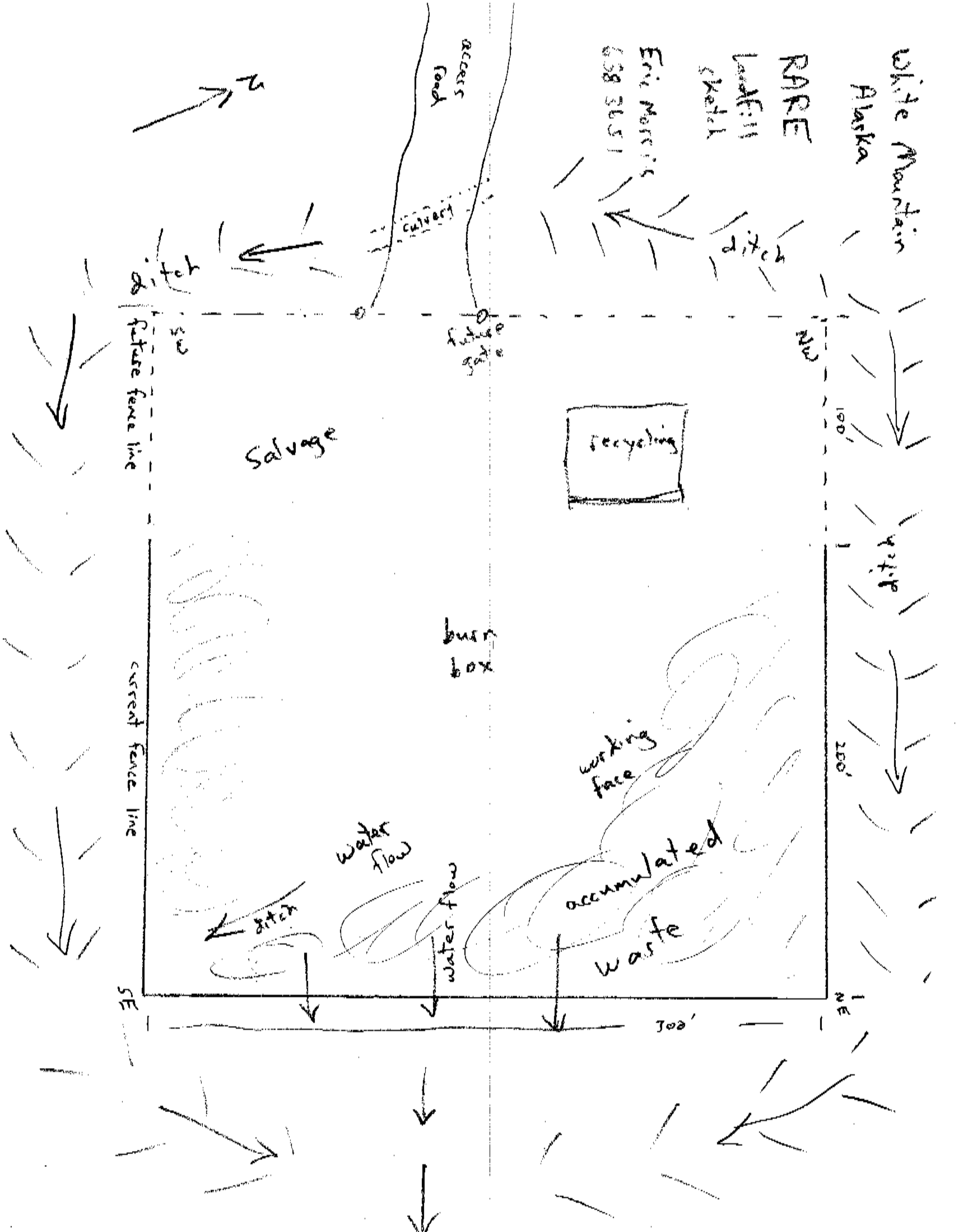
- **Photos of your site.** (digital camera images are best for to the engineers and scientists working on the project). We would like at least 4-5 photos, one from each side of the site. We recommend that you send batches of 4-5 pictures at a time, due to server limitations. Also, please put a note on each photo that gives us some information about where they were taken, end which way water may flow from that location. **Please e-mail these to Ted Jacobson @ tjacobson@ruralcap.com**

Then, fill out rest of this worksheet and fax it attention Ted Jacobsen at (800) 478-6343. If you have transmission problems, call him at (907) 865-7363. Please feel free to attach other information, or additional pages that may help us to better understand site conditions.

- Is there standing water in the dump site? During break-up and heavy precipitation but not normally.
- Is the standing water present year round or seasonally such as just at break-up? see above
- Does the dump site flood? About how often? no
- When there is water in the site does it flow over the top of the ground and through the site (sheet flow) or does it stand in puddles or ponds in the site, or both? Sheet flow does occur during break-up. Water also pours out of the trash wall built up on the bottom side of the dump
- If you were to dig a hole at the dump site, how deep would you have go before you hit ground water? No groundwater. One would hit bedrock. Maybe 5' or 6' of overburden before limestone.
- If there is permafrost under the site, how deep would you have to dig before you hit permafrost? limestone bedrock
- About how large is the dump site (use the measure you are most familiar with to make this estimate such acres, square feet, square meters). Once fenced, 300' x 300'
- How old is your dump? 1981
- About how deep is it? Accumulated waste piled up to 15' high along fence lines.

On a separate page, please draw a rough sketch of your dump site and give the dimensions, show any surface water rivers, sloughs, or ponds that may be near by, indicate north-south east-west, and draw an arrow or arrows in the direction(s) you think that water flows over or under the dump site. Please fax this worksheet and map with the name of your village, a contact person and telephone number to Ted Jacobson at **(800) 478-6343**. Please feel free to call either Ted or Michelle Davis **(907 271-3434)** if you have questions.

Thank you!



White Mountain Alaska
RARE
Landfill sketch
Eric Morris
638 3651
access road
N
culvert
ditch
ditch
ditch
future gate
SW
NW
future fence line
Salvage
recycling
100'
burn box
current fence line
200'
working face
water flow
water flow
accumulated waste
ditch
SE
NE
300'

Native Village of White Mountain
RARE Landfill Photo Request
7/29/09

Entrance to landfill area and highest elevation

View of SW corner and toward natural drainage direction to the SE

View of NW corner

View toward NE corner with dead zone at head of natural drainage

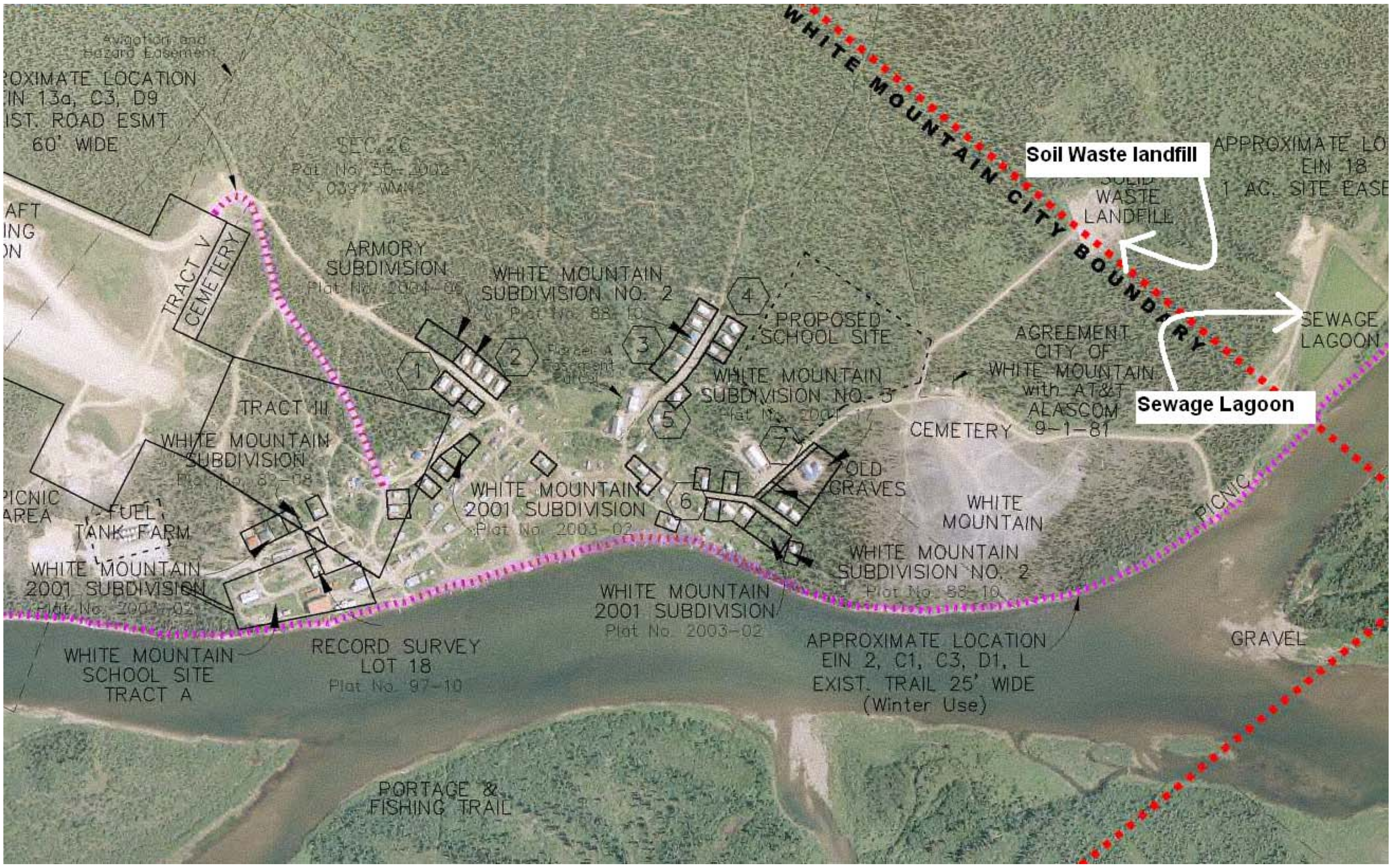
View of SE corner and head of natural drainage

View of bottom side of accumulated waste through which spring runoff flows


View SE from inside landfill and showing surface drainage ditch through waste area


Exit of interior landfill drainage ditch by SE corner

White Mountain, AK (WMO)



White Mountain map showing landfill and sewage lagoon.

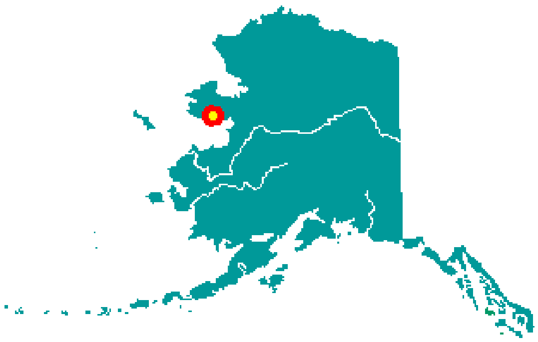
Contact: Amy Titus, city clerk; (907) 638-3411

City of White Mountain: (907) 638-3411
Email: wmocity@gci.net

Landfill: Class 3; unpermitted; refuse dispose of by individuals; maintained once a week by city landfill operator; designed 1981
Community water: derived from a well near Fish River then treated and distributed by pipe system
Sewage systems: most homes connected to a piped sewage system
Access: Air, sea
Local Transportation: unspecified

Sources: http://www.commerce.state.ak.us/dca/profiles/profile-maps.htm; http://www.commerce.state.ak.us/dca/commdb/CF_CIS.htm
Last Updated July 23rd, 2009

Alaska Community Database Community Information Summaries (CIS)



White Mountain

For Photos of White Mountain click here

For a Map of White Mountain click here

Current Population:	199 (2011 Alaska Department of Labor Estimate)
Incorporation Type:	2nd Class City
Located In:	Nome Census Area
Taxes:	Sales: 1%, Property: None, Special: 3% Bingo/Pull tab sales tax

Location and Climate

White Mountain is located on the west bank of the Fish River, near the head of Golovin Lagoon, on the Seward Peninsula. It is 63 miles east of Nome. The community lies at approximately 64.681390° North Latitude and -163.405560° West Longitude. (Sec. 26, T009S, R024W, Kateel River Meridian.) White Mountain is located in the Cape Nome Recording District. The area encompasses 1.8 sq. miles of land and 0.2 sq. miles of water.

White Mountain has a transitional climate with less extreme seasonal and daily temperatures than Interior Alaska. Continental influences prevail in the ice-bound winter. Average summer temperatures range from 43 to 80 °F; winter temperatures average -7 to 15 °F. Annual precipitation averages 15 inches, with 60 inches of snow. The Fish River freezes up in November; break-up occurs in mid to late May.

History, Culture and Demographics

The Inupiat fish camp of "Nutchirviq" was located here. The bountiful resources of both the Fish and Niukluk Rivers supported the area's Native populations. White Mountain grew after the influx of prospectors during the gold rush of 1900. The first structure was a warehouse built by miner Charles Lane to store supplies for his claim in the Council District. It was the site of a government-subsidized orphanage, which became an industrial school in 1926. A post office was opened in 1932. The city government was incorporated in 1969.

A federally-recognized tribe is located in the community -- the Native Village of White Mountain. White Mountain is a Kawerak Eskimo village, with historical influences from the gold rush. Subsistence activities are prevalent.

According to Census 2010, there were 79 housing units in the community and 65 were occupied. Its population was 81.6 percent American Indian or Alaska Native; 12.1 percent white; 6.3 percent of the local residents had multi-racial backgrounds. Additionally, 1.1 percent of the population was of Hispanic decent.

Facilities, Utilities, Schools and Health Care

Water is derived from a well near the Fish River and is treated. Forty-eight (48) households and facilities are connected to the piped water and sewer system. Eighteen (18) additional households haul honeybuckets. The school operates its own water and sewer system. Electricity is provided by White Mountain Utilities. There is one school located in the community, attended by 52 students. Local hospitals or health clinics include Natchirsvik Health Clinic. Emergency Services have river and air access. Emergency service is provided by a health aide

Economy

The entire population depends on subsistence hunting and fishing, and most spend the entire summer at fish camps. Salmon, other fish, beluga whale, seal, moose, reindeer, caribou, and brown bear are utilized. The school, store, post office, city, IRA, and airport provide the only local employment. Construction outside of town and firefighting provide seasonal employment. In 2010, one resident held a commercial fishing permit. Ivory and bone carvings contribute some cash. A reindeer farm is run by a local resident.

The 2006-2010 American Community Survey (ACS) estimated 51[1] residents as employed. The public sector employed 9.8%[1] of all workers. The local unemployment rate was 31.1%[1]. The percentage of workers not in labor force was 48.3%[1]. The ACS surveys established that average median household income (in 2010 inflation-adjusted dollars) was $29,375 (MOE +/-$18,022)[1]. The per capita income (in 2010 inflation-adjusted dollars) was $15,749 (MOE +/-$8,277)[1]. About 38.3%[1] of all residents had incomes below the poverty level.

[1] All ACS statistics are published with their repective margin of error (MOE). Some of the statistics here are calculated from the original ACS data. The MOE was unable to be carried through the calculations.

For additional ACS information please click here.

For current Local Labor Market Information please click here

Transportation

Access to White Mountain is by air and sea. There are no roads. The 3,000' long by 60' wide gravel runway is operated by the state, and scheduled flights are available daily from Nome. There is no dock in the village; supplies are lightered from Nome and offloaded on the beach. Cargo barges cannot land at White Mountain.

Organizations with Local Offices

City - City of White Mountain
P.O. Box 130
White Mountain, AK 99784
Phone 907-638-3411
Fax 907-638-3421
E-mail wmocity@gci.net

Electric Utility - City of White Mountain
P.O. Box 130
White Mountain, AK 99784
Phone 907-638-3421
Fax 907-638-3421

Tribe - federally recognized - Native Village of White Mountain
P.O. Box 84090
White Mountain, AK 99784
Phone 907-638-3651
Fax 907-638-3652
E-mail tc.wmo@kawerak.org
Web http://www.kawerak.org/tribalHomePages/whiteMountain/index.html

Village Corporation - White Mountain Native Corporation
P.O. Box 81
White Mountain, AK 99784
Phone 907-638-3651
Fax 907-638-3652

Regional Organizations

School District - Bering Strait School District
P.O. Box 225
Unalakleet, AK 99684-0225
Phone 907-624-3611
Fax 907-624-3099
E-mail rpicou@bssd.org

Web http://www.bssd.org

Regional Native Corporation - Bering Straits Native Corporation
4600 Debarr Rd., Suite 200
Nome, AK 99762
Phone 907-563-3788
Fax 907-563-3788
E-mail info@beringstraits.com
Web http://www.beringstraits.com

Regional Native Health Corporation - Norton Sound Health Corporation
P.O. Box 966
Nome, AK 99762
Phone 907-443-3311
Fax 907-443-2085
E-mail nshcorp@gmail.com
Web http:/www.nortonsoundhealth.org/

Regional Native Non-Profit - Kawerak, Incorporated
P.O. Box 948
Nome, AK 99762
Phone 907-443-5421
Fax 907-443-4452
E-mail exec.sec@kawerak.org
Web http://www.kawerak.org

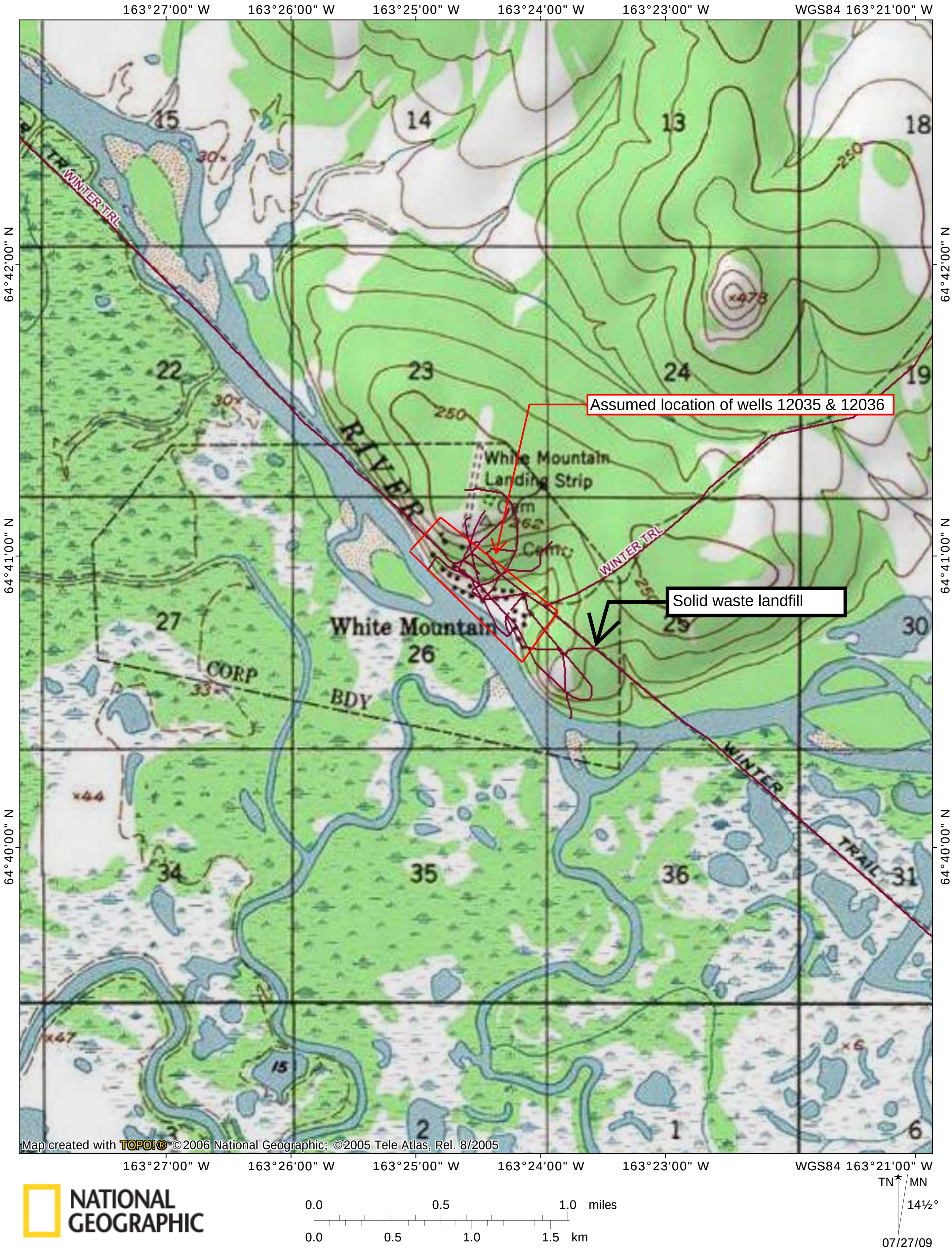
Native Housing Authority - Bering Straits Regional Housing Authority
P.O. Box 995
Nome, AK 99762
Phone 907-443-5256
Fax 907-443-2160
E-mail bmocan@bsrha.org

Regional Development - Bering Strait Development Council
P.O. Box 948
Nome, 99762
Phone 907-443-4248
Fax 907-443-4449
E-mail cpd.pd@kawerak.org
Web http://www.kawerak.org/servicedivisions/csd/cpd/index.html

Economic Development - CDQ Group - Norton Sound Economic Development Corporation
420 L St., Suite 310
Anchorage, AK 99501-1971
Phone 907-274-2248
Fax 907-274-2249
Web http://www.nsedc.com

Town	Well Log File Number	Well Name/Property Description	Owner	Date of Completion	Total Depth (ft)	Purpose	Screened Interval (ft)	Static Water Level (ft)	Permafrost Depth	Type of Soil (to Static Water Level)	Driller	Meridian Quadrant	Township	Range	Section	Section Parts	Approximate elevation from Google Earth (ft)	Landfill approximate elevation from Google Earth (ft)
White Mountain	12035	White Mountain	US Bureau of Indian Affairs, White Mountain	6/22/1968	129	Public	118-129	90	Frozen from surface to 8 feet	0-8' frozen silt & limestone gravel 8-94' limestone with loose rocks	Roy Longbothem/Galen Lee Dirksen	KC	9	24	26 (assumed)	-	80	140
White Mountain	12036	White Mountain (2 wells)	US Bureau of Indian Affairs, White Mountain	4/8/1964	117	Public	Unknown	88	Frozen from surface to 69 feet	0-3' frozen muck 3-69' frozen limestone 69-117' limestone	Longbothem/Swindle	KC	9	24	26 (assumed)	-	80	140
White Mountain	12036	White Mountain (2 wells)	US Bureau of Indian Affairs, White Mountain	3/17/1964	47	Public	None	25	Frozen from surface to 7 feet	0-7' frozen brown muck 7-9' thawed brown muck 9-30' fractured limestone	Longbothem/Swindle	KC	9	24	26 (assumed)	-	80	140

TOPO! map printed on 07/27/09 from "UNTITLED.TPO"



12035 NW

FORM 9-1642
(1-68)

Well No. White Mountain

WELL SCHEDULE

U. S. DEPT. OF THE INTERIOR KP GEOLOGICAL SURVEY WATER RESOURCES DIVISION

MASTER CARD

Record by AJK Source of data BIA Date 11-14-69 Map Solomon (C-3)

State Alaska [0 2] County (or town) White Mountain [D A]

Latitude: [6 4 4 1 0 0 N] deg min sec (N) S Longitude: [1 6 3 2 4 3 0] degrees min sec Sequential number: [1]

Lat-long accuracy: [4] T___ N S, R___ E W, Sec___, ___¼, ___¼, ___¼ KATEEL B & M

Local well number: [K C] Other number: well 1

Local use: [7 5 0 0 5] Owner or name: BIA

Owner or name: [B I A W H I T E M T N] Address: White Mountain

Ownership: (C) County, (F) Fed Gov't, (M) City, (N) Corp or Co, (P) Private, (S) State Agency, (W) Water Dist [F]

Use of water: (A) Air cond, (B) Bottling, (C) Comm, (D) Dewater, (E) Power, (F) Fire, (H) Dom, (I) Irr, (M) Med, (N) Ind, (P) P S, (R) Rec, (S) Stock, (T) Instit, (U) Unused, (V) Repressure, (W) Recharge, (X) Desal-P S, (Y) Desal-other, (Z) Other [P]

Use of well: (A) Anode, (D) Drain, (G) Seismic, (H) Heat Res, (O) Obs, (P) Oil-gas, (R) Recharge, (T) Test, (U) Unused, (W) Withdraw, (X) Waste, (Z) Destroyed. [W]

DATA AVAILABLE: Well data [ ] Freq. W/L meas.: [ ] Field aquifer char. [ ]

Hyd. lab. data: [ ]

Qual. water data; type: Comp # 11648 [C]

Freq. sampling: [ ] Pumpage inventory: yes no, period: [ ]

Aperture cards: yes [ ]

Log data: [D]

WELL-DESCRIPTION CARD

129' 3"

SAME AS ON MASTER CARD Depth well: 129 ft [1 2 9] Meas rep accuracy [3]

Depth cased; (first perf.) ___ ft [ ] Casing type: steel; Diam. 4 in [4]

Finish: (C) porous concrete, (F) gravel w. (perf.), (G) gravel w. (screen), (H) horiz. gallery, (O) open end, (P) perf., (S) screen, (T) sd. pt., (W) shored, (X) open hole, (Z) other [ ]

Method Drilled: (A) air rot, (B) bored, (C) cable, (D) dug, (H) hyd rot., (J) jetted, (P) air percussion, (R) reverse rotary, (T) trenching, (V) driven, (W) drive wash, (Z) other [ ]

Date Drilled: June 22, 1968 [9 6 8] Pump intake setting: ___ ft [ ]

Driller: Roy Longbithom name, address

Lift (type): (A) air, (B) bucket, (C) cent, (J) jet, (L) multiple (cent.), (M) multiple (turb.), (N) none, (P) piston, (R) rot, (S) submerg, (T) turb, (Z) other [ ] Deep Shallow [ ]

Power (type): diesel, elec, nat gas, gasoline, hand, LP gas, wind; H.P. ___ [ ] Trans. or meter no.

Descrip. MP ___ ft above below LSD, Alt. MP

Alt. LSD: 115 [1 1 5] Accuracy: (source) TOPO [6]

Water Level 90 ft above below MP; Ft above (below) LSD [9 0] Accuracy: [D]

Date meas: 1968 [6 6 8] Yield: 15 gpm [1 5] Method determined [ ]

Drawdown: 20 ft [2 0] Accuracy: [3] Pumping period ___ hrs [ ]

QUALITY OF WATER DATA: Iron ppm [ ] Sulfate ppm [ ] Chloride ppm [ ] Hard. ppm [ ]

Sp. Conduct ___ K x 10^6 [ ] Temp. ___ °F [ ] Date sampled [ ]

Taste, color, etc.

Well No. KC 9-24

White Mountain, Alaska Nome 7/25/83 12035

BIA-PD-3
AOA 2130

Ground surface
Frozen silt &
8 Limestone gravel

Limestone with
loose rocks

94'5"
Crack carrying water &
Loose lime

Limestone with loose rocks

Bottom of casing on
119' solid limestone rock.
122' Hard limestone
Crack in water
129' Hard limestone

This well is 129'3" deep, has 10'8" of 6" casing, 122'7" of 4" casing. 6" casing is set at 119' on hard limestone. Have stratis at 94'5" cut off with 4" casing.
The water is traveling in a crack in the limestone at 122' Static level is 90', will produce 30gpm on full drawdown, but should not be pumped at more than 15gpm, if so it will have loose lime in the water, also after settin for a long period of time it will pump some lime but let it run and it will clear up. There is two 5'8" screens in this well, 5'8" of.015 slot and.020 on the bottom. Well has 240' of heat tape hanging on well cap.

Driller:
Galen Lee Dirksen

Foreman:
Roy E. Longbotham, Jr.

RECEIVED
AUG 13 1990
F.A.C.M. UNIT
ANCHORAGE

KC 9-24

12035

2GW

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WATER ANALYSIS

Location White Mountain well #1 WORK ORDER # 8130 County
Source Depth (ft) 129 Diam (in.)
Cased to (ft) Date drilled June 22, 1968 Point of coll. at pump discharge
Owner Bureau of Indian Affairs
Treatment Use
WBF crack in limeston WL Yield
Temp (°F) Appear. when coll. clear
Collected July 11, 1968 By Roy Longbotham
Remarks no separate iron sample

	~~ppm~~ mg/1	epm		~~ppm~~ mg/1	epm
Silica (SiO_2)	8.0		Bicarbonate (HCO_3)	308	5.05
Aluminum (Al)	---		Carbonate (CO_3)	0	.00
Iron (Fe)	---				
			Sulfate (SO_4)	18	.37
			Chloride (Cl)	150	4.23
			Fluoride (F)	.1	.00
Calcium (Ca)	71	3.54			
Magnesium (Mg)	36	2.96	Nitrate (NO_3)	3.6	.06
Sodium (Na)	71	3.09			
Potassium (K)	1.3	.03			
Total		9.62	Total		9.71

	~~ppm~~ mg/1		
		Specific conductance (micromhos at 25° C)	967
Dissolved solids: Calculated	511	pH	7.5
Residue on evaporation at 180°C		Color	5
Hardness as $CaCO_3$	325	RECEIVED AUG 26 196	
Noncarbonate	73	F.A.C.M. 1967	

KC 9-24

Lab. No. Col11648-63-947 Field No. Project Bureau of Indian Affairs

12036

WELL DRILLING LOG

PROJECT NO: 300-300 TITLE: White Mountain W.O. 4108 P.D. & C
LOCATION: White Mountain, Alaska TYPE OF RIG: Cable
CONTRACTOR: Langbatham - Swindle

DATE	START. DEPTH	STOP DEPTH	DEPTH TO WATER	SAMPLE CLASSIFICATION
1964				
3/18-19	—	—	—	Moving to PD&C Water Well
3/20	—	—	—	Moving & Erecting Rig
3/21	0	3		Frozen Muck
	3	10		Frozen Blue Limestone (Hard)
3/23	10	16		" " " "
	16	18		" White " "
3/24	18	25		" " " "
3/25	25	31.6		" " " "
	31.6	35.6		" Yellow " "
3/26	35.6	51		" " " "
3/27	51	58		" " " "
3/28	58	67.6		" White " "
3/30	67.6	68		" " " "
	68.	69		" " (Hardest)
4/1	69	80.6		Blue Limestone (Very hard)
4/2	80.6	82.6		" " " "
	82.6	88		Wite Limestone " "
4/3	88	95	1 Gal per. hr.	" " " "
4/4	95	104.6		Blue " " "
4/6	104.6	113.4	More Water	" " " "
4/7	113.4	116.3	71'	" " " "
	116.3	117	71'	" & Yellow Limestone 2/3 G.P.M.
	117	117.10	71'	Water in good Vol. +5 G.P.M.
	117.10	118	71'	White Sand
	118	118.3	71'	White Sandstone set Test Pump Ran PM
4/8				Test Pump till noon - Shows Oil (Dicel) in water
	0	19		6" Hole - Ream to set Casing & Shoe
4/9	19	34		" " " " " " " "
4/10	34	45		" " - Very difficult Ream
4/11	45	50		" " " " Reamer Stick
4/13	—	—		Repair Rig - Replace Drill Line

12036

WELL DRILLING LOG

Sheet #2

PROJECT NO: 300-300 TITLE: White MOUNTAIN W04108
LOCATION: White Mountain, Alaska TYPE OF RIG: Cable
CONTRACTOR: Longbothom - Swindle

DATE	START DEPTH Feet	STOP DEPTH Feet	DEPTH TO WATER	SAMPLE CLASSIFICATION
1964				
4/14	50	—	—	Repair Dressing Tools
4/15	50	67		6" Hole - Reaming " "
4/16 4/17	67	83		" " " " "
4/18	83	95		" "
4/20	95	112		" " " " "
4/21	112	115		" " - Finish Reaming Well
	0	39		4" Casing
4/22	39	115³		" " Finished
				16 Sacks Cement fill pockets
4/23 to 26				Repairs on Rig
4/27	109	118		4" Open hole Drilled thru cement - Btm of shoe
				1/2 day Devel. - Surg - Cleaning out sand
4/29				Sustained Production test & clean Oil out of well
4/30				5 G.P.M. Clear Good water only trace of Oil taste

Total casing in hole 117.10
Outer casing 4" 117.10 + 2'-0" above Ground
120 hours pump testing 4/27 to 5/1
Yield 5 G.P.M. Crystal Clear, Excellent Taste
36,000 Gal. water pumped
Pumping Water Level 110 ft.

KC 9-24

WELL DRILLING LOG

12036

PROJECT NO: 300-300 TITLE: White Mountain Water Well
LOCATION: White Mountain, Alaska TYPE OF RIG: Cable
CONTRACTOR: Longbotham & Swindle

DATE	START DEPTH FT.	STOP DEPTH FT.	DEPTH to WATER	SAMPLE CLASSIFICATION
1964				
2/28	0	0		Drill Rig broken down - Moving to
2/29	0	0		White Mountain
3/2	0	0		2 Loads R. Longbotham with last load
3/3	0	0		4 Loads with crew
3/4	0	0		Rig being assembled
3/5	0	7'		Frozen Brown Muck - Temp. 18°
	7	9'		Thawed Brown Muck
	9	20		Fractured Limestone (Takes Water)
3/6	20	30	25'	Struck Water ½ Gal. P.M. Temp +18°
3/7	30	42	25'	Hard Limestone
3/9	42	45	25'	Water 10 G.P.M. Clear & Good
	45	46	25.8	Water - Limestone
3/10	46	46.6	25.8	Drilled 6" Only - Set Test Pump
3/11-17			27.6	Casing in well - Test Pumping & Developing - Sand & Silt trouble Bailing Open Hole No Screen

100 hrs Test Pumping
18 G.P.M.
40' Water Level
Water Good Tasting and clear

KC 9-24

APPENDIX A.iv.
FORT YUKON RARE SITE BACKGROUND INFORMATION

R.A.R.E. Opportunity

Regional Applied Research Effort, U.S. Environmental Protection Agency

The EPA, Office of Research and Development and the EPA, Alaska Operations Office are partnering to look at how contaminants in leachate from open dumps may harm the environment especially drinking water sources. The EPA resources for the project are limited but we think this can be a good start in looking at the relationship between dump site leachate and impacts to our environment. There is the opportunity for EPA to partner with five villages on the project.

Five different types of dump site conditions are needed for the project: 1) a dump site in dug up tundra; 2) a dump site mostly on top of the tundra; 3) a dump site in a tundra pond; 4) a dump site in ground that is not tundra where there is a short distance (twenty-five feet or less) to ground water; and 4) a dump site in ground that is not tundra where there is a longer distance (twenty-five feet or more) to ground water.

If you think your village may be interested in participating in the project please complete this form and return it to either Michelle Davis or Joe Sarcone of the EPA, Alaska Operations Office. Our fax number is (907) 271-3424. Thanks.

Name of Village: Fort Yukon, Alaska

Contact Person: Clayton Tackett

Email address: ctackett7@hotmail.com

Telephone number: 907-662-2581

IGAP program: yes X no ___

Owner/operator of dump site (for example: the city government): City of Fort Yukon

Owner of the land the dump site is located on (for example: the corporation): Gwichyaa Zhee Gwichin Tribal Government

Age of the dump site: 30 years

Distance of the dump site to the village: 1/2 mile

Distance of the dump site to a drinking water source (this could be the source of water for your watering point/washeteria or it could be a traditional water source such as river, tundra pond, spring, or ice): 1/10 mile from Hospital Lake

Distance of dump from a source of subsistence (for example, a river or slough or a berry picking area): 1/10 mile from Hospital Lake

Type of dump site condition, Please circle one:

1) dump site in dug up tundra;

2) dump site mostly on top of the tundra;

3) dump site in a tundra pond;

4) dump site in ground that is not tundra where there is a short distance (twenty-five feet or less) to ground water;

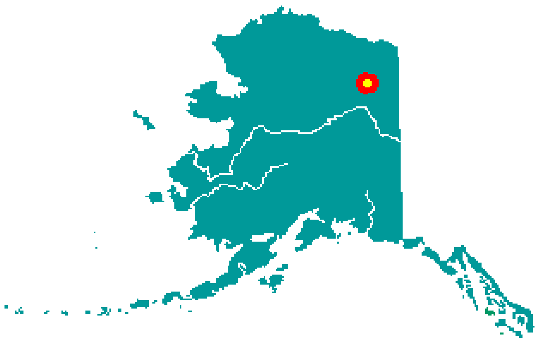
5) dump site in ground that is not tundra where there is a longer distance (twenty-five feet or more) to ground water.

6) other (please describe)

Additional information you would like for us to know:

This dumpsite has never been regulated and is consitered a open dump. For many years all types of materials have been deposited.

Alaska Community Database Community Information Summaries (CIS)



Fort Yukon

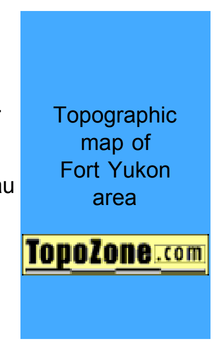
(YOO-kawn)

For Photos of Fort Yukon click here

For a Map of Fort Yukon click here

Current Population:	598 (2011 Alaska Department of Labor Estimate)
Incorporation Type:	2nd Class City
Located In:	Yukon-Koyukuk Census Area
Taxes:	Sales: 3%, Property: None, Special: None
National Flood Insurance Program Participant:	Yes

Location and Climate



Fort Yukon is located at the confluence of the Yukon and Porcupine Rivers, about 145 air miles northeast of Fairbanks. The community lies at approximately 66.564720° North Latitude and -145.273890° West Longitude. (Sec. 18, T020N, R012E, Fairbanks Meridian.) Fort Yukon is located in the Fairbanks Recording District. The area encompasses 7.0 sq. miles of land and 0.4 sq. miles of water.

The winters are long and harsh, and the summers are short but warm. After freeze-up, the plateau is a source of cold, continental arctic air. Daily minimum temperatures between November and March are usually below 0 °F. Extended periods of -50 to -60 °F are common. Summer high temperatures run 65 to 72 °F; a high of 97 °F has been recorded. Total annual precipitation averages 6.58 inches, with 43.4 inches of snowfall. The Yukon River is ice-free from the end of May through mid-September.

History, Culture and Demographics

Fort Yukon was founded in 1847 by Alexander Murray as a Canadian outpost in Russian territory. It became an important trade center for the Gwich'in Indians, who inhabited the vast lowlands of the Yukon Flats and River valleys. The Hudson Bay Company, a British trading company, operated at Fort Yukon from 1846 until 1869. In 1862, a mission school was established. In 1867, Alaska was purchased by the U.S., and, two years later, it was determined that Fort Yukon was on American soil. Moses Mercier, a trader with the Alaska Commercial Company, took over operation of the Fort Yukon Trading Post. A post office was established in 1898. The fur trade of the 1800s, the whaling boom on the Arctic coast (1889-1904), and the Klondike Gold Rush spurred economic activity and provided some economic opportunities for the Natives. However, major epidemics of introduced diseases struck the Fort Yukon population from the 1860s until the 1920s. In 1949, a flood damaged or destroyed many homes in Fort Yukon. During the 1950s, a White Alice Communications System and an Air Force station were established. Fort Yukon incorporated as a city in 1959.

A federally-recognized tribe is located in the community -- the Native Village of Fort Yukon; Canyon Village Traditional Council (not recognized). Most Fort Yukon residents are descendants of the Yukon Flats, Chandalar River, Birch Creek, Black River, and Porcupine River Gwich'in Athabascan tribes. Subsistence is an important component of the local culture.

According to Census 2010, there were 325 housing units in the community and 246 were occupied. Its population was 89.2 percent American Indian or Alaska Native; 7.7 percent white; 0.5 percent black; 0.2 percent Asian; 0.5 percent Pacific Islander; 1.7 percent of the local residents had multi-racial backgrounds. Additionally, 0.3 percent of the population was of Hispanic decent.

Facilities, Utilities, Schools and Health Care

Water is derived from two wells and is treated and stored in a 110,000-gallon tank. A combination of piped water, water delivery, and individual wells serve households. A flush/haul system, septic tanks, honeybuckets, and outhouses are used for sewage disposal. Approximately half of all homes are plumbed. The piped water system and household septic tanks were installed in 1984. Electricity is provided by Gwitchyaa Zhee Utilities. There is one school located in the community, attended by 117 students. Local hospitals or health clinics include Fort Yukon Public Health Office and the Yukon Flats Health Center. The clinic is a qualified emergency care center. Fort Yukon is an isolated town/sub-regional center it is part of the Interior EMS Region. Emergency Services include river and air access and are within 30 minutes of a higher-level satellite health care facility. Emergency service is provided by 911 telephone service volunteers and a health aide. Auxiliary health care is provided by Fort Yukon Emergency Medical Services (Dispatch 907-662-2462 Office 662-2460).

Economy

City, state, and federal agencies and the Native corporation are the primary employers in Fort Yukon. The school district is the largest employer. Winter tourism is becoming increasingly popular; Fort Yukon experiences spectacular northern lights. The BLM operates an emergency firefighting base at the airport. The U.S. Air Force operates a White Alice Communications System in Fort Yukon. Trapping and Native handicrafts also provide income. Residents rely on subsistence foods -- salmon, whitefish, moose, bear, caribou, and waterfowl provide most meat sources. In 2009, one resident held a commercial fishing permit.

The 2006-2010 American Community Survey (ACS) estimated 212[1] residents as employed. The public sector employed 31.6%[1] of all workers. The local unemployment rate was 21.5%[1]. The percentage of workers not in labor force was 32.0%[1]. The ACS surveys established that average median household income (in 2010 inflation-adjusted dollars) was $30,500 (MOE +/-$12,733)[1]. The per capita income (in 2010 inflation-adjusted dollars) was $18,555 (MOE +/-$3,695)[1]. About 20.6%[1] of all residents had incomes below the poverty level.

[1] All ACS statistics are published with their repective margin of error (MOE). Some of the statistics here are calculated from the original ACS data. The MOE was unable to be carried through the calculations.

For additional ACS information please click here.

For current Local Labor Market Information please click here

Transportation

Fort Yukon is accessible by air year-round and by barge during the summer months. Heavy cargo is brought in by barge from the end of May through mid-September; there is a barge off-loading area but no dock. Riverboats and skiffs are used for recreation, hunting, fishing, and other subsistence activities. A state-owned 5,810' long by 150' wide lighted gravel airstrip is available; Hospital Lake, adjacent to the airport, is used by float planes. There are 17 miles of local roads and over 100 automobiles and trucks. The city transit bus system provides transport throughout the town. Snowmachines and dog sleds are used on area trails or the frozen river, which becomes an ice road to area villages during winter.

Organizations with Local Offices

City - City of Fort Yukon
P.O. Box 269
Fort Yukon, AK 99740
Phone 907-662-2479 alternate:(907)662-5129
Fax 907-662-2717
E-mail fycitymgr@hotmail.com; cityclerk@gci.net

Economic Development - Yukon Flats Resource Conservation and Development
P.O. Box 283
Fort Yukon, AK 99740
Phone 907-662-2667

Electric Utility - Gwitchyaa Zhee Utilities
P.O. Box 9

Fort Yukon, AK 99740-0009
Phone 907-662-2322
Fax 907-662-2983
E-mail gzutilities@yahoo.com

School District - Yukon Flats School District
P.O. Box 350
Ft. Yukon, AK 99740-0350
Phone 907-662-2515
Fax 907-662-3094
E-mail lance.bowie@yukonflats.net
Web http://www.yukonflats.net

Tribe - federally recognized - Native Village of Fort Yukon
P.O. Box 126
Fort Yukon, AK 99740
Phone 907-662-2581
Fax 907-662-2222
E-mail tina.herbert@fortyukon.org

Village Corporation - Canyon Village Traditional Council
P.O. Box 13
Fort Yukon, AK 99740
Phone 907-662-2502
Fax 907-662-3047

Village Corporation - Gwitchyaa Zhee Corporation
P.O. Box 329
Fort Yukon, AK 99740
Phone 907-662-3056
Fax 907-662-2646

Village Council - Council of Athabascan Tribal Governments, Incorporated
P.O. Box 33
Fort Yukon, AK 99740
Phone 907-662-2581
Fax 907-662-3333
E-mail tina.herbert@fortyukon.org
Web http://www.catg.org

Regional Organizations

School District - Yukon Flats School District
P.O. Box 350
Ft. Yukon, AK 99740-0350
Phone 907-662-2515
Fax 907-662-3094
E-mail lance.bowie@yukonflats.net
Web http://www.yukonflats.net

Regional Native Corporation - Doyon, Limited
1 Doyon Place, Suite 300
Fairbanks, AK 99701-2941
Phone 907-459-2000
Fax 907-459-2060
E-mail info@doyon.com
Web http://www.doyon.com

Regional Native Health Corporation - Tanana Chiefs Conference
122 First Ave, Suite 600
Fairbanks, AK 99701
Phone 907-452-8251
Fax 907-459-3851
E-mail jerryisaac@tananachiefs.org
Web http://www.tananachiefs.org

Native Housing Authority - Native Village of Fort Yukon

P.O. Box 126
Fort Yukon, AK 99740
Phone 907-662-2581
Fax 907-662-2222
E-mail tina.herbert@fortyukon.org

Alaska Well Log Tracking System
Fort Yukon Well Logs
(Searched May 2012)

#	Driller	Owner	Property Description	Key
1	UNKNOWN	US DOD, AIR FORCE, FORT YUKON	FORT YUKON AFB WELL 1	11500
2	USGS	USGS	FORT YUKON	23725
3	SWAN DRILLING	FORT YUKON, CITY OF	FORT YUKON SCHOOL WELL 1	23855
4	SWAN DRILLING	FORT YUKON, CITY OF	FORT YUKON SCHOOL WELL 2	23856
5	US ARMY CORPS OF ENGINEERS	US DOD, CORPS OF ENGINEER (COE)	FORT YUKON EXPLORATORY WELL	24048
6	ALPINE DRILLING	ASAF - ARCTEC	FORT YUKON ARS SITE, 2007 WELL 1	33044
7	ALPINE DRILLING	ASAF - ARCTEC	FORT YUKON ARS SITE, 2007 WELL 2	33045

http://www.navmaps.alaska.gov/welts/switchbox.asp

23855

Swan Drilling Co.
4 Mile Steese Hwy.
Fairbanks, Alaska 99701

WELL LOG

STATE SCHOOL PUMP HOUSE
FORT YUKDN, ALASKA
1974

8" WELLS

WELL #1 [redacted]
(Closest to Pump House)

0' - 2' Silt & Sand (frozen)
2' - 9' Silt & Sand
9' - 12' Black Mud
12' - 30' Gravel, Sand & Water

WELL # 2

0' - 2' Silt & Sand (frozen)
2' - 11' Silt & Sand
11' - 29' Gravel, Sand & Water

Water Static Level 13'
Water Temperature 33
Pumps Make 60 GPM each
Pump Test Well #1 & #2 for 1 hour at 60GPM each, ater Static Level remained at 13'
Well #1 & #2 have 15' Johnson's Screen (Stainless Steel) #60 Slot
Extended casing 4' 8" above ground level on both Wells
Installed WEBTROL 708TC154-3ph Turbine Pumps
Pumps set 21' from top of casing
Installed 15' Copper Heat Cables down Well #1 & #2
#EZ-CU-15-2
300W 120V 15' 2.5AMPS
2½" Pipe between Wells & Pump House has two (2) separate Heat Cables which are Auto-Trace Self-Limiting.

Fort Yukon School
Contract P-786
DB 131-4-29140

LOCAL NO. FA 20-12
SITE ID

23855 [ ] Emergency

WATER ANALYSIS REPORT FORM [ ] Illness Suspected

Doug Lowe or John H. Jamesson

Mail Report To: Dept of Environmental Conservation Box 1601 Fairbanks, Alaska 99701 Explain: New Water Well

C 615

Name SWAN Drilling Co INC Ft. Yukon, Well

Collected By Swan Drilling Co Inc. Date 12-26 Hour

Legal Address of Property: Lot Block U.S. Survey #

WATER SYSTEM

1. Well Type 8" Casing Drilled Depth 75' Gallons per Minute 10 GPM
2. Surface Water: None Temporary [ ] Permanent [X]
3. Number of Homes Served School
4. Treatment: [ ] Yes [X] No

PURPOSE OF ANALYSIS

[ ] 1. Water Approval for Building Permit. (Column 1)
[X] 2. Routine Analysis. (Columns 1 and 2)
[X] 3. Special: Check Specific Items for Analysis. (Columns 1, 2 and 3)

(1)	Analysis	Limits
Iron (Fe)	0.00	0.3
Fluoride (F)	0.08	1.5
Chloride (Cl)	4	250
Phosphate (PO_4)	0.00	.05 good 30 poor
Total Hardness	124	50 soft 300 hard
Detergents	0	0.
pH	7.81	6.5 - 8.5
Specific Conductance	248	

(2)	Analysis	Limits
Magnesium (Mg)	22	125
Calcium Ca)	33	300
Turbidity	1	5
Color	5	15
Bicarbonate (HCO_3)	138	25 good 500 poor
Carbonate	0	350
Alkalinity	113	350
Total Disolved Solids	168	500

(3)	Analysis	Limits
Sodium (Na)	3	200
Potassium (K)	<1	
Sulfate (SO_4)	22	250
Sulfite *(SO_3)		5.0
Nitrate (NO_3)	0.78	10.
Suspended Solids	0.5	
Arsenic (As)	0.00	0.01
Copper (Cu)		1.0
Cyanide (Cn)	Out Dated	0.01
Phenols	Out Dated	0.001
Zinc (Zn)	insufficient	5.0
Barium (Ba)	sample	1.0
Cadmium (Cd)		0.01
Lead (Pb)		0.05
Silver (Ag)		0.05
Mercury (Hg)		0.05
Manganese (Mn)	0.112	0.05

Rec'd 1/13/75

SANITARIANS COMMENTS:

RECEIVED FEB 13 1975 DEPT. OF ENVIRONMENTAL CONSERVATION NRO

Dan Gerber & K. Salisbury 1/21/75

FA 20-12

* Requires Special Container

Instructions on Back

23856

Swan Drilling Co.

4 Mile Steese Hwy.
Fairbanks, Alaska 99701

WELL LOG

STATE SCHOOL PUMP HOUSE
FORT YUKON, ALASKA
1974

8" WELLS

WELL # 1
(Closest to Pump House)

0' - 2' Silt & Sand (frozen)
2' - 9' Silt & Sand
9' - 12' Black Mud
12' - 30' Gravel, Sand & Water

WELL #2
[redacted]

0' - 2' Silt & Sand (frozen)
2' - 11' Silt & Sand
11' - 29' Gravel, Sand & Water

Water Static Level 13'
Water Temperature 33
Pumps Make 60 GPM each
Pump Test Well #1 & #2 for 1 hour at 60GPM each, Water Static Level remained at 13'
Well #1 & #2 have 15' Johnson's Screen (Stainless Steel) #60 Slot
Extended casing 4' 8" above ground level on both Wells
Installed WEBTROL 708TC154-3ph Turbine Pumps
Pumps set 21' from top of casing
Installed 15' Copper Heat Cables down Well #1 & #2
#EZ-CU-15-2
300W 120V 15' 2.5AMPS
2½" Pipe between Wells & Pump House has two (2) separate Heat Cables which are Auto-Trace Self-Limiting.

Fort Yukon School
Contract P-786
DB 131-4-29140

LOCAL NO. FA20-12
SITE ID

23856

WATER ANALYSIS REPORT FORM

Doug Lowee Or John H. Vanes...

[ ] Illness Suspecte

Mail Report To: Dept of Environmental Conservation Box 1601 Fairbanks, Alaska 99701

Explain: New Water Well

C 815

Name SWAN Drilling Co INC. T. Yukon, Well

Collected By Swan Drilling Co INC. Date 12-26 Hour ______

Legal Address of Property: Lot ______ Block ______ U.S. Survey # ______

WATER SYSTEM

1. Well Type 8" Casing Drilled Depth 75' Gallons per Minute 10 GPM
2. Surface Water: None Temporary [ ] Permanent [X]
3. Number of Homes Served School
4. Treatment: [ ] Yes ______ [X] No

PURPOSE OF ANALYSIS

[ ] 1. Water Approval for Building Permit. (Column 1)
[X] 2. Routine Analysis. (Columns 1 and 2)
[X] 3. Special: Check Specific Items for Analysis. (Columns 1, 2 and 3)

(1)	Analysis	Limits
Iron (Fe)	0.00	0.3
Fluoride (F)	0.08	1.5
Chloride (Cl)	4	250
Phosphate (PO_4)	0.00	.05 good 30 poor
Total Hardness	124	50 soft 300 hard
Detergents	0	0.
pH	7.81	6.5 - 8.5
Specific Conductance	248	

(2)	Analysis	Limits
Magnesium (Mg)	22	125
Calcium (Ca)	33	300
Turbidity	1	5
Color	5	15
Bicarbonate (HCO_3)	138	25 good 500 poor
Carbonate	0	350
Alkalinity	113	350
Total Disolved Solids	168	500

(3)	Analysis	Limits
Sodium (Na)	3	200
Potassium (K)	<1	
Sulfate (SO_4)	22	250
Sulfite *(SO_3)		5.0
Nitrate (NO_3)	0.78	10.
Suspended Solids	0.5	
Arsenic (As)	0.00	0.0
Copper (Cu)		1.0
Cyanide (Cn)	Out Dated	0.0
Phenols	Out Dated	0.0
Zinc (Zn)	Insufficient	5.0
Barium (Ba)	sample	1.0
Cadmium (Cd)		0.0
Lead (Pb)		0.0
Silver (Ag)		0.0
Mercury (Hg)		0.0
Manganese (Mn)	0.112	0.0

Rec'd 1/13/75

SANITARIANS COMMENTS: ______

RECEIVED

FEB 13 1975

DEPT. OF ENVIRONMENTAL CONSERVATION NRO

Dan Gerber & K. Salisbury 1/21/75

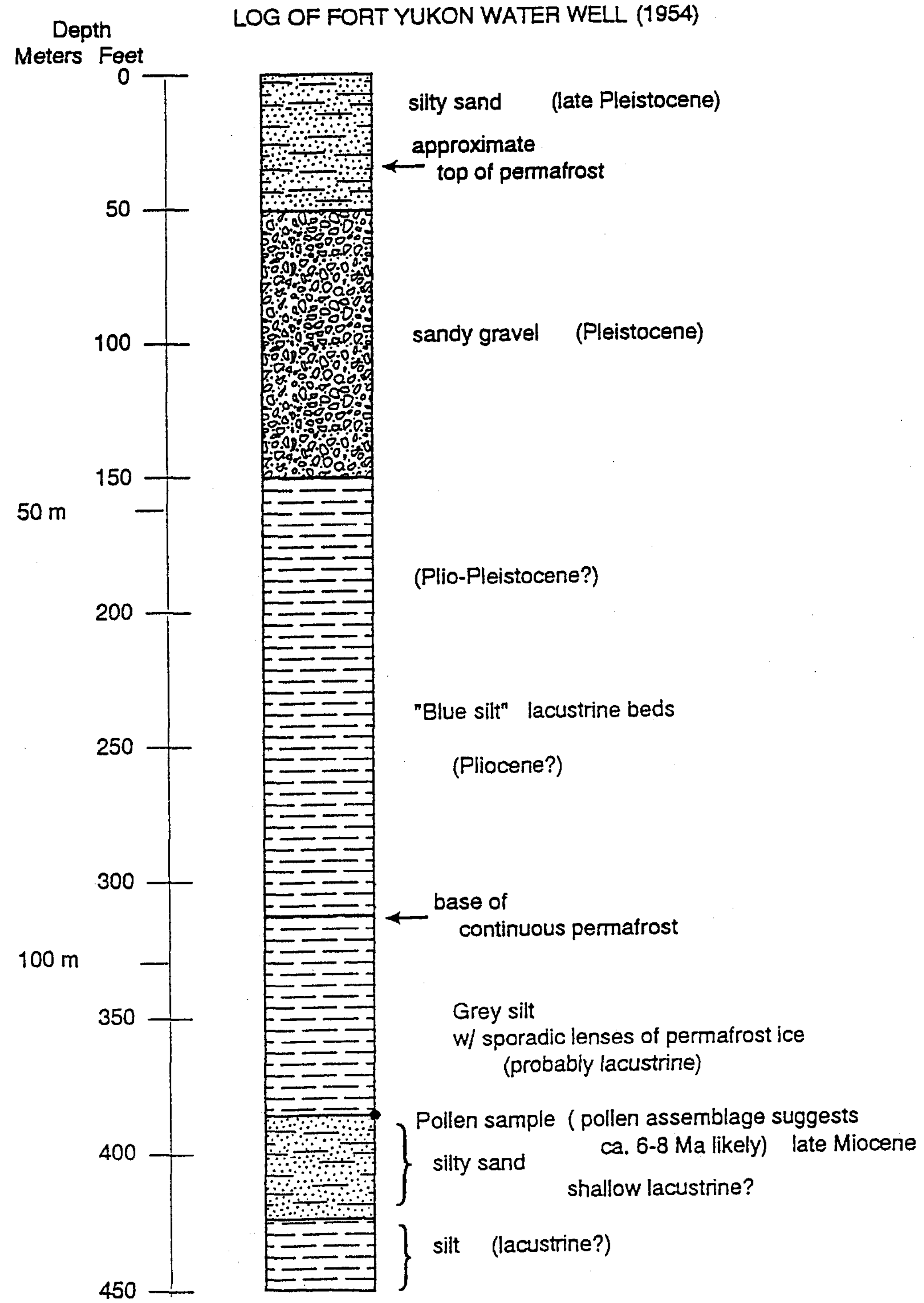
FA 20-12

* Requires Special Container

Instructions on Back

EXPLORATORY WELL

24048



LOCAL NO. FA 20-12
SITE ID

Fig. 4. Log of Fort Yukon, Alaska, water well drilled by the U.S. Army Corps of Engineers in 1954 (Williams, 1962). A single sample of sediment collected from a depth of ca. 390 feet (119 m) was found to contain a fossil pollen assemblage that suggests a probable late Miocene age (ca. 6-8 million yrs. old) for that depth.

ALPINE DRILLING & ENTERPRISES

Permit Number: #SW_____ **Date of Issue:** _____ **Parcel Identification Number:**_____
Date Started: 8-18-07 **Date Completed:** 8-18-07 Is well located at approved permit location? ☒ **Yes** ☐ **No**
Legal Description: 2007 Test Well # 1 Fort Yukon ARS Site
Property Owner Name & Address: USAF - ARCTEC

Borehole Data:
Soil Type, Thickness & Water Strata

Soil Type	Depth (ft) From	To
stick-up	0	1
Sandy Silt	1	12
silty sand	12	24
silty sandy gravel small amt H20	24	32
silty sandy gravel Frozen	32	100

Method of Drilling ☒ air rotary ☐ cable tool

Casing type: steel
Wall Thickness: .025 inches
Diameter: 6 inches Depth: 60 feet
Liner Type: _____
Diameter: _____ inches Depth: _____ feet
Casing stickup above ground: 1 feet

Static water level (from ground level): 0 feet
Pumping level:______feet after
_____ hours pumping _____ gpm
Recovery Rate: _____ gpm
Method of Testing: _____

Well Intake Opening Type:
☐ Open End ☒ Open Hole
☐ Screened Start _____ feet Stopped _____ feet
☐ Perforations Start _____ feet Stopped _____ feet

Grout Type: *bentonite granules* **Volume:** 4
Depth: Start bgs feet Stopped 20 feet

Pump: Intake Depth _____ **feet**
Pump size _____ hp Brand Name _____

Well Disinfected Upon Completion? ☐ **Yes** ☐ **No**
Method of Disinfection: _____

Comments: *Well appears to be pema frost from the 32' level. A well seal was installed but the USAf may want to decommission this well in the future.*

Well Driller: Alpine Drilling & Enterprises
P.O. Box 110496
Anchorage, AK 99511-0496

Attention: The well driller shall provide a well log to the property owner within 30 days of completion and the property owner or the well driller shall provide a well log to the Development Services Department within 60 days of completion.

APPENDIX A.v.
ALLAKAKET RARE SITE BACKGROUND INFORMATION

R.A.R.E. Opportunity

Regional Applied Research Effort, U.S. Environmental Protection Agency

The EPA, Office of Research and Development and the EPA, Alaska Operations Office are partnering to look at how contaminants in leachate from open dumps may harm the environment especially drinking water sources. The EPA resources for the project are limited but we think this can be a good start in looking at the relationship between dump site leachate and impacts to our environment. There is the opportunity for EPA to partner with five villages on the project.

Five different types of dump site conditions are needed for the project: 1) a dump site in dug up tundra; 2) a dump site mostly on top of the tundra; 3) a dump site in a tundra pond; 4) a dump site in ground that is not tundra where there is a short distance (twenty-five feet or less) to ground water; and 4) a dump site in ground that is not tundra where there is a longer distance (twenty-five feet or more) to ground water.

If you think your village may be interested in participating in the project please complete this form and return it to either Michelle Davis or Joe Sarcone of the EPA, Alaska Operations Office. Our fax number is (907) 271-3424. Thanks.

Name of Village:
Allakaket
Contact Person:
Pamela Vent EPA Coordinator
Email address:
allakaketepa@yahoo.com
Telephone number:
907-968-2529
IGAP program: yes_X no ___

Owner/operator of dump site (for example: the city government):
City of Allakaket
Owner of the land the dump site is located on (for example: the corporation):
City of Allakaket
Age of the dump site:
The dump was built 1999
Distance of the dump site to the village:
The dump is around 2-3 miles away from any houses
Distance of the dump site to a drinking water source (this could be the source of water for your watering point/washeteria or it could be a traditional water source such as river, tundra pond, spring, or ice):
It is about 2 ½ - 3 ½ miles away from the washeteria
Distance of dump from a source of subsistence (for example, a river or slough or a berry picking area):
The dump is about 2 ½ -3 ½ away from the Koyukuk River, there is berry picking areas all around the tundra between the dump and Allakaket.

Type of dump site condition, Please circle one:

1) dump site in dug up tundra;

2) dump site mostly on top of the tundra;

3) dump site in a tundra pond;

4) dump site in ground that is not tundra where there is a short distance (twenty-five feet or less) to ground water;

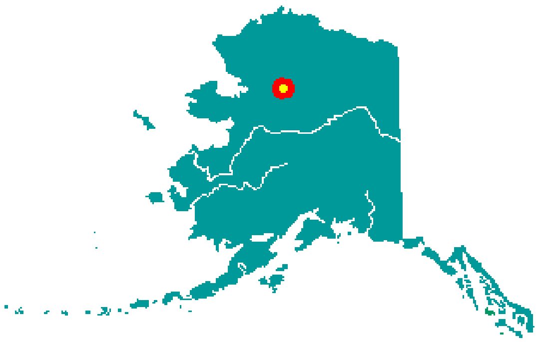
5) dump site in ground that is not tundra where there is a longer distance (twenty-five feet or more) to ground water.

6) other (please describe)
The dump is mostly on top of tundra and also on Permafrost

Additional information you would like for us to know:

The Tribal Council and Community are interested on learning what would happen if the permafrost would melt and the affects it would have on our lands.

Alaska Community Database Community Information Summaries (CIS)



Allakaket

(al-uh-KACK-ut); also see New Allakaket

For Photos of Allakaket click here

For a Map of Allakaket click here

Current Population:	103 (2011 Alaska Department of Labor Estimate)
Incorporation Type:	2nd Class City
Located In:	Yukon-Koyukuk Census Area
Taxes:	Sales: None, Property: None, Special: None

Location and Climate

Allakaket is on the south bank of the Koyukuk River, southwest of its junction with the Alatna River, approximately 190 air miles northwest of Fairbanks and 57 miles upriver from Hughes. The village of Alatna is located directly across the river. The community lies at approximately 66.562610° North Latitude and -152.647560° West Longitude. (Sec. 14, T020N, R024W, Fairbanks Meridian.) Allakaket is located in the Fairbanks Recording District. The area encompasses 3.6 sq. miles of land and 0.7 sq. miles of water.

The area experiences a cold, continental climate with extreme temperature differences. The average high temperature during July is 70 °F. The average low temperature during January is well below zero and extended periods of -40 °F are common. The highest temperature ever recorded was 94 °F, and the lowest was -75 °F. Average annual precipitation is 13 inches, and average annual snowfall is 72 inches. The Koyukuk River is ice-free from June through October.

History, Culture and Demographics

Several Native groups have lived in the area, including Koyukon Athabascans and Kobuk, Selawik, and Nunamiut Eskimos from the north and northwest. The Koyukon lived in several camps throughout the year, moving as the seasons changed, following the wild game and fish. The various bands established joint settlements after 1851. The old site of Alatna was a traditional trading center for Athabascans and Eskimos. The first mission on the Koyukuk River, St. John's-in-the-Wilderness Episcopal Mission, was established in 1906. A post office was opened in 1925. In 1938, the name of the community was changed to Allakaket (the old name for the mission), and the name Alatna was assumed by the small Eskimo community across the river. The first public school was established in 1957. A flood caused by ice jamming inundated 85% of the community in the Spring of 1964. In 1975, the community incorporated as a city, including both settlements of Allakaket and Alatna. A clinic and airport were built in 1978. A new school and community roads were built in 1979. In September 1994, flood waters destroyed and swept away nearly all of the community's buildings, homes, and food caches for the winter. Residents rebuilt near the old city site, but some new homes and facilities are now located outside of the incorporated city boundaries. New Allakaket and Alatna are located outside of the city limits.

A federally-recognized tribe is located in the community -- the Allakaket Village. Allakaket is mainly an Athabascan community; Kobuk Eskimos live across the river in Alatna. Two separate village councils exist. Traditional potlatches, dances and foot races attract visitors from area villages. Subsistence activities provide the majority of food sources. The sale, importation, and possession of alcohol is banned in the village.

According to Census 2010, there were 58 housing units in the community and 44 were occupied. Its population was 95.2 percent American Indian or Alaska Native; 1 percent white; 3.8 percent of the local residents had multi-racial backgrounds.

Facilities, Utilities, Schools and Health Care

Most public facilities were severely damaged in the 1994 Koyukuk River flood. Major components have been replaced -- a washeteria, well and treatment plant, 100,000-gal. water storage tank, sewage lagoon, and force main have been completed. The lagoon is connected to the washeteria and school. Residents carry treated water and haul honeybuckets or use pit privies; no households have plumbing. Electricity is provided by Alaska Power Company. There is one school located in the community, attended by 41 students. Local hospitals or health clinics include Allakaket Health Clinic. Allakaket Health Clinic is a Primary Health Care facility with river and air access.

Economy

Most cash jobs are part-time or seasonal. The primary year-round employers are the school, city, tribe, and village corporation store. Construction and BLM emergency firefighting provide summer jobs. A few earn income from trapping or selling traditional Native handicrafts. Subsistence is the focus of the local economy. Salmon, whitefish, moose, bear, small game, and berries provide most food sources. Caribou are taken when available.

The 2006-2010 American Community Survey (ACS) estimated 20[1] residents as employed. The public sector employed 30.0%[1] of all workers. The local unemployment rate was 54.5%[1]. The percentage of workers not in labor force was 18.5%[1]. The ACS surveys established that average median household income (in 2010 inflation-adjusted dollars) was $19,250 (MOE +/-$5,250)[1]. The per capita income (in 2010 inflation-adjusted dollars) was $15,925 (MOE +/-$5,965)[1]. About 49.2%[1] of all residents had incomes below the poverty level.

[1] All ACS statistics are published with their repective margin of error (MOE). Some of the statistics here are calculated from the original ACS data. The MOE was unable to be carried through the calculations.

For additional ACS information please click here.

For current Local Labor Market Information please click here

Transportation

Allakaket has no road link, but winter trails connect it with Hughes, Bettles, and Tanana. River transportation is important in summer, but there is no commercial barge access due to shallow water. A state-owned 4,000' long by 100' wide gravel runway is accessible year-round. A $6 million airport improvement began construction in 1997.

Organizations with Local Offices

City - City of Allakaket
P.O. Box 30
Allakaket, AK 99720
Phone 907-968-2424
Fax 907-968-2241
E-mail cityofallakaket@gmail.com

Electric Utility - Alaska Power Company
P.O. Box 3222
Port Townsend, WA 98368
Phone 800-982-0136
Fax 360-385-5177
E-mail apt@aptalaska.com
Web http://www.aptalaska.com/

Tribe - federally recognized - Allakaket Village
P.O. Box 50
Allakaket, AK 99720
Phone 907-968-2241
Fax 907-968-2233

Regional Organizations

School District - Yukon-Koyukuk School District
4762 Old Airport Way
Fairbanks, AK 99709-4456
Phone 907-374-9400
Fax 907-374-9442
E-mail kboyd@yksd.com
Web http://www.yksd.com

Regional Native Corporation - Doyon, Limited
1 Doyon Place, Suite 300
Fairbanks, AK 99701-2941
Phone 907-459-2000
Fax 907-459-2060
E-mail info@doyon.com
Web http://www.doyon.com

Regional Native Health Corporation - Tanana Chiefs Conference
122 First Ave, Suite 600
Fairbanks, AK 99701
Phone 907-452-8251
Fax 907-459-3851
E-mail jerryisaac@tananachiefs.org
Web http://www.tananachiefs.org

Native Housing Authority - Allakaket Village
P.O. Box 50
Allakaket, AK 99720
Phone 907-968-2241
Fax 907-968-2233

Alaska Well Log Tracking System
Allakaket Well Logs
(Searched May 2012)

#	Driller	Owner	Property Description	Key
1	US BIA	US BIA, ALLAKAKET	ALLAKAKET AREA	2625
2	US BIA	US BIA, ALLAKAKET	ALLAKAKET AREA	2626
3	US BIA	US BIA, ALLAKAKET	ALLAKAKET AREA	2627
4	US BIA	US BIA, ALLAKAKET	ALLAKAKET AREA	2647
5	LCMF LTD	ALLAKAKET, CITY OF	ALLAKAKET AREA	23081
6	US PHS	US PHS, ALLAKAKET	ALLAKAKET, COMMUNITY WELL	23838

http://www.navmaps.alaska.gov/welts/switchbox.asp

2647

Log of Churn Drill Hole #3 Allakaket, Alaska
1 Aug 1962 – 3 Aug 1962

Ground level

0 – 1	Tundra
1 – 7	silty sand
7 – 14	Gravel with large boulders
water line	Static level 19½ feet
14 – 26	Silty gravel
26 – 35	Very clean gravel
35 – 37.5	Heaveing sand

No frost of any kind encountered
Only eleven feet from #2
Struck water 26' – Static 19½ from ground
38' casing in hole with 2' stickup
Made & assembled plunger type pump
Pumped 3 gpm. no drawdown
Temperature of water 33° F
Sample sent to A.N.H. Anchorage.
Screen too large to go in hole, Made
& developed well thru gravel pack
around bottom

B I A. Well Driller
Alfred D. Rulf

SITE ID
LOCAL NO. FB 30-24-23 / 14

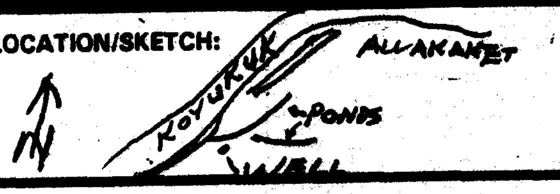
LAS 23081 19981
11-17-95
~~10-27-95~~ 1K2D
FMSec 22, T20N, R24W
NE4NE4
Ch. N62W12

STATE OF ALASKA
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF MINING & WATER MGMT
WATER WELL RECORD

LOCATION OF WELL ALLAKAKET, AK.

BOROUGH	SUBDIVISION	LOT	BLOCK	SECTION QTRS	SECTION	TOWNSHIP	RANGE	MERIDIAN
UNORGANIZED	NONE	NA	NA	IN NE 1/4	22	20 ☒N ☐S	24 ☐E ☒W	FAIRBANKS

LOCATION/SKETCH:



WELL OWNER:
LAND: KOYITL'OTS'INA, LTD
WELL: CITY OF ALLAKAKET

DEPTHS MEASURED FROM: ☐casing top ☐ground surface

WELL DEPTH:
Depth of hole: 73 ft
Depth of casing: 69 ft

DATE OF COMPLETION 9 / 21 / 95

BOREHOLE DATA: Material Type and Color

Material Type and Color	Depth From	Depth To
THAWED ORGANICS & SILT	0	2
FROZEN SILT	2	9
FROZEN SANDY GRAVEL	9	22
THAWED SANDY GRAVEL WATER FROM 26 TO 34	22	34
SILT · DRIER W/DEPTH	34	60
SANDY SILTY GRAVEL WATER FROM 67 TO 69	60	69
GRAY BEDROCK	69	73

DEPTH TO STATIC WATER LEVEL: 22.4 ft below ☐ top of casing ☒ ground surface
Date: 9 / 21 / 95

METHOD OF DRILLING: ☒ air rotary ☐ cable tool ☐ other SIMCO 5000-WS

USE OF WELL: ☐ domestic ☐ irrigation ☐ monitor ☒ public supply ☐ other

CASING STICK-UP: 5 ft. Diam: 6 in. to ___ ft
Casing type: 1/4" STEEL 6 in. to ___ ft

WELL INTAKE OPENING TYPE: ☒ open end ☐ screened ☐ perforated ☐ open hole
Depths of openings: N/A to ___ ft

SCREEN TYPE: N/A Diam: ___ in.
Slot/Mesh Size: ___ Length: ___ ft

GRAVEL PACK TYPE: N/A
Volume used: ___ Depth to top: ___

GROUT TYPE: BENTONITE OUTSIDE WELL CASING Volume: 5 · 50 LB SACKS
Depth: from SURFACE ft to -10 ft

DEVELOPMENT METHOD: PUMPING
Duration: 4 HRS

PUMPING LEVEL AND YIELD:
65 ft after 4 hrs pumping 10 gpm

PUMP INTAKE DEPTH: 64.5 ft Horsepower: ___
WELL DISINFECTED UPON COMPLETION? ☒ YES ☐ NO

SITE ID / LOCATION: FB 20 24 22AA

CONTRACTOR INFORMATION:

LCMF, LTD
Registered Business Name

Morgan P. Merritt 10/6/95
Signature of Authorized Respresentative Date

REMARKS: WELL IS 205' E. OF KOYUKUK, 75' S.E. OF SLOUGH/POND. DRILLING BY ALPINE-DAVE HARPER

PLEASE MAIL WHITE COPY OF LOG TO:
DNR/DIVISION OF MINING & WATER MGMT
3601 C St, Suite 800
Anchorage, Ak 99503-5935

Ph(907)762-2538,Fax(907)562-1384

23838
Burge copy in Allakaket file

WELL LOG

U.S. PUBLIC HEALTH SERVICE, DIVISION OF INDIAN HEALTH

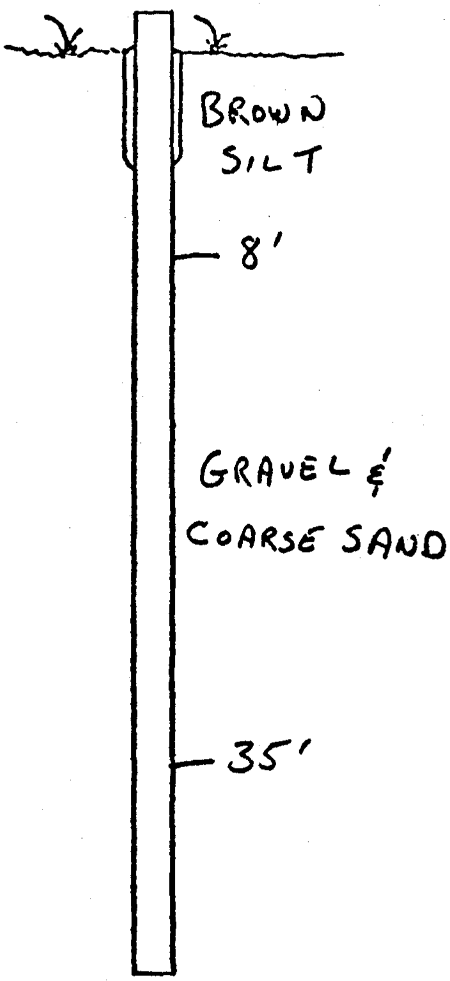
LOCATION ALLAKAKET DATE STARTED 8/11/73

DATE COMPLETED 8/18/73 DRILLER ESTABROOK

TOTAL DEPTH OF WELL 35 FT. CASING INSTALLED 30' DIAMETER 6"

GROUT ______ SCREEN SIZE 6" #20 MFG. Johnson LENGTH 5'

STATIC WATER LEVEL 18' HRS. PUMPED 30 @ 15 GPM. DRAWDOWN 0 FT



DATE	DEPTH FROM - TO	FORMATION	DRILLER

LOCAL NO. FB 20-24-22 14 ppa
SITE ID

SPECIAL NOTES:

Water analysis 5/18/76

Fe 0.44
Hd 245
turbid 5
color 10

database 4/7/99 MAM

23838

CHEMICAL & GEOLOGICAL LABORATORIES OF ALASKA, INC.

TELEPHONE (907) 278-4014

P.O. BOX 4-1276 ANCHORAGE, ALASKA 99509 4649 BUSINESS PARK BLVD.

ANALYTICAL REPORT

CUSTOMER Alaska Area Native Health Service SAMPLE LOCATION: Allakaket, Alaska

DATE COLLECTED 8-27-78 TIME COLLECTED: ----

SAMPLED BY Tom Bolen SOURCE Community Well

REMARKS Treatment: None. Preservation: None. Color: Clear. Taste: Good. Smell: None.

FOR LAB USE ONLY

RECVD. BY SE LAB # 8605

DATE RECEIVED 8-30-78

DATE COMPLETED 9-6-78

DATE REPORTED 9-7-78

SIGNED Archie L. Green

	mg/l		mg/l		mg/l
[]Ag, Silver	< 0.01	[]P, Phosphorous		[]Cyanide	
[]Al, Aluminum		[]Pb, Lead	< 0.02	[]Sulfate	25
[]As, Arsenic	< 0.01	[]Pt, Platinum		[]Phenol	
[]Au, Gold		[]Sb, Antimony		[]Total Dissolved Solids	218
[]B, Boron		[]Se, Selenium	< 0.01	[]Total Volatile Solids	
[]Ba, Barium	< 0.1	[]Si, Silicon		[]Suspended Solids	
[]Bi, Bismuth		[]Sn, Tin		[]Volatile Suspended Solids	
[]Ca, Calcium	59	[]Sr, Strontium		[]Hardness as $CaCO_3$	188
[]Cd, Cadmium	< 0.01	[]Ti, Titanium		[]Alkalinity as $CaCO_3$	166
[]Co, Cobalt		[]W, Tungsten		[]	
[]Cr, Chromium	< 0.01	[]V, Vanadium		[]	
[]Cu, Copper	< 0.01	[]Zn, Zinc	< 0.01	[]	
[]Fe, Iron	0.02	[]Zr, Zirconium		[]	
				* * * * * *	
[]Hg, Mercury	< 0.002	[]Ammonia Nitrogen-N		[]mmhos Conductivity	310
[]K, Potassium	< 0.1	[]Kjedahl Nitrogen-N		[]pH Units	7.3
[]Mg, Magnesium	9.9	[]Nitrate-N	0.17	[]Turbidity NTU	
[]Mn, Manganese	< 0.01	[]Nitrite-N		[]Color Units	
[]Mo, Molybdenum		[]Phosphorus (Ortho)-P		[]T.Coliform/100ml	
[]Na, Sodium	1.4	[]Chloride	2	[]	
[]Ni, Nickel		[]Fluoride		[]	

FB20-24-14

APPENDIX B
FIELD LOGS

APPENDIX B.i.
EKWOK FIELD LOGS

Shaw® Alaska, Inc.

LOG OF EXPLORATORY BORING

CLIENT/PROJECT RARE-AK Tribal LF

PERSONNEL Wayne Coppel, Jack Janes, Colin Nicol

BORING NO. EKWPZ01

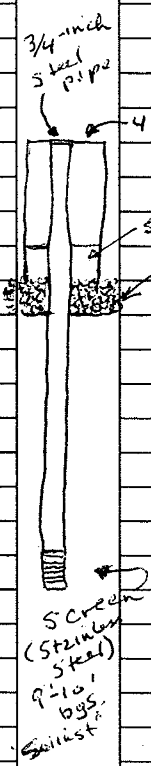
SHEET 1 OF 1

WATER LEVEL DATA

DEPTH	No water @ 9'-		10' bgs.
DATE	090909		
TIME	0930		
BORING DEPTH	10'		
CASING DEPTH	10'		

GROUND ELEVATION

DATUM:

OTHER	BOREHOLE / WELL / PIEZOMETER DETAILS	SAMPLE NUMBER	SAMPLE METHOD	BLOWS/ 6"	RECOVERY	INTERVAL SAMPLED	DEPTH IN FEET	SOIL GROUP USCS SYMBOL	LITHOLOGIC DESCRIPTION
									Hand driven ~~Solinst~~ Solinst 615S
							0		organic, silty soil
							2		gray clay to gravel
							4		
							6		
							8		
							10		Refusal @ 10'

REMARKS: Broken fitting @ 1' bgs repaired with plastic sleeve

_____150# HAMMER _____300# HAMMER _____=1.5" ID SPLIT BARREL SAMPLER _____=3" ID SPLIT BARREL SAMPLER

Shaw® Alaska, Inc.

LOG OF EXPLORATORY BORING

CLIENT/PROJECT RARE - AK Tribal LF

PERSONNEL Wayne Coppel, Jack James, Colin Nicoli

BORING NO. EKWPZ02

SHEET 1 OF 1

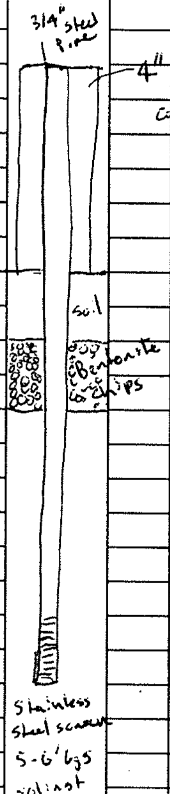
WATER LEVEL DATA

DEPTH	No water	at 5-6'	bgs
DATE	090909		
TIME	11:00		
BORING DEPTH	6'		
CASING DEPTH	6'		

GROUND ELEVATION

DATUM:

OTHER	BOREHOLE / WELL / PIEZOMETER DETAILS	SAMPLE NUMBER	SAMPLE METHOD	BLOWS/ 6"	RECOVERY	INTERVAL SAMPLED	DEPTH IN FEET	SOIL GROUP USCS SYMBOL	LITHOLOGIC DESCRIPTION



Hand driven ~~Solists~~ Solinst 615 s

0 — organic mat

1 — organic, silty soil

2

3

4

5

6 — Refusal @ 6'

REMARKS:

_____150# HAMMER _____300# HAMMER _____=1.5" ID SPLIT BARREL SAMPLER _____=3" ID SPLIT BARREL SAMPLER

Shaw® Alaska, Inc.

LOG OF EXPLORATORY BORING

CLIENT/PROJECT RARE - AK Tribal LF

PERSONNEL Wayne Coppel, Jack James, Colin Nicoli

BORING NO EKWPZ03

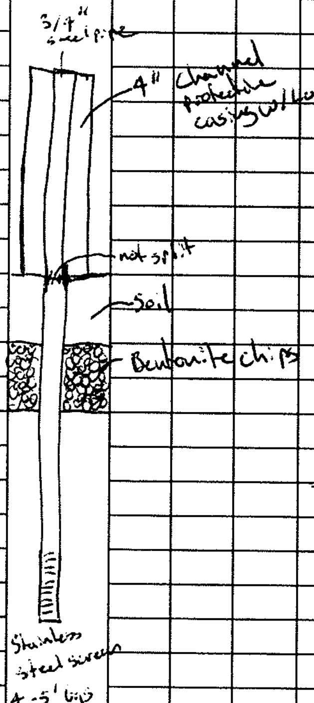
SHEET 1 OF 1

WATER LEVEL DATA			
DEPTH	No water @ 4-5' bgs		
DATE	090909		
TIME	14:30		
BORING DEPTH	5'		
CASING DEPTH	5'		

GROUND ELEVATION

DATUM:

OTHER	BOREHOLE / WELL / PIEZOMETER DETAILS	SAMPLE NUMBER	SAMPLE METHOD	BLOWS/ 6"	RECOVERY	INTERVAL SAMPLED	DEPTH IN FEET	SOIL GROUP USCS SYMBOL	LITHOLOGIC DESCRIPTION
									Hand driven Solinst 615s
							0		organic mat
							1		organic, silty soil
							2		
							3		
							4		
							5		Refusal @ 5'



REMARKS:

_____150# HAMMER _____300# HAMMER _____=1.5" ID SPLIT BARREL SAMPLER _____=3" ID SPLIT BARREL SAMPLER

EKWPZ01

EKWPZ02

EKWPZ03

APPENDIX B.ii.
EEK FIELD LOGS

Shaw® Alaska, Inc.

LOG OF EXPLORATORY BORING

CLIENT/PROJECT: RARE-AK Tribal LF

PERSONNEL: Wayne Cooper, Jack James, Scott ?

BORING NO. EEKPZ01

SHEET 1 OF 1

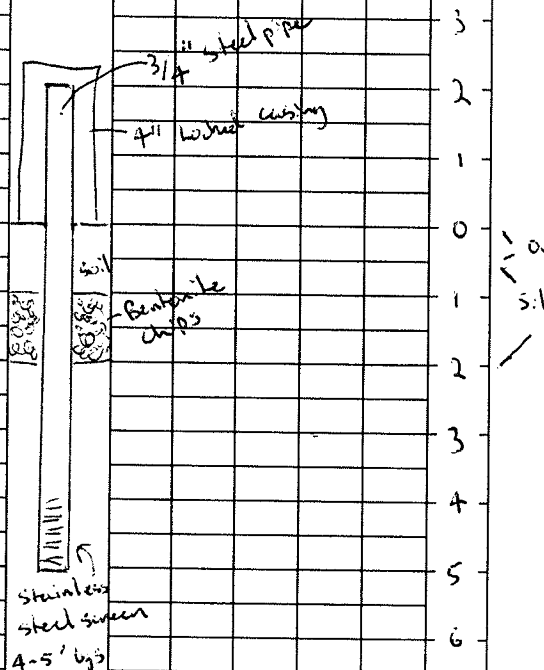
WATER LEVEL DATA

DEPTH	2' bgs	4.04 DTW
DATE	091109	091109
TIME	~~15:29~~ 14:14	15:29
BORING DEPTH	5'	5'
CASING DEPTH	5'	5'

GROUND ELEVATION

DATUM:

OTHER	BOREHOLE / WELL / PIEZOMETER DETAILS	SAMPLE NUMBER	SAMPLE METHOD	BLOWS/ 6"	RECOVERY	INTERVAL SAMPLED	DEPTH IN FEET	SOIL GROUP USCS SYMBOL



LITHOLOGIC DESCRIPTION

Hand driven Solinst ~~ss~~ 615 S

9/11/09 installed @ 09:07

9/11/09 14:14

3' of water in well

bailed dry

9/11/09 15:29

1' of water in well

Field parameters

Temp: 6.0°C

%DO: 16.7%

Conductivity: 644.0 µS/cm

pH: 6.49

ORP: -12.8 mV

Total metals, total Hg, and anions sample bottles collected

REMARKS:

____150# HAMMER ____300# HAMMER ____=1.5" ID SPLIT BARREL SAMPLER ____=3" ID SPLIT BARREL SAMPLER

Shaw® Alaska, Inc.

LOG OF EXPLORATORY BORING

CLIENT/PROJECT RARE - AK Tribal LF

PERSONNEL Wayne Coppel, Jack Jeanes, Sun?

BORING NO. EEKPZ02

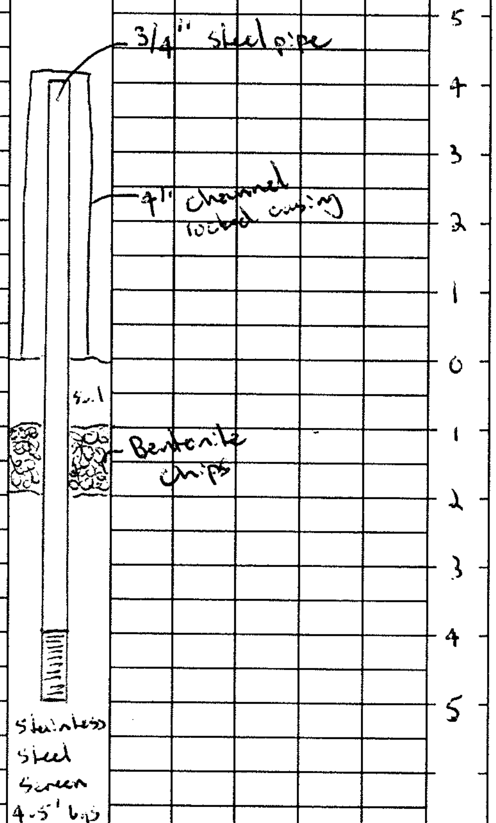
SHEET 1 OF 1

WATER LEVEL DATA			
DEPTH	Installed	5.09' DTW	4.04' DTW
DATE	9/11/09	9/11/09	9/11/09
TIME	11:05	14:39	15:55
BORING DEPTH	5' bgs	5' bgs	5' bgs
CASING DEPTH	5' bgs	5' bgs	5' bgs

GROUND ELEVATION

DATUM:

OTHER	BOREHOLE / WELL / PIEZOMETER DETAILS	SAMPLE NUMBER	SAMPLE METHOD	BLOWS/ 6"	RECOVERY	INTERVAL SAMPLED	DEPTH IN FEET	SOIL GROUP USCS SYMBOL



LITHOLOGIC DESCRIPTION

Depth to Bottom from top of casing 9.09'

Hand Driven Solinst 615's

well finished at 11:05

14:39 ≈ 4' of water in well, Bailed dry

15:55 ≈ 5' of water in well, field parameters and total metals, total Hg, and anions sample bottles collected

Field Parameters:

Temp: 3.1°c

% DO: 19.5 %

conductivity: 447.1 $\frac{\mu S}{cm}$

pH 6.46

ORP : -19.6 mV

well located on other side (south western) of a permafrost ridge from LF

REMARKS:

____150# HAMMER ____300# HAMMER ____=1.5" ID SPLIT BARREL SAMPLER ____=3" ID SPLIT BARREL SAMPLER

Shaw® Alaska, Inc.

LOG OF EXPLORATORY BORING

CLIENT/PROJECT RARE - AK Tribal LF

PERSONNEL Wayne Coppel, Jack James, Scott?

BORING NO. EEK PZ Ø3

SHEET 1 OF 1

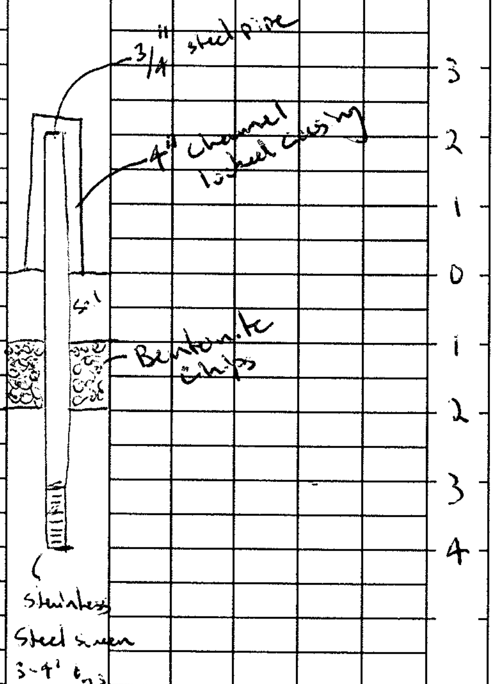
WATER LEVEL DATA

DEPTH	Installed	5.2' DTW	6.1' DTW	
DATE	9/11/09	9/11/09	9/11/09	
TIME	12:00	14:52	~~14:52~~	(5) 16:10
BORING DEPTH	4' bgs	4' bgs	4' bgs	
CASING DEPTH	4' bgs	4' bgs	4' bgs	

GROUND ELEVATION

DATUM:

OTHER	BOREHOLE / WELL / PIEZOMETER DETAILS	SAMPLE NUMBER	SAMPLE METHOD	BLOWS/ 6"	RECOVERY	INTERVAL SAMPLED	DEPTH IN FEET	SOIL GROUP USCS SYMBOL	LITHOLOGIC DESCRIPTION



Hand Driven solinst 615s

Depth to bottom from top of casing 6.3'

≈ 1 foot of water in well at 14:52

Bailed dry. allowed to recover

≈ 0.2 (5) feet of water in well at 16:10.

Insufficient volume to collect field parameters or samples

well is located on the flat near the dump pond next to the permafrost ridge that borders the landfill

REMARKS:

____150# HAMMER ____300# HAMMER ____=1.5" ID SPLIT BARREL SAMPLER ____=3" ID SPLIT BARREL SAMPLER

Shaw® Alaska, Inc.

LOG OF EXPLORATORY BORING

CLIENT/PROJECT RARE - AK Tribal LF

PERSONNEL Wayne Coppel, Jack James Scott?

BORING NO. EEKPZ04

SHEET 1 OF 1

WATER LEVEL DATA

DEPTH	Installed	5.5' BTW	
DATE	9/11/09	9/11/09	
TIME	10:00	14:22	
BORING DEPTH	3.5'	3.5'	
CASING DEPTH	3.5'	3.5'	

GROUND ELEVATION

DATUM:

OTHER	BOREHOLE / WELL / PIEZOMETER DETAILS	SAMPLE NUMBER	SAMPLE METHOD	BLOWS/ 6"	RECOVERY	INTERVAL SAMPLED	DEPTH IN FEET	SOIL GROUP USCS SYMBOL

3/4" steel pipe

4" Unnamed welded casing

soil

Bentonite chips

2½'-3½' bgs stainless steel screened interval

Depth in feet: 1, 0, 1, 2, 3, 4, 5

LITHOLOGIC DESCRIPTION

Depth To Bottom from top of casing: 6.00'
≈6" of water in well at 14:22.
Bailed dry

≈0.38" of water in well at 15:42
insufficient volume to collect
Samples or field parameters

Hand driven solinst 615s

REMARKS:

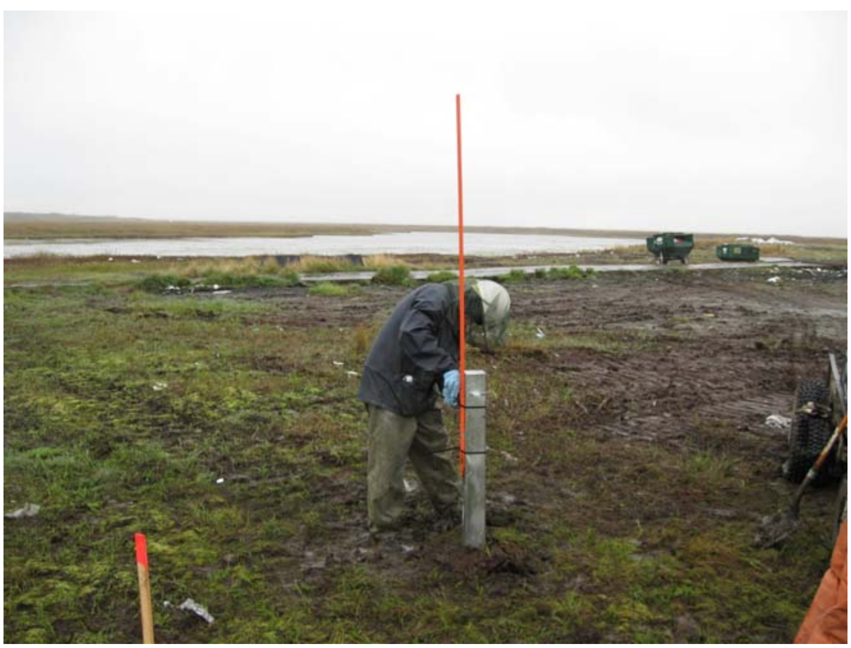
_____150# HAMMER _____300# HAMMER _____=1.5" ID SPLIT BARREL SAMPLER _____=3" ID SPLIT BARREL SAMPLER

EEKPZ01

EEKPZ02

EEKPZ03

EEKPZ04



APPENDIX B.iii.
WHITE MOUNTAIN FIELD LOGS

Shaw® Alaska, Inc.

LOG OF EXPLORATORY BORING

Eric Morris present

CLIENT/PROJECT 136277 USEPA

PERSONNEL Bill Bailor Steve Crupi

BORING NO. WMT PZ01

SHEET 1 OF 1

GROUND ELEVATION 22.93M (MSL)

DATUM:

WATER LEVEL DATA

DEPTH	—		
DATE	9/17/09		
TIME	1200		
BORING DEPTH from ground level	10.8 ft		
CASING DEPTH	13.5 ft		

OTHER	BOREHOLE / WELL / PIEZOMETER DETAILS	SAMPLE NUMBER	SAMPLE METHOD	BLOWS/ 6"	RECOVERY	INTERVAL SAMPLED	DEPTH IN FEET	SOIL GROUP USCS SYMBOL	from top of casing LITHOLOGIC DESCRIPTION to Point bottom
	WMTPZ01								Dug about 2 feet. Silt sand organic material (small roots) Moss w/in 1st 1/2 inch layer Fairly consistent soil, little to no clay Start 10:45
									Attempted water level at 1200 - None - Will leave to work on another site. opened screen about 6 inches. Roped off w/ survey tape until return. Lat 64°40'35.366" N Long 163°23'17.498° W Point + 3 sections of pipe 3rd section 2.7 feet above ground. Unable to drive further. Fitting between pipes 2+3 - threads damaged while hammering. Replaced.
									Locate Couple opposite side of LF from WMT AW01, where runoff towards lagoon & river occurs. South corner of LF just to the east of the road/path from LF to lagoon.

REMARKS:

_____150# HAMMER _____300# HAMMER _____=1.5" ID SPLIT BARREL SAMPLER _____=3" ID SPLIT BARREL SAMPLER

Shaw® Alaska, Inc.

LOG OF EXPLORATORY BORING

CLIENT/PROJECT 136277 EPA

PERSONNEL Bill Bailor Steve Crupi

BORING NO. WMTPZ02

SHEET 1 OF 1

GROUND ELEVATION 25.72 M (MSL)

DATUM:

WATER LEVEL DATA

DEPTH	—
DATE	9/17/09
TIME ground surface	1702
BORING DEPTH	4.3
CASING DEPTH	13.2

top casing to pt

OTHER	BOREHOLE / WELL / PIEZOMETER DETAILS	SAMPLE NUMBER	SAMPLE METHOD	BLOWS/ 6"	RECOVERY	INTERVAL SAMPLED	DEPTH IN FEET	SOIL GROUP USCS SYMBOL	LITHOLOGIC DESCRIPTION
									Lat 64°40'36.765N Long 163°23'16.403W Dug about 2.5-3 feet 4 inch silt sand organics mostly clay rest of way down point and 2 lengths pipe driven 3rd length couple inches below surface

REMARKS:

____150# HAMMER ____300# HAMMER ____=1.5" ID SPLIT BARREL SAMPLER ____=3" ID SPLIT BARREL SAMPLER

WMTPZ-01

WMTPZ02

WMTSUMP01

APPENDIX B.iv.
FORT YUKON FIELD LOGS

Shaw Alaska, Inc.
LOG OF EXPLORATORY BORING

CLIENT/PROJECT Rare
PERSONNEL JJ + BB

BORING NO. ~~FWA~~ FW P2-01
SHEET 1 OF 1

WATER LEVEL DATA

DEPTH		3.8 TOC
DATE	6/21	6/23
TIME	3:40	11:40
BORING DEPTH		
CASING DEPTH		

GROUND ELEVATION
DATUM:

OTHER	BOREHOLE / WELL / PIEZOMETER DETAILS	SAMPLE NUMBER	SAMPLE METHOD	BLOWS/ 6"	RECOVERY	INTERVAL SAMPLED	DEPTH IN FEET	SOIL GROUP USCS SYMBOL
							1	
							2	
		ground level					3	
7"							4	
1ft screen ss screen		permafrost					5	

LITHOLOGIC DESCRIPTION

- upper soil is organic layer
permafrost @ ~~10~~ 10" ~~14~~ down
1'7" to bottom of screen
~~4~~ 7" of screen out of permafrost
≈ 10" of organic mat

- area ~~of~~ of well ~~house~~ has permafrost 7-12" down.

- many dead willows in the area

- ~6 bailers will dry well

recharge 3 mL in 30 minutes

66° 34' 55.935 N
145° 13' 07.578 W

Start 1415

REMARKS:

____150# HAMMER ____300# HAMMER ____=1.5" ID SPLIT BARREL SAMPLER ____=3" ID SPLIT BARREL SAMPLER

Shaw® Alaska, Inc.
LOG OF EXPLORATORY BORING

CLIENT/PROJECT Rare
PERSONNEL JJ & GB

BORING NO. PZ-02
SHEET 1 OF 1

WATER LEVEL DATA

DEPTH	~~[illegible]~~	4.55	
DATE	6/22	6/23	
TIME	11:05	12:20	
BORING DEPTH			
CASING DEPTH			

GROUND ELEVATION 465.14 ft
DATUM:

OTHER	BOREHOLE / WELL / PIEZOMETER DETAILS	SAMPLE NUMBER	SAMPLE METHOD	BLOWS/ 6"	RECOVERY	INTERVAL SAMPLED	DEPTH IN FEET	SOIL GROUP USCS SYMBOL	LITHOLOGIC DESCRIPTION

2.9ft

Bentonite

Sampling screen

Ground level

3 in

organic mat ≈ 10" thick

permafrost

SS screen

permafrost 14" BGL

66° 34' 57.003 N
145° 13' 05.612 W

organic mat extended down ≈ 10"
dug to end then installed well, well was retracted until top of SS fitting was seen.

well is slanted ~ 15°

2.9ft
~~2'~~9" of pipe AGL

~~[illegible]~~ area similar to PZ-01

REMARKS:

_____150# HAMMER _____300# HAMMER _____=1.5" ID SPLIT BARREL SAMPLER _____=3" ID SPLIT BARREL SAMPLER

Shaw® Alaska, Inc.

LOG OF EXPLORATORY BORING

CLIENT/PROJECT Range

PERSONNEL JJ - DB

BORING NO. PZ-03

SHEET 1 OF 1

GROUND ELEVATION 466.07 ft

DATUM:

WATER LEVEL DATA

DEPTH			
DATE			
TIME			
BORING DEPTH			
CASING DEPTH			

OTHER	BOREHOLE / WELL / PIEZOMETER DETAILS	SAMPLE NUMBER	SAMPLE METHOD	BLOWS/ 6"	RECOVERY	INTERVAL SAMPLED	DEPTH IN FEET	SOIL GROUP USCS SYMBOL	LITHOLOGIC DESCRIPTION
		TOC							permafrost @ 14" inches
	3.1ft								66° 34' 58.759 N
									145° 13' 01.591 W
Bentonite →		ground level							
		organic mat							
		permafrost							organic mat was ≈ 10" deep
		sampling screen (SS)							6/22/10 - well Dry
									6/23/10 - well Dry
									3.1 ft to top of casing AGL
									refusal @ 2.2 ft

REMARKS:

____150# HAMMER ____300# HAMMER ____=1.5" ID SPLIT BARREL SAMPLER ____=3" ID SPLIT BARREL SAMPLER

Shaw® Alaska, Inc.

LOG OF EXPLORATORY BORING

CLIENT/PROJECT RARE

PERSONNEL JJ & BB

BORING NO. PZ-04

SHEET 2 OF 2

WATER LEVEL DATA

DEPTH		8ft
DATE	6/22	6/23
TIME	14:00	14:55
BORING DEPTH		
CASING DEPTH	13 ft	from TOC

GROUND ELEVATION 408.2ft

DATUM:

OTHER	BOREHOLE / WELL / PIEZOMETER DETAILS	SAMPLE NUMBER	SAMPLE METHOD	BLOWS/6"	RECOVERY	INTERVAL SAMPLED	DEPTH IN FEET	SOIL GROUP USCS SYMBOL

LITHOLOGIC DESCRIPTION

6" over pipe

TOC

2.95ft

Ground level

organic mat

Betonite

3/4" well pipe

1 ft SS Screened interval

BOC

2.95 ft

13 ft

water level 10.45ft at 16:45

66° 34 min 50.812 sec N

145° 12 min 54.024 sec W

16:45 - DTW ~~9.6 ft~~ 10.45ft from TOC (metal pipe)

6/23/10

Temp - 7.0°C

31.5% DO

980 ms/cm SPC

680 ms/cm cond

7.84 pH

-113.3 mV ORP

REMARKS:

____150# HAMMER ____300# HAMMER ____=1.5" ID SPLIT BARREL SAMPLER ____=3" ID SPLIT BARREL SAMPLER

FYUPZ01

FYUPZ02

FYUPZ03

FYUPZ04

APPENDIX B.v.
ALLAKAKET FIELD LOGS

Shaw® Alaska, Inc.

LOG OF EXPLORATORY BORING

CLIENT/PROJECT RARE

PERSONNEL JJ-WB-Parela Vent

BORING NO. AET P ~~2~~-01

SHEET 1 OF 1

7/7/10

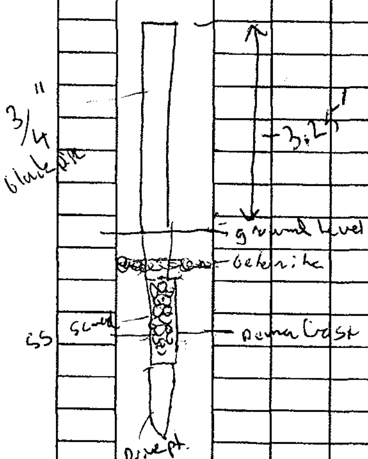
GROUND ELEVATION 615.96 ft ± 8.4

DATUM:

OTHER	BOREHOLE / WELL / PIEZOMETER DETAILS	SAMPLE NUMBER	SAMPLE METHOD	BLOWS/ 6"	RECOVERY	INTERVAL SAMPLED	DEPTH IN FEET	SOIL GROUP USCS SYMBOL

WATER LEVEL DATA

DEPTH			
DATE			
TIME			
BORING DEPTH			
CASING DEPTH			



LITHOLOGIC DESCRIPTION

Exploring hole 66° 31 min 41.898 sec N 152° 39 min 52.817 sec W

Permafrost 1.2 - 1.4 ft bgs
organic mat 0 - 0.2 ft bgs
moisture wet soil at permafrost to 0.5 ft above

Drove pipe/well down to point where ≈ 3' of pipe was above groundsurface retracted well until top of screened piece became visible dumped betonite to seal around pipe

Finished pipe is 3.25 from ground to TOC.

7/8/10 - dry
7/9/10 - dry

REMARKS:

____150# HAMMER ____300# HAMMER ____=1.5" ID SPLIT BARREL SAMPLER ____=3" ID SPLIT BARREL SAMPLER

Shaw® Alaska, Inc.

LOG OF EXPLORATORY BORING

CLIENT/PROJECT: RARE

PERSONNEL: JJ, WB, Pam Vert

BORING NO.: AET PZ02

SHEET 1 OF 1

7/7/10

GROUND ELEVATION: 618 ft ± 11 ft

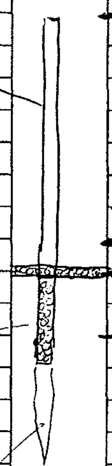
DATUM:

WATER LEVEL DATA

DEPTH			
DATE			
TIME			
BORING DEPTH			
CASING DEPTH			

OTHER	BOREHOLE / WELL / PIEZOMETER DETAILS	SAMPLE NUMBER	SAMPLE METHOD	BLOWS/6"	RECOVERY	INTERVAL SAMPLED	DEPTH IN FEET	SOIL GROUP USCS SYMBOL	LITHOLOGIC DESCRIPTION

3/4" black pipe



3.05 ft

ground

GT → organic Mat non native

Permafrost

3/4" SS screen

Drive pt

Permafrost ≈ 1.35 - 1.55 ft bgs

dug 0.5 ft to native soil (top covered organic material) ~~likely from digging drainage ditch~~)

Pounded pipe to 2.05 ft above ground surface refusal at this point

lifted to final height of 3.05 ft.

well is located ≈ ½ distance along ~~SW~~ SSE easterly (Downhill side) formed drainage ditch (lower swale ~~below~~ along berm area.)

well is located along drainage on town side

7/8/10 - ~~no water~~ 1.5" water, bailed dry

7/9/10 - 1.5" water bailed dry

REMARKS:

____150# HAMMER ____300# HAMMER ____=1.5" ID SPLIT BARREL SAMPLER ____=3" ID SPLIT BARREL SAMPLER

.5 ft

2.05 ft

.5

2.95 ft

-1.55

1.40 - 1.60 into

Shaw® Alaska, Inc.

LOG OF EXPLORATORY BORING

CLIENT/PROJECT RARE

PERSONNEL JS, WB, & Pam

~~BORING~~ Sump NO. 1 & 2

SHEET 1 OF 1

7/8/10

GROUND ELEVATION

DATUM:

OTHER	BOREHOLE / WELL / PIEZOMETER DETAILS	SAMPLE NUMBER	SAMPLE METHOD	BLOWS/6"	RECOVERY	INTERVAL SAMPLED	DEPTH IN FEET	SOIL GROUP USCS SYMBOL

WATER LEVEL DATA

DEPTH			
DATE			
TIME			
BORING DEPTH			
CASING DEPTH			

LITHOLOGIC DESCRIPTION

Sump Ø1 - Located upgradient. found permafrost about 2' down barred sump to level of bucket gently filled in around hole sump is white plastic bucket w/Lid holes drilled in columns 2" apart and columns 2"-1.5" apart, outside fence

7-9-10 ~~dry~~ water droplets

Sump Ø2 - Located downgradient near excavated trench berm, inside fence. no permafrost found first attempt made outside fence ground was muskeg. excavated 3-5 buckets worth of grey sticky clay but ~~when~~ hole was filling in as fast as ~~as~~ soil was being removed. Surround moss layer began to fall. second attempt and location of bucket was moved inside where ground was less musheggy. A rock from nearby was placed to assist in keep bucket in place. Rim was left out of the ground 2-3" high moss was placed upside down and wedged between bucket and sides of hole to secure. Clay was then packed around bucket to seal moss in place. Bucket filled with water and then bailed dry.

7/9/10 - water was cloudy, bailed dry water recharged quickly

REMARKS:

_____150# HAMMER _____300# HAMMER _____=1.5" ID SPLIT BARREL SAMPLER _____=3" ID SPLIT BARREL SAMPLER

Shaw® Alaska, Inc.

LOG OF EXPLORATORY BORING

CLIENT/PROJECT RAVE

PERSONNEL WB, JJ, Pan Vent

BORING NO. AETPZ - Ø3

SHEET 1 OF 1

66° 31 min 44.812 sec N
152° 39 min 48.804 W

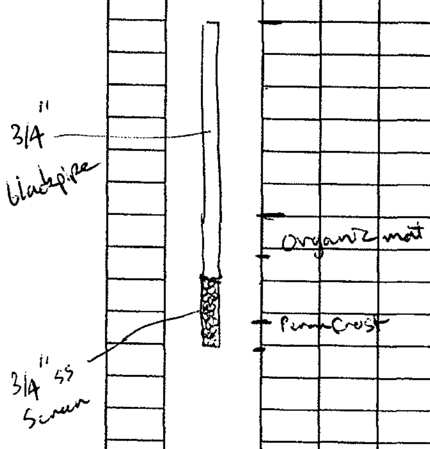
7/7/10

GROUND ELEVATION 612 ± 8.7 ft

DATUM:

WATER LEVEL DATA			
DEPTH			
DATE			
TIME			
BORING DEPTH			
CASING DEPTH			

OTHER	BOREHOLE / WELL / PIEZOMETER DETAILS	SAMPLE NUMBER	SAMPLE METHOD	BLOWS/ 6"	RECOVERY	INTERVAL SAMPLED	DEPTH IN FEET	SOIL GROUP USCS SYMBOL



LITHOLOGIC DESCRIPTION

Permafrost ~~1.6"~~ 1.6 ft bgs

organic mat ≈ 0.6' ft bgs

Pounded pipe until 2 ft above ground Surface

pulled pipe up to 3 ft above ground Surface

well is located along East side of LF top 1/4 of fence about 1 foot from top of trench and about 1 foot from bottom

7/8/10 - Dry

7/9/10 - 6-7" of water in bailer (7/8/10 - measurement may be wrong water level indicator used and false reading given)

7/8 was Dry, seems odd see note

REMARKS:

_____150# HAMMER _____300# HAMMER _____=1.5" ID SPLIT BARREL SAMPLER _____=3" ID SPLIT BARREL SAMPLER

AETPZ01

AETPZ02

AETPZ03

AETSUMP01

AETSUMP02

APPENDIX C
SGS ANALYTICAL REPORTS

SGS North America Inc.
Alaska Division
Level II Laboratory Data Report

Project:	RARE-AKTribal Landfill Sept.09
Client:	Shaw Env & Infrastructure Inc.
SGS Work Order:	1094697

Released by:

Contents:

Note:
Unless otherwise noted, all quality assurance/quality control criteria is in compliance with the standards set forth by the proper regulatory authority, the SGS Quality Assurance Program Plan, and the National Environmental Accreditation Conference.

SGS

Case Narrative

Client	SHAWENV	Shaw Env & Infrastructure Inc.	**Printed Date/Time**	9/30/2009 9:54
Workorder	1094697	RARE-AKTribal Landfill Sept.09		

Sample ID **Client Sample ID**

Refer to the sample receipt form for information on sample condition.

1094697001 **PS** **0909ERNOBPWG401**

2320B - Alkalinity RPD was outside of QC criteria. The result for the sample and duplicate is less than the PQL.

922277 **LCSD** **LCSD for HBN 219718 [XXX/21596**

8270D- LCS/LCSD RPD for pyridine does not meet QC criteria. This analyte was not detected above the PQL in the associated samples.

924651 **DUP** **0909ERNOBPWG401(1094697001DUP)**

2320B - Alkalinity RPD was outside of QC criteria. The result for the sample and duplicate is less than the PQL.

Laboratory Analysis Report

200 W. Potter Drive
Anchorage, AK 99518-1605
Tel: (907) 562-2343
Fax: (907) 561-5301
Web: http://www.us.sgs.com

Wayne Coppel
Shaw Env & Infrastructure Inc.
2000 W. Int'l Airport, Ste C1
Anchorage, AK 99502

Work Order: 1094697
RARE-AKTribal Landfill Sept.09

Released by:

Client: Shaw Env & Infrastructure Inc.

Report Date: September 30, 2009

Enclosed are the analytical results associated with the above workorder.

As required by the state of Alaska and the USEPA, a formal Quality Assurance/Quality Control Program is maintained by SGS. A copy of our Quality Assurance Plan (QAP), which outlines this program, is available at your request.

The laboratory certification numbers are AK971-05 (DW), UST-005 (CS) and AK00971 (Micro) for ADEC and AK100001 for NELAP (RCRA methods: 1020A, 1311, 6010B, 7470A, 7471A, 9040B, 9045C, 9056, 9060, 9065, 8015B, 8021B, 8081A/8082, 8260B, 8270C).

Except as specifically noted, all statements and data in this report are in conformance to the provisions set forth by the SGS QAP, the National Environmental Laboratory Accreditation Program and, when applicable, other regulatory authorities.

If you have any questions regarding this report or if we can be of any other assistance, please contact your SGS Project Manager at 907-562-2343. All work is being provided under SGS general terms and conditions (http://www.sgs.com/terms_and_conditions.htm) unless other written agreements have been accepted by both parties.

PQL	Practical Quantitation Limit (reporting limit).
U	Indicates the analyte was analyzed for but not detected.
F	Indicates value that is greater than or equal to the MDL.
J	The quantitation is an estimation.
ND	Indicates the analyte is not detected.
B	Indicates the analyte is found in a blank associated with the sample.
*	The analyte has exceeded allowable regulatory or control limits.
GT	Greater Than
D	The analyte concentration is the result of a dilution.
LT	Less Than
!	Surrogate out of control limits.
Q	QC parameter out of acceptance range.
M	A matrix effect was present.
JL	The analyte was positively identified, but the quantitation is a low estimation.
E	The analyte result is above the calibrated range.
R	Rejected

Note: Sample summaries which include a result for "Total Solids" have already been adjusted for moisture content.

SGS

Detectable Results Summary

Print Date: 9/30/2009 9:54 am

Client Sample ID: **0909ERWHBPWG401**

SGS Ref. #: 1094697002

Waters Department

Parameter	Result	Units
TPH Silica Gel HEM	5.53	mg/L
Total Organic Carbon	3.77	mg/L

SGS Ref.#	1094697001
Client Name	Shaw Env & Infrastructure Inc.
Project Name/#	RARE-AKTribal Landfill Sept.09
Client Sample ID	0909ERNOBPWG401
Matrix	Water (Surface, Eff., Ground)
Location/Well ID	ERNOBP

Printed Date/Time	09/30/2009 9:54
Collected Date/Time	09/03/2009 16:00
Received Date/Time	09/04/2009 12:35
Technical Director	**Stephen C. Ede**

Sample Remarks:

2320B - Alkalinity RPD was outside of QC criteria. The result for the sample and duplicate is less than the PQL.

Parameter	Results	PQL	Units	Method	Container ID	Allowable Limits	Prep Date	Analysis Date	Init
Metals Department									
Mercury	ND	0.200	ug/L	SW7470A/E245.1	A		09/10/09	09/11/09	KAR
Waters Department									
Alkalinity	ND	10.0	mg/L	SM20 2320B	C			09/17/09	MPL
Total Dissolved Solids	ND	10.0	mg/L	SM20 2540C	C			09/09/09	OLT
TPH Silica Gel HEM	ND	4.44	mg/L	EPA 1664A	D		09/17/09	09/17/09	RTS
Total Organic Carbon	ND	0.500	mg/L	SM 5310B	B			09/11/09	KAR
Semivolatile Organic GC/MS									
N-Nitrosodimethylamine	ND	0.0110	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Aniline	ND	0.0549	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Phenol	ND	0.0110	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Bis(2-Chloroethyl)ether	ND	0.0110	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
2-Chlorophenol	ND	0.0110	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
1,3-Dichlorobenzene	ND	0.0110	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
1,4-Dichlorobenzene	ND	0.0110	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Benzyl alcohol	ND	0.0110	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
1,2-Dichlorobenzene	ND	0.0110	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
2-Methylphenol (o-Cresol)	ND	0.0110	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Bis(2chloro1methylethyl)Ether	ND	0.0110	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
3&4-Methylphenol (p&m-Cresol)	ND	0.0220	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
N-Nitroso-di-n-propylamine	ND	0.0110	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Hexachloroethane	ND	0.0110	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Nitrobenzene	ND	0.0110	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Isophorone	ND	0.0110	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
2-Nitrophenol	ND	0.0110	mg/L	SW8270D	F		09/08/09	09/19/09	MCM

SGS Ref.#	1094697001		
Client Name	Shaw Env & Infrastructure Inc.	**Printed Date/Time**	09/30/2009 9:54
Project Name/#	RARE-AKTribal Landfill Sept.09	**Collected Date/Time**	09/03/2009 16:00
Client Sample ID	0909ERNOBPWG401	**Received Date/Time**	09/04/2009 12:35
Matrix	Water (Surface, Eff., Ground)	**Technical Director**	**Stephen C. Ede**
Location/Well ID	ERNOBP		

Parameter	Results	PQL	Units	Method	Container ID	Allowable Limits	Prep Date	Analysis Date	Init
Semivolatile Organic GC/MS									
2,4-Dimethylphenol	ND	0.0110	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Benzoic acid	ND	0.0549	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Bis(2-Chloroethoxy)methane	ND	0.0110	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
1,2,4-Trichlorobenzene	ND	0.0110	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Naphthalene	ND	0.0110	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
4-Chloroaniline	ND	0.0110	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Hexachlorobutadiene	ND	0.0110	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
4-Chloro-3-methylphenol	ND	0.0110	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
2,4-Dichlorophenol	ND	0.0110	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
2-Methylnaphthalene	ND	0.0110	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Hexachlorocyclopentadiene	ND	0.0330	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
2,4,6-Trichlorophenol	ND	0.0110	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
2,4,5-Trichlorophenol	ND	0.0110	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
2-Chloronaphthalene	ND	0.0110	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
2-Nitroaniline	ND	0.0110	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Dimethylphthalate	ND	0.0110	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Acenaphthylene	ND	0.0110	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
2,6-Dinitrotoluene	ND	0.0110	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
3-Nitroaniline	ND	0.0110	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Acenaphthene	ND	0.0110	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
2,4-Dinitrophenol	ND	0.0549	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
4-Nitrophenol	ND	0.0549	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Dibenzofuran	ND	0.0110	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
2,4-Dinitrotoluene	ND	0.0110	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Diethylphthalate	ND	0.0110	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
4-Chlorophenyl-phenylether	ND	0.0110	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Fluorene	ND	0.0110	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
4-Nitroaniline	ND	0.0110	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
2-Methyl-4,6-dinitrophenol	ND	0.0549	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
N-Nitrosodiphenylamine	ND	0.0110	mg/L	SW8270D	F		09/08/09	09/19/09	MCM

SGS Ref.#	1094697001
Client Name	Shaw Env & Infrastructure Inc.
Project Name/#	RARE-AKTribal Landfill Sept.09
Client Sample ID	0909ERNOBPWG401
Matrix	Water (Surface, Eff., Ground)
Location/Well ID	ERNOBP

Printed Date/Time	09/30/2009 9:54
Collected Date/Time	09/03/2009 16:00
Received Date/Time	09/04/2009 12:35
Technical Director	**Stephen C. Ede**

Parameter	Results	PQL	Units	Method	Container ID	Allowable Limits	Prep Date	Analysis Date	Init
Semivolatile Organic GC/MS									
4-Bromophenyl-phenylether	ND	0.0110	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Hexachlorobenzene	ND	0.0110	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Pentachlorophenol	ND	0.0549	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Phenanthrene	ND	0.0110	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Anthracene	ND	0.0110	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Di-n-butylphthalate	ND	0.0110	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Fluoranthene	ND	0.0110	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Pyrene	ND	0.0110	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Azobenzene	ND	0.0110	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Butylbenzylphthalate	ND	0.0110	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
3,3-Dichlorobenzidine	ND	0.0110	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Benzo(a)Anthracene	ND	0.0110	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Chrysene	ND	0.0110	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
bis(2-Ethylhexyl)phthalate	ND	0.0110	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
di-n-Octylphthalate	ND	0.0110	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Benzo[b]Fluoranthene	ND	0.0110	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Benzo[k]fluoranthene	ND	0.0110	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Benzo[a]pyrene	ND	0.0110	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Indeno[1,2,3-c,d] pyrene	ND	0.0110	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Dibenzo[a,h]anthracene	ND	0.0110	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Benzo[g,h,i]perylene	ND	0.0110	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Surrogates									
2-Fluorophenol <surr>	63.4		%	SW8270D	F	21-88	09/08/09	09/19/09	MCM
Phenol-d6 <surr>	68		%	SW8270D	F	28-97	09/08/09	09/19/09	MCM
Nitrobenzene-d5 <surr>	68.9		%	SW8270D	F	41-110	09/08/09	09/19/09	MCM
2-Fluorobiphenyl <surr>	74.9		%	SW8270D	F	50-110	09/08/09	09/19/09	MCM
2,4,6-Tribromophenol <surr>	81		%	SW8270D	F	45-124	09/08/09	09/19/09	MCM
Terphenyl-d14 <surr>	101		%	SW8270D	F	52-135	09/08/09	09/19/09	MCM

SGS Ref.#	1094697002
Client Name	Shaw Env & Infrastructure Inc.
Project Name/#	RARE-AKTribal Landfill Sept.09
Client Sample ID	0909ERWHBPWG401
Matrix	Water (Surface, Eff., Ground)
Location/Well ID	ERWHBP

Printed Date/Time	09/30/2009 9:54
Collected Date/Time	09/03/2009 16:00
Received Date/Time	09/04/2009 12:35
Technical Director	**Stephen C. Ede**

Sample Remarks:

Parameter	Results	PQL	Units	Method	Container ID	Allowable Limits	Prep Date	Analysis Date	Init
Metals Department									
Mercury	ND	0.200	ug/L	SW7470A/E245.1	A		09/10/09	09/11/09	KAR
Waters Department									
Alkalinity	ND	10.0	mg/L	SM20 2320B	C			09/17/09	MPL
Total Dissolved Solids	ND	10.0	mg/L	SM20 2540C	C			09/09/09	OLT
TPH Silica Gel HEM	5.53	4.26	mg/L	EPA 1664A	E		09/17/09	09/17/09	RTS
Total Organic Carbon	3.77	0.500	mg/L	SM 5310B	B			09/12/09	KAR
Semivolatile Organic GC/MS									
N-Nitrosodimethylamine	ND	0.0109	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Aniline	ND	0.0543	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Phenol	ND	0.0109	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Bis(2-Chloroethyl)ether	ND	0.0109	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
2-Chlorophenol	ND	0.0109	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
1,3-Dichlorobenzene	ND	0.0109	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
1,4-Dichlorobenzene	ND	0.0109	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Benzyl alcohol	ND	0.0109	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
1,2-Dichlorobenzene	ND	0.0109	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
2-Methylphenol (o-Cresol)	ND	0.0109	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Bis(2chloro1methylethyl)Ether	ND	0.0109	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
3&4-Methylphenol (p&m-Cresol)	ND	0.0217	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
N-Nitroso-di-n-propylamine	ND	0.0109	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Hexachloroethane	ND	0.0109	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Nitrobenzene	ND	0.0109	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Isophorone	ND	0.0109	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
2-Nitrophenol	ND	0.0109	mg/L	SW8270D	F		09/08/09	09/19/09	MCM

SGS Ref.#	1094697002		
Client Name	Shaw Env & Infrastructure Inc.	**Printed Date/Time**	09/30/2009 9:54
Project Name/#	RARE-AKTribal Landfill Sept.09	**Collected Date/Time**	09/03/2009 16:00
Client Sample ID	0909ERWHBPWG401	**Received Date/Time**	09/04/2009 12:35
Matrix	Water (Surface, Eff., Ground)	**Technical Director**	**Stephen C. Ede**
Location/Well ID	ERWHBP		

Parameter	Results	PQL	Units	Method	Container ID	Allowable Limits	Prep Date	Analysis Date	Init
Semivolatile Organic GC/MS									
2,4-Dimethylphenol	ND	0.0109	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Benzoic acid	ND	0.0543	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Bis(2-Chloroethoxy)methane	ND	0.0109	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
1,2,4-Trichlorobenzene	ND	0.0109	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Naphthalene	ND	0.0109	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
4-Chloroaniline	ND	0.0109	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Hexachlorobutadiene	ND	0.0109	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
4-Chloro-3-methylphenol	ND	0.0109	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
2,4-Dichlorophenol	ND	0.0109	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
2-Methylnaphthalene	ND	0.0109	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Hexachlorocyclopentadiene	ND	0.0326	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
2,4,6-Trichlorophenol	ND	0.0109	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
2,4,5-Trichlorophenol	ND	0.0109	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
2-Chloronaphthalene	ND	0.0109	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
2-Nitroaniline	ND	0.0109	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Dimethylphthalate	ND	0.0109	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Acenaphthylene	ND	0.0109	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
2,6-Dinitrotoluene	ND	0.0109	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
3-Nitroaniline	ND	0.0109	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Acenaphthene	ND	0.0109	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
2,4-Dinitrophenol	ND	0.0543	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
4-Nitrophenol	ND	0.0543	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Dibenzofuran	ND	0.0109	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
2,4-Dinitrotoluene	ND	0.0109	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Diethylphthalate	ND	0.0109	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
4-Chlorophenyl-phenylether	ND	0.0109	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Fluorene	ND	0.0109	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
4-Nitroaniline	ND	0.0109	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
2-Methyl-4,6-dinitrophenol	ND	0.0543	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
N-Nitrosodiphenylamine	ND	0.0109	mg/L	SW8270D	F		09/08/09	09/19/09	MCM

SGS Ref.#	1094697002
Client Name	Shaw Env & Infrastructure Inc.
Project Name/#	RARE-AKTribal Landfill Sept.09
Client Sample ID	0909ERWHBPWG401
Matrix	Water (Surface, Eff., Ground)
Location/Well ID	ERWHBP

Printed Date/Time	09/30/2009 9:54
Collected Date/Time	09/03/2009 16:00
Received Date/Time	09/04/2009 12:35
Technical Director	**Stephen C. Ede**

Parameter	Results	PQL	Units	Method	Container ID	Allowable Limits	Prep Date	Analysis Date	Init

Semivolatile Organic GC/MS

Parameter	Results	PQL	Units	Method	Container ID	Allowable Limits	Prep Date	Analysis Date	Init
4-Bromophenyl-phenylether	ND	0.0109	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Hexachlorobenzene	ND	0.0109	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Pentachlorophenol	ND	0.0543	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Phenanthrene	ND	0.0109	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Anthracene	ND	0.0109	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Di-n-butylphthalate	ND	0.0109	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Fluoranthene	ND	0.0109	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Pyrene	ND	0.0109	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Azobenzene	ND	0.0109	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Butylbenzylphthalate	ND	0.0109	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
3,3-Dichlorobenzidine	ND	0.0109	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Benzo(a)Anthracene	ND	0.0109	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Chrysene	ND	0.0109	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
bis(2-Ethylhexyl)phthalate	ND	0.0109	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
di-n-Octylphthalate	ND	0.0109	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Benzo[b]Fluoranthene	ND	0.0109	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Benzo[k]fluoranthene	ND	0.0109	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Benzo[a]pyrene	ND	0.0109	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Indeno[1,2,3-c,d] pyrene	ND	0.0109	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Dibenzo[a,h]anthracene	ND	0.0109	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Benzo[g,h,i]perylene	ND	0.0109	mg/L	SW8270D	F		09/08/09	09/19/09	MCM

Surrogates

Parameter	Results	PQL	Units	Method	Container ID	Allowable Limits	Prep Date	Analysis Date	Init
2-Fluorophenol <surr>	53.8		%	SW8270D	F	21-88	09/08/09	09/19/09	MCM
Phenol-d6 <surr>	59		%	SW8270D	F	28-97	09/08/09	09/19/09	MCM
Nitrobenzene-d5 <surr>	65.6		%	SW8270D	F	41-110	09/08/09	09/19/09	MCM
2-Fluorobiphenyl <surr>	76.3		%	SW8270D	F	50-110	09/08/09	09/19/09	MCM
2,4,6-Tribromophenol <surr>	90.9		%	SW8270D	F	45-124	09/08/09	09/19/09	MCM
Terphenyl-d14 <surr>	87.7		%	SW8270D	F	52-135	09/08/09	09/19/09	MCM

SGS

SGS Ref.#	1094697003		
Client Name	Shaw Env & Infrastructure Inc.	**Printed Date/Time**	09/30/2009 9:54
Project Name/#	RARE-AKTribal Landfill Sept.09	**Collected Date/Time**	09/03/2009 16:00
Client Sample ID	0909DIBLNKWG501	**Received Date/Time**	09/04/2009 12:35
Matrix	Water (Surface, Eff., Ground)	**Technical Director**	**Stephen C. Ede**
Location/Well ID	DIBLNK		

Sample Remarks:

Parameter	Results	PQL	Units	Method	Container ID	Allowable Limits	Prep Date	Analysis Date	Init
Metals Department									
Mercury	ND	0.200	ug/L	SW7470A/E245.1	G		09/28/09	09/29/09	KAR
Waters Department									
Alkalinity	ND	10.0	mg/L	SM20 2320B	C			09/17/09	MPL
Total Dissolved Solids	ND	10.0	mg/L	SM20 2540C	C			09/09/09	OLT
TPH Silica Gel HEM	ND	4.55	mg/L	EPA 1664A	E		09/17/09	09/17/09	RTS
Total Organic Carbon	ND	0.500	mg/L	SM 5310B	B			09/12/09	KAR
Semivolatile Organic GC/MS									
N-Nitrosodimethylamine	ND	0.0108	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Aniline	ND	0.0538	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Phenol	ND	0.0108	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Bis(2-Chloroethyl)ether	ND	0.0108	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
2-Chlorophenol	ND	0.0108	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
1,3-Dichlorobenzene	ND	0.0108	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
1,4-Dichlorobenzene	ND	0.0108	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Benzyl alcohol	ND	0.0108	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
1,2-Dichlorobenzene	ND	0.0108	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
2-Methylphenol (o-Cresol)	ND	0.0108	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Bis(2chloro1methylethyl)Ether	ND	0.0108	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
3&4-Methylphenol (p&m-Cresol)	ND	0.0215	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
N-Nitroso-di-n-propylamine	ND	0.0108	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Hexachloroethane	ND	0.0108	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Nitrobenzene	ND	0.0108	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Isophorone	ND	0.0108	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
2-Nitrophenol	ND	0.0108	mg/L	SW8270D	F		09/08/09	09/19/09	MCM

SGS

SGS Ref.#	1094697003			
Client Name	Shaw Env & Infrastructure Inc.		**Printed Date/Time**	09/30/2009 9:54
Project Name/#	RARE-AKTribal Landfill Sept.09		**Collected Date/Time**	09/03/2009 16:00
Client Sample ID	0909DIBLNKWG501		**Received Date/Time**	09/04/2009 12:35
Matrix	Water (Surface, Eff., Ground)		**Technical Director**	**Stephen C. Ede**
Location/Well ID	DIBLNK			

Parameter	Results	PQL	Units	Method	Container ID	Allowable Limits	Prep Date	Analysis Date	Init
Semivolatile Organic GC/MS									
2,4-Dimethylphenol	ND	0.0108	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Benzoic acid	ND	0.0538	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Bis(2-Chloroethoxy)methane	ND	0.0108	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
1,2,4-Trichlorobenzene	ND	0.0108	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Naphthalene	ND	0.0108	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
4-Chloroaniline	ND	0.0108	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Hexachlorobutadiene	ND	0.0108	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
4-Chloro-3-methylphenol	ND	0.0108	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
2,4-Dichlorophenol	ND	0.0108	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
2-Methylnaphthalene	ND	0.0108	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Hexachlorocyclopentadiene	ND	0.0323	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
2,4,6-Trichlorophenol	ND	0.0108	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
2,4,5-Trichlorophenol	ND	0.0108	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
2-Chloronaphthalene	ND	0.0108	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
2-Nitroaniline	ND	0.0108	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Dimethylphthalate	ND	0.0108	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Acenaphthylene	ND	0.0108	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
2,6-Dinitrotoluene	ND	0.0108	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
3-Nitroaniline	ND	0.0108	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Acenaphthene	ND	0.0108	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
2,4-Dinitrophenol	ND	0.0538	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
4-Nitrophenol	ND	0.0538	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Dibenzofuran	ND	0.0108	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
2,4-Dinitrotoluene	ND	0.0108	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Diethylphthalate	ND	0.0108	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
4-Chlorophenyl-phenylether	ND	0.0108	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Fluorene	ND	0.0108	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
4-Nitroaniline	ND	0.0108	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
2-Methyl-4,6-dinitrophenol	ND	0.0538	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
N-Nitrosodiphenylamine	ND	0.0108	mg/L	SW8270D	F		09/08/09	09/19/09	MCM

SGS Ref.#	1094697003
Client Name	Shaw Env & Infrastructure Inc.
Project Name/#	RARE-AKTribal Landfill Sept.09
Client Sample ID	0909DIBLNKWG501
Matrix	Water (Surface, Eff., Ground)
Location/Well ID	DIBLNK

Printed Date/Time	09/30/2009 9:54
Collected Date/Time	09/03/2009 16:00
Received Date/Time	09/04/2009 12:35
Technical Director	**Stephen C. Ede**

Parameter	Results	PQL	Units	Method	Container ID	Allowable Limits	Prep Date	Analysis Date	Init
Semivolatile Organic GC/MS									
4-Bromophenyl-phenylether	ND	0.0108	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Hexachlorobenzene	ND	0.0108	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Pentachlorophenol	ND	0.0538	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Phenanthrene	ND	0.0108	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Anthracene	ND	0.0108	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Di-n-butylphthalate	ND	0.0108	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Fluoranthene	ND	0.0108	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Pyrene	ND	0.0108	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Azobenzene	ND	0.0108	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Butylbenzylphthalate	ND	0.0108	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
3,3-Dichlorobenzidine	ND	0.0108	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Benzo(a)Anthracene	ND	0.0108	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Chrysene	ND	0.0108	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
bis(2-Ethylhexyl)phthalate	ND	0.0108	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
di-n-Octylphthalate	ND	0.0108	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Benzo[b]Fluoranthene	ND	0.0108	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Benzo[k]fluoranthene	ND	0.0108	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Benzo[a]pyrene	ND	0.0108	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Indeno[1,2,3-c,d] pyrene	ND	0.0108	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Dibenzo[a,h]anthracene	ND	0.0108	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Benzo[g,h,i]perylene	ND	0.0108	mg/L	SW8270D	F		09/08/09	09/19/09	MCM
Surrogates									
2-Fluorophenol <surr>	62.9		%	SW8270D	F	21-88	09/08/09	09/19/09	MCM
Phenol-d6 <surr>	69.8		%	SW8270D	F	28-97	09/08/09	09/19/09	MCM
Nitrobenzene-d5 <surr>	72.5		%	SW8270D	F	41-110	09/08/09	09/19/09	MCM
2-Fluorobiphenyl <surr>	77.6		%	SW8270D	F	50-110	09/08/09	09/19/09	MCM
2,4,6-Tribromophenol <surr>	84.8		%	SW8270D	F	45-124	09/08/09	09/19/09	MCM
Terphenyl-d14 <surr>	98.8		%	SW8270D	F	52-135	09/08/09	09/19/09	MCM

SGS Ref.#	1094697004			
Client Name	Shaw Env & Infrastructure Inc.		**Printed Date/Time**	09/30/2009 9:54
Project Name/#	RARE-AKTribal Landfill Sept.09		**Collected Date/Time**	09/11/2009 15:29
Client Sample ID	0909EEKPZ01WG001		**Received Date/Time**	09/14/2009 13:40
Matrix	Water (Surface, Eff., Ground)		**Technical Director**	**Stephen C. Ede**
Location/Well ID	PZ01			

Sample Remarks:

Parameter	Results	PQL	Units	Method	Container ID	Allowable Limits	Prep Date	Analysis Date	Init
Metals Department									
Mercury	ND	0.200	ug/L	SW7470A/E245.1	A		09/23/09	09/23/09	KAR

SGS Ref.#	1094697005		
Client Name	Shaw Env & Infrastructure Inc.	**Printed Date/Time**	09/30/2009 9:54
Project Name/#	RARE-AKTribal Landfill Sept.09	**Collected Date/Time**	09/11/2009 15:55
Client Sample ID	0909EEKPZ02WG001	**Received Date/Time**	09/14/2009 13:40
Matrix	Water (Surface, Eff., Ground)	**Technical Director**	**Stephen C. Ede**
Location/Well ID	PZ02		

Sample Remarks:

Parameter	Results	PQL	Units	Method	Container ID	Allowable Limits	Prep Date	Analysis Date	Init
Metals Department									
Mercury	ND	0.200	ug/L	SW7470A/E245.1	A		09/23/09	09/23/09	KAR

SGS Ref.#	1094697006		
Client Name	Shaw Env & Infrastructure Inc.	**Printed Date/Time**	09/30/2009 9:54
Project Name/#	RARE-AKTribal Landfill Sept.09	**Collected Date/Time**	08/24/2009 8:00
Client Sample ID	Blue Jug-Idaho	**Received Date/Time**	08/24/2009 8:30
Matrix	Water (Surface, Eff., Ground)	**Technical Director**	**Stephen C. Ede**

Sample Remarks:

Parameter	Results	PQL	Units	Method	Container ID	Allowable Limits	Prep Date	Analysis Date	Init
Metals by ICP/MS									
Aluminum	ND	4.00	ug/L	200.8 Low Level	A			08/27/09	NRB
Antimony	ND	0.100	ug/L	200.8 Low Level	A			08/27/09	NRB
Arsenic	ND	1.00	ug/L	200.8 Low Level	A			08/27/09	NRB
Barium	ND	0.100	ug/L	200.8 Low Level	A			08/27/09	NRB
Beryllium	ND	0.100	ug/L	200.8 Low Level	A			08/27/09	NRB
Boron	ND	10.0	ug/L	200.8 Low Level	A			08/27/09	NRB
Cadmium	ND	0.100	ug/L	200.8 Low Level	A			08/27/09	NRB
Calcium	ND	100	ug/L	200.8 Low Level	A			08/27/09	NRB
Chromium	ND	0.400	ug/L	200.8 Low Level	A			08/27/09	NRB
Cobalt	ND	0.0400	ug/L	200.8 Low Level	A			08/27/09	NRB
Copper	ND	0.200	ug/L	200.8 Low Level	A			08/27/09	NRB
Iron	ND	40.0	ug/L	200.8 Low Level	A			08/27/09	NRB
Lead	ND	0.200	ug/L	200.8 Low Level	A			08/27/09	NRB
Magnesium	ND	40.0	ug/L	200.8 Low Level	A			08/27/09	NRB
Manganese	ND	0.100	ug/L	200.8 Low Level	A			08/27/09	NRB
Molybdenum	ND	0.100	ug/L	200.8 Low Level	A			08/27/09	NRB
Nickel	ND	0.400	ug/L	200.8 Low Level	A			08/27/09	NRB
Selenium	ND	2.00	ug/L	200.8 Low Level	A			08/27/09	NRB
Silver	ND	0.0400	ug/L	200.8 Low Level	A			08/27/09	NRB
Sodium	ND	200	ug/L	200.8 Low Level	A			08/27/09	NRB
Thallium	ND	0.0400	ug/L	200.8 Low Level	A			08/27/09	NRB
Vanadium	ND	2.00	ug/L	200.8 Low Level	A			08/27/09	NRB
Tin	ND	0.400	ug/L	200.8 Low Level	A			08/27/09	NRB
Zinc	ND	2.00	ug/L	200.8 Low Level	A			08/27/09	NRB
Bismuth	ND	0.100	ug/L	200.8 Low Level	A			08/27/09	NRB
Potassium	ND	100	ug/L	200.8 Low Level	A			08/27/09	NRB

SGS Ref.#	922275 Method Blank	**Printed Date/Time**		09/30/2009 9:54
Client Name	Shaw Env & Infrastructure Inc.	**Prep**	**Batch**	XXX21596
Project Name/#	RARE-AKTribal Landfill Sept.09		**Method**	SW3520C
Matrix	Water (Surface, Eff., Ground)		**Date**	09/08/2009

QC results affect the following production samples:

1094697001, 1094697002, 1094697003

Parameter	Results	Reporting/Control Limit	MDL	Units	Analysis Date
Semivolatile Organic GC/MS					
N-Nitrosodimethylamine	ND	0.0100	0.00310	mg/L	09/18/09
Aniline	ND	0.0500	0.0150	mg/L	09/18/09
Phenol	ND	0.0100	0.00310	mg/L	09/18/09
Bis(2-Chloroethyl)ether	ND	0.0100	0.00310	mg/L	09/18/09
2-Chlorophenol	ND	0.0100	0.00310	mg/L	09/18/09
1,3-Dichlorobenzene	ND	0.0100	0.00310	mg/L	09/18/09
1,4-Dichlorobenzene	ND	0.0100	0.00310	mg/L	09/18/09
Benzyl alcohol	ND	0.0100	0.00310	mg/L	09/18/09
1,2-Dichlorobenzene	ND	0.0100	0.00310	mg/L	09/18/09
2-Methylphenol (o-Cresol)	ND	0.0100	0.00310	mg/L	09/18/09
Bis(2chloro1methylethyl)Ether	ND	0.0100	0.00310	mg/L	09/18/09
3&4-Methylphenol (p&m-Cresol)	ND	0.0200	0.00620	mg/L	09/18/09
N-Nitroso-di-n-propylamine	ND	0.0100	0.00310	mg/L	09/18/09
Hexachloroethane	ND	0.0100	0.00310	mg/L	09/18/09
Nitrobenzene	ND	0.0100	0.00310	mg/L	09/18/09
Isophorone	ND	0.0100	0.00310	mg/L	09/18/09
2-Nitrophenol	ND	0.0100	0.00310	mg/L	09/18/09
2,4-Dimethylphenol	ND	0.0100	0.00310	mg/L	09/18/09
Benzoic acid	ND	0.0500	0.0250	mg/L	09/18/09
Bis(2-Chloroethoxy)methane	ND	0.0100	0.00310	mg/L	09/18/09
1,2,4-Trichlorobenzene	ND	0.0100	0.00310	mg/L	09/18/09
Naphthalene	ND	0.0100	0.00310	mg/L	09/18/09
4-Chloroaniline	ND	0.0100	0.00310	mg/L	09/18/09
Hexachlorobutadiene	ND	0.0100	0.00310	mg/L	09/18/09
4-Chloro-3-methylphenol	ND	0.0100	0.00310	mg/L	09/18/09
2,4-Dichlorophenol	ND	0.0100	0.00310	mg/L	09/18/09
2-Methylnaphthalene	ND	0.0100	0.00310	mg/L	09/18/09
Hexachlorocyclopentadiene	ND	0.0300	0.00940	mg/L	09/18/09
2,4,6-Trichlorophenol	ND	0.0100	0.00310	mg/L	09/18/09
2,4,5-Trichlorophenol	ND	0.0100	0.00310	mg/L	09/18/09
2-Chloronaphthalene	ND	0.0100	0.00310	mg/L	09/18/09
2-Nitroaniline	ND	0.0100	0.00310	mg/L	09/18/09
Dimethylphthalate	ND	0.0100	0.00310	mg/L	09/18/09
Acenaphthylene	ND	0.0100	0.00310	mg/L	09/18/09
2,6-Dinitrotoluene	ND	0.0100	0.00310	mg/L	09/18/09
3-Nitroaniline	ND	0.0100	0.00310	mg/L	09/18/09

SGS

SGS Ref.#	922275 Method Blank	**Printed Date/Time**	09/30/2009 9:54
Client Name	Shaw Env & Infrastructure Inc.	**Prep** **Batch**	XXX21596
Project Name/#	RARE-AKTribal Landfill Sept.09	**Method**	SW3520C
Matrix	Water (Surface, Eff., Ground)	**Date**	09/08/2009

Parameter	Results	Reporting/Control Limit	MDL	Units	Analysis Date
Semivolatile Organic GC/MS					
Acenaphthene	ND	0.0100	0.00310	mg/L	09/18/09
2,4-Dinitrophenol	ND	0.0500	0.0150	mg/L	09/18/09
4-Nitrophenol	ND	0.0500	0.0150	mg/L	09/18/09
Dibenzofuran	ND	0.0100	0.00310	mg/L	09/18/09
2,4-Dinitrotoluene	ND	0.0100	0.00310	mg/L	09/18/09
Diethylphthalate	ND	0.0100	0.00310	mg/L	09/18/09
4-Chlorophenyl-phenylether	ND	0.0100	0.00310	mg/L	09/18/09
Fluorene	ND	0.0100	0.00310	mg/L	09/18/09
4-Nitroaniline	ND	0.0100	0.00310	mg/L	09/18/09
2-Methyl-4,6-dinitrophenol	ND	0.0500	0.0150	mg/L	09/18/09
N-Nitrosodiphenylamine	ND	0.0100	0.00310	mg/L	09/18/09
4-Bromophenyl-phenylether	ND	0.0100	0.00310	mg/L	09/18/09
Hexachlorobenzene	ND	0.0100	0.00310	mg/L	09/18/09
Pentachlorophenol	ND	0.0500	0.0150	mg/L	09/18/09
Phenanthrene	ND	0.0100	0.00310	mg/L	09/18/09
Anthracene	ND	0.0100	0.00310	mg/L	09/18/09
Di-n-butylphthalate	ND	0.0100	0.00310	mg/L	09/18/09
Fluoranthene	ND	0.0100	0.00310	mg/L	09/18/09
Pyrene	ND	0.0100	0.00310	mg/L	09/18/09
Azobenzene	ND	0.0100	0.00310	mg/L	09/18/09
Butylbenzylphthalate	ND	0.0100	0.00310	mg/L	09/18/09
3,3-Dichlorobenzidine	ND	0.0100	0.00310	mg/L	09/18/09
Benzo(a)Anthracene	ND	0.0100	0.00310	mg/L	09/18/09
Chrysene	ND	0.0100	0.00310	mg/L	09/18/09
bis(2-Ethylhexyl)phthalate	ND	0.0100	0.00310	mg/L	09/18/09
di-n-Octylphthalate	ND	0.0100	0.00310	mg/L	09/18/09
Benzo[b]Fluoranthene	ND	0.0100	0.00310	mg/L	09/18/09
Benzo[k]fluoranthene	ND	0.0100	0.00310	mg/L	09/18/09
Benzo[a]pyrene	ND	0.0100	0.00310	mg/L	09/18/09
Indeno[1,2,3-c,d] pyrene	ND	0.0100	0.00310	mg/L	09/18/09
Dibenzo[a,h]anthracene	ND	0.0100	0.00310	mg/L	09/18/09
Benzo[g,h,i]perylene	ND	0.0100	0.00310	mg/L	09/18/09
Surrogates					
2-Fluorophenol <surr>	61.2	21-88		%	09/18/09
Phenol-d6 <surr>	68.4	28-97		%	09/18/09
Nitrobenzene-d5 <surr>	70.8	41-110		%	09/18/09
2-Fluorobiphenyl <surr>	76.9	50-110		%	09/18/09
2,4,6-Tribromophenol <surr>	89.6	45-124		%	09/18/09

SGS Ref.#	922275	Method Blank	**Printed Date/Time**		09/30/2009 9:54
Client Name	Shaw Env & Infrastructure Inc.		**Prep**	**Batch**	XXX21596
Project Name/#	RARE-AKTribal Landfill Sept.09			**Method**	SW3520C
Matrix	Water (Surface, Eff., Ground)			**Date**	09/08/2009

Parameter	Results	Reporting/Control Limit	MDL	Units	Analysis Date
Semivolatile Organic GC/MS					
Terphenyl-d14 <surr>	105	52-135		%	09/18/09

Batch XMS5090
Method SW8270D
Instrument HP 5890 Series II MS4 SVPA

SGS

SGS Ref.#	923028	Method Blank	**Printed Date/Time**	09/30/2009 9:54
Client Name	Shaw Env & Infrastructure Inc.		**Prep** **Batch**	
Project Name/#	RARE-AKTribal Landfill Sept.09		**Method**	
Matrix	Water (Surface, Eff., Ground)		**Date**	

QC results affect the following production samples:

1094697001, 1094697002, 1094697003

Parameter	Results	Reporting/Control Limit	MDL	Units	Analysis Date
Waters Department					
Total Dissolved Solids	ND	10.0	3.10	mg/L	09/09/09

Batch WAT7807
Method SM20 2540C
Instrument

SGS

SGS Ref.#	923501 Method Blank	**Printed Date/Time**	09/30/2009 9:54
Client Name	Shaw Env & Infrastructure Inc.	**Prep** **Batch**	
Project Name/#	RARE-AKTribal Landfill Sept.09	**Method**	
Matrix	Water (Surface, Eff., Ground)	**Date**	

QC results affect the following production samples:

1094697001

Parameter	Results	Reporting/Control Limit	MDL	Units	Analysis Date
Waters Department					
Total Organic Carbon	0.172 J	0.500	0.150	mg/L	09/11/09

Batch WTC1931

Method SM 5310B

Instrument TOC Analyzer

SGS

SGS Ref.#	923515	Method Blank	**Printed Date/Time**	09/30/2009 9:54
Client Name	Shaw Env & Infrastructure Inc.		**Prep** **Batch**	
Project Name/#	RARE-AKTribal Landfill Sept.09		**Method**	
Matrix	Water (Surface, Eff., Ground)		**Date**	

QC results affect the following production samples:

1094697001, 1094697002, 1094697003

Parameter	Results	Reporting/Control Limit	MDL	Units	Analysis Date
Waters Department					
Total Organic Carbon	0.169 J	0.500	0.150	mg/L	09/12/09

Batch WTC1931
Method SM 5310B
Instrument TOC Analyzer

SGS Ref.#	923521 Method Blank	**Printed Date/Time**		09/30/2009 9:54
Client Name	Shaw Env & Infrastructure Inc.	**Prep**	**Batch**	MXX22208
Project Name/#	RARE-AKTribal Landfill Sept.09		**Method**	METHOD
Matrix	Water (Surface, Eff., Ground)		**Date**	09/10/2009

QC results affect the following production samples:

1094697001, 1094697002

Parameter	Results	Reporting/Control Limit	MDL	Units	Analysis Date
Metals Department					
Mercury	ND	0.200	0.0620	ug/L	09/11/09

Batch MCV4314

Method SW7470A/E245.1

Instrument PSA Millennium mercury AA

SGS Ref.#	924649 Method Blank	**Printed Date/Time**	09/30/2009 9:54
Client Name	Shaw Env & Infrastructure Inc.	**Prep** **Batch**	
Project Name/#	RARE-AKTribal Landfill Sept.09	**Method**	
Matrix	Water (Surface, Eff., Ground)	**Date**	

QC results affect the following production samples:

1094697001, 1094697002, 1094697003

Parameter	Results	Reporting/Control Limit	MDL	Units	Analysis Date
Waters Department					
Alkalinity	ND	10.0	3.10	mg/L	09/17/09

Batch WTI3186

Method SM20 2320B

Instrument

SGS Ref.#	924739 Method Blank	**Printed Date/Time**	09/30/2009 9:54
Client Name	Shaw Env & Infrastructure Inc.	**Prep Batch**	TPHX1983
Project Name/#	RARE-AKTribal Landfill Sept.09	**Method**	EXT_1664TP
Matrix	Water (Surface, Eff., Ground)	**Date**	09/17/2009

QC results affect the following production samples:

1094697001, 1094697002, 1094697003

Parameter	Results	Reporting/Control Limit	MDL	Units	Analysis Date
Waters Department					
TPH Silica Gel HEM	ND	4.00	1.20	mg/L	09/17/09

Batch TPH2166

Method EPA 1664A

Instrument

SGS Ref.#	926319 Method Blank	**Printed Date/Time**		09/30/2009 9:54
Client Name	Shaw Env & Infrastructure Inc.	**Prep**	**Batch**	MXX22266
Project Name/#	RARE-AKTribal Landfill Sept.09		**Method**	METHOD
Matrix	Water (Surface, Eff., Ground)		**Date**	09/23/2009

QC results affect the following production samples:

1094697004, 1094697005

Parameter	Results	Reporting/Control Limit	MDL	Units	Analysis Date
Metals Department					
Mercury	ND	0.200	0.0620	ug/L	09/23/09

Batch MCV4329

Method SW7470A/E245.1

Instrument PSA Millennium mercury AA

SGS

SGS Ref.#	927678 Method Blank	**Printed Date/Time**		09/30/2009 9:54
Client Name	Shaw Env & Infrastructure Inc.	**Prep**	**Batch**	MXX22299
Project Name/#	RARE-AKTribal Landfill Sept.09		**Method**	METHOD
Matrix	Water (Surface, Eff., Ground)		**Date**	09/28/2009

QC results affect the following production samples:

1094697003

Parameter	Results	Reporting/Control Limit	MDL	Units	Analysis Date
Metals Department					
Mercury	ND	0.200	0.0620	ug/L	09/29/09

Batch MCV4342
Method SW7470A/E245.1
Instrument PSA Millennium mercury AA

SGS

SGS Ref.#	927685 Method Blank	**Printed Date/Time**		09/30/2009 9:54
Client Name	Shaw Env & Infrastructure Inc.	**Prep**	**Batch**	MXX22299
Project Name/#	RARE-AKTribal Landfill Sept.09		**Method**	METHOD
Matrix	Water (Surface, Eff., Ground)		**Date**	09/28/2009

QC results affect the following production samples:

1094697003

Parameter	Results	Reporting/Control Limit	MDL	Units	Analysis Date

Metals Department

Parameter	Results	Reporting/Control Limit	MDL	Units	Analysis Date
Mercury	ND	0.200	0.0620	ug/L	09/29/09

Batch MCV4342

Method SW7470A/E245.1

Instrument PSA Millennium mercury AA

SGS Ref.#	923030	Duplicate	**Printed Date/Time**	09/30/2009 9:54
Client Name	Shaw Env & Infrastructure Inc.		**Prep**	**Batch**
Project Name/#	RARE-AKTribal Landfill Sept.09			**Method**
Original	1094697003			**Date**
Matrix	Water (Surface, Eff., Ground)			

QC results affect the following production samples:

1094697001, 1094697002, 1094697003

Parameter	Original Result	QC Result	Units	RPD	RPD Limits	Analysis Date
Waters Department						
Total Dissolved Solids	ND	ND	mg/L	0	(< 25)	09/09/2009

Batch WAT7807

Method SM20 2540C

Instrument

SGS

SGS Ref.#	924651 Duplicate	**Printed Date/Time**	09/30/2009 9:54
Client Name	Shaw Env & Infrastructure Inc.	**Prep** **Batch**	
Project Name/#	RARE-AKTribal Landfill Sept.09	**Method**	
Original	1094697001	**Date**	
Matrix	Water (Surface, Eff., Ground)		

QC results affect the following production samples:

1094697001, 1094697002, 1094697003

Parameter	Original Result	QC Result	Units	RPD	RPD Limits	Analysis Date

Waters Department

Parameter	Original Result	QC Result	Units	RPD	RPD Limits	Analysis Date
Alkalinity	ND	ND	mg/L	0	(< 25)	09/17/2009

Batch WTI3186
Method SM20 2320B
Instrument

SGS Ref.#	924652	Duplicate	**Printed Date/Time**	09/30/2009 9:54
Client Name	Shaw Env & Infrastructure Inc.		**Prep**	**Batch**
Project Name/#	RARE-AKTribal Landfill Sept.09			**Method**
Original	1094762001			**Date**
Matrix	Water (Surface, Eff., Ground)			

QC results affect the following production samples:

1094697002, 1094697003

Parameter	Original Result	QC Result	Units	RPD	RPD Limits	Analysis Date
Waters Department						
Alkalinity	100	100	mg/L	0	(< 25)	09/17/2009

Batch WTI3186

Method SM20 2320B

Instrument

SGS Ref.#	922276 Lab Control Sample	Printed Date/Time	09/30/2009 9:54
	922277 Lab Control Sample Duplicate	Prep Batch	XXX21596
Client Name	Shaw Env & Infrastructure Inc.	Method	SW3520C
Project Name/#	RARE-AKTribal Landfill Sept.09	Date	09/08/2009
Matrix	Water (Surface, Eff., Ground)		

QC results affect the following production samples:

1094697001, 1094697002, 1094697003

Parameter		QC Results	Pct Recov	LCS/LCSD Limits	RPD	RPD Limits	Spiked Amount	Analysis Date
Semivolatile Organic GC/MS								
N-Nitrosodimethylamine	LCS	0.0657	66	(27-100)			0.1 mg/L	09/19/2009
	LCSD	0.0638	64		3	(< 20)	0.1 mg/L	09/19/2009
Aniline	LCS	0.0631	63	(21-119)			0.1 mg/L	09/19/2009
	LCSD	0.0532	53		17	(< 20)	0.1 mg/L	09/19/2009
Phenol	LCS	0.0727	73	(26-92)			0.1 mg/L	09/19/2009
	LCSD	0.0667	67		9	(< 20)	0.1 mg/L	09/19/2009
Bis(2-Chloroethyl)ether	LCS	0.0682	68	(37-100)			0.1 mg/L	09/19/2009
	LCSD	0.0653	65		4	(< 20)	0.1 mg/L	09/19/2009
2-Chlorophenol	LCS	0.0732	73	(37-97)			0.1 mg/L	09/19/2009
	LCSD	0.0713	71		3	(< 20)	0.1 mg/L	09/19/2009
1,3-Dichlorobenzene	LCS	0.0664	66	(32-98)			0.1 mg/L	09/19/2009
	LCSD	0.0659	66		1	(< 20)	0.1 mg/L	09/19/2009
1,4-Dichlorobenzene	LCS	0.0644	64	(32-97)			0.1 mg/L	09/19/2009
	LCSD	0.0659	66		2	(< 20)	0.1 mg/L	09/19/2009
Benzyl alcohol	LCS	0.0774	77	(38-110)			0.1 mg/L	09/19/2009
	LCSD	0.0732	73		6	(< 20)	0.1 mg/L	09/19/2009
1,2-Dichlorobenzene	LCS	0.0669	67	(35-99)			0.1 mg/L	09/19/2009
	LCSD	0.0667	67		0	(< 20)	0.1 mg/L	09/19/2009
2-Methylphenol (o-Cresol)	LCS	0.0771	77	(38-99)			0.1 mg/L	09/19/2009
	LCSD	0.0740	74		4	(< 20)	0.1 mg/L	09/19/2009
Bis(2chloro1methylethyl)Ether	LCS	0.0693	69	(36-103)			0.1 mg/L	09/19/2009
	LCSD	0.0692	69		0	(< 20)	0.1 mg/L	09/19/2009
3&4-Methylphenol (p&m-Cresol)	LCS	0.114	81	(38-105)			0.14 mg/L	09/19/2009
	LCSD	0.108	77		5	(< 20)	0.14 mg/L	09/19/2009
N-Nitroso-di-n-propylamine	LCS	0.0758	76	(42-108)			0.1 mg/L	09/19/2009
	LCSD	0.0738	74		3	(< 20)	0.1 mg/L	09/19/2009

SGS Ref.#	922276 Lab Control Sample	Printed Date/Time		09/30/2009 9:54
	922277 Lab Control Sample Duplicate	Prep	Batch	XXX21596
Client Name	Shaw Env & Infrastructure Inc.		Method	SW3520C
Project Name/#	RARE-AKTribal Landfill Sept.09		Date	09/08/2009
Matrix	Water (Surface, Eff., Ground)			

Parameter		QC Results	Pct Recov	LCS/LCSD Limits	RPD	RPD Limits	Spiked Amount	Analysis Date
Semivolatile Organic GC/MS								
Hexachloroethane	LCS	0.0586	59	(30-95)			0.1 mg/L	09/19/2009
	LCSD	0.0578	58		2	(< 20)	0.1 mg/L	09/19/2009
Nitrobenzene	LCS	0.0705	71	(45-105)			0.1 mg/L	09/19/2009
	LCSD	0.0700	70		1	(< 20)	0.1 mg/L	09/19/2009
Isophorone	LCS	0.0786	79	(50-110)			0.1 mg/L	09/19/2009
	LCSD	0.0758	76		4	(< 20)	0.1 mg/L	09/19/2009
2-Nitrophenol	LCS	0.0787	79	(40-109)			0.1 mg/L	09/19/2009
	LCSD	0.0777	78		1	(< 20)	0.1 mg/L	09/19/2009
2,4-Dimethylphenol	LCS	0.0700	70	(32-86)			0.1 mg/L	09/19/2009
	LCSD	0.0701	70		0	(< 20)	0.1 mg/L	09/19/2009
Benzoic acid	LCS	0.0870	62	(20-101)			0.14 mg/L	09/19/2009
	LCSD	0.0825	59		5	(< 20)	0.14 mg/L	09/19/2009
Bis(2-Chloroethoxy)methane	LCS	0.0768	77	(46-105)			0.1 mg/L	09/19/2009
	LCSD	0.0736	74		4	(< 20)	0.1 mg/L	09/19/2009
1,2,4-Trichlorobenzene	LCS	0.0690	69	(37-104)			0.1 mg/L	09/19/2009
	LCSD	0.0693	69		0	(< 20)	0.1 mg/L	09/19/2009
Naphthalene	LCS	0.0723	72	(45-100)			0.1 mg/L	09/19/2009
	LCSD	0.0718	72		1	(< 20)	0.1 mg/L	09/19/2009
4-Chloroaniline	LCS	0.0746	75	(37-110)			0.1 mg/L	09/19/2009
	LCSD	0.0652	65		13	(< 20)	0.1 mg/L	09/19/2009
Hexachlorobutadiene	LCS	0.0707	71	(38-105)			0.1 mg/L	09/19/2009
	LCSD	0.0696	70		2	(< 20)	0.1 mg/L	09/19/2009
4-Chloro-3-methylphenol	LCS	0.0952	95	(50-110)			0.1 mg/L	09/19/2009
	LCSD	0.0903	90		5	(< 20)	0.1 mg/L	09/19/2009
2,4-Dichlorophenol	LCS	0.0829	83	(50-105)			0.1 mg/L	09/19/2009
	LCSD	0.0798	80		4	(< 20)	0.1 mg/L	09/19/2009
2-Methylnaphthalene	LCS	0.0784	78	(46-105)			0.1 mg/L	09/19/2009
	LCSD	0.0774	77		1	(< 20)	0.1 mg/L	09/19/2009

SGS Ref.#	922276 Lab Control Sample	**Printed Date/Time**		09/30/2009	9:54
	922277 Lab Control Sample Duplicate	**Prep**	**Batch**	XXX21596	
Client Name	Shaw Env & Infrastructure Inc.		**Method**	SW3520C	
Project Name/#	RARE-AKTribal Landfill Sept.09		**Date**	09/08/2009	
Matrix	Water (Surface, Eff., Ground)				

Semivolatile Organic GC/MS

Parameter		QC Results	Pct Recov	LCS/LCSD Limits	RPD	RPD Limits	Spiked Amount	Analysis Date
Hexachlorocyclopentadiene	LCS	0.0204	20	(10-58)			0.1 mg/L	09/19/2009
	LCSD	0.0235	24		14	(< 20)	0.1 mg/L	09/19/2009
2,4,6-Trichlorophenol	LCS	0.0937	94	(50-115)			0.1 mg/L	09/19/2009
	LCSD	0.0894	89		5	(< 20)	0.1 mg/L	09/19/2009
2,4,5-Trichlorophenol	LCS	0.0933	93	(50-110)			0.1 mg/L	09/19/2009
	LCSD	0.0884	88		5	(< 20)	0.1 mg/L	09/19/2009
2-Chloronaphthalene	LCS	0.0699	70	(50-105)			0.1 mg/L	09/19/2009
	LCSD	0.0675	68		4	(< 20)	0.1 mg/L	09/19/2009
2-Nitroaniline	LCS	0.0927	93	(54-115)			0.1 mg/L	09/19/2009
	LCSD	0.0870	87		6	(< 20)	0.1 mg/L	09/19/2009
Dimethylphthalate	LCS	0.0834	83	(36-125)			0.1 mg/L	09/19/2009
	LCSD	0.0792	79		5	(< 20)	0.1 mg/L	09/19/2009
Acenaphthylene	LCS	0.0843	84	(53-105)			0.1 mg/L	09/19/2009
	LCSD	0.0815	82		3	(< 20)	0.1 mg/L	09/19/2009
2,6-Dinitrotoluene	LCS	0.0891	89	(55-115)			0.1 mg/L	09/19/2009
	LCSD	0.0865	87		3	(< 20)	0.1 mg/L	09/19/2009
3-Nitroaniline	LCS	0.0917	92	(54-125)			0.1 mg/L	09/19/2009
	LCSD	0.0863	86		6	(< 20)	0.1 mg/L	09/19/2009
Acenaphthene	LCS	0.0851	85	(53-110)			0.1 mg/L	09/19/2009
	LCSD	0.0834	83		2	(< 20)	0.1 mg/L	09/19/2009
2,4-Dinitrophenol	LCS	0.0952	53	(29-130)			0.18 mg/L	09/19/2009
	LCSD	0.0971	54		2	(< 20)	0.18 mg/L	09/19/2009
4-Nitrophenol	LCS	0.130	93	(42-112)			0.14 mg/L	09/19/2009
	LCSD	0.115	82		13	(< 20)	0.14 mg/L	09/19/2009
Dibenzofuran	LCS	0.0838	84	(55-105)			0.1 mg/L	09/19/2009
	LCSD	0.0819	82		2	(< 20)	0.1 mg/L	09/19/2009
2,4-Dinitrotoluene	LCS	0.0848	85	(55-115)			0.1 mg/L	09/19/2009

SGS Ref.#	922276 Lab Control Sample		**Printed Date/Time**	09/30/2009	9:54
	922277 Lab Control Sample Duplicate		**Prep** **Batch**	XXX21596	
Client Name	Shaw Env & Infrastructure Inc.		**Method**	SW3520C	
Project Name/#	RARE-AKTribal Landfill Sept.09		**Date**	09/08/2009	
Matrix	Water (Surface, Eff., Ground)				

Parameter		QC Results	Pct Recov	LCS/LCSD Limits	RPD	RPD Limits	Spiked Amount	Analysis Date
Semivolatile Organic GC/MS								
	LCSD	0.0830	83		2	(< 20)	0.1 mg/L	09/19/2009
Diethylphthalate	LCS	0.0821	82	(51-120)			0.1 mg/L	09/19/2009
	LCSD	0.0794	79		3	(< 20)	0.1 mg/L	09/19/2009
4-Chlorophenyl-phenylether	LCS	0.0804	80	(50-110)			0.1 mg/L	09/19/2009
	LCSD	0.0773	77		4	(< 20)	0.1 mg/L	09/19/2009
Fluorene	LCS	0.0874	87	(56-110)			0.1 mg/L	09/19/2009
	LCSD	0.0831	83		5	(< 20)	0.1 mg/L	09/19/2009
4-Nitroaniline	LCS	0.0923	92	(52-120)			0.1 mg/L	09/19/2009
	LCSD	0.0867	87		6	(< 20)	0.1 mg/L	09/19/2009
2-Methyl-4,6-dinitrophenol	LCS	0.105	58	(43-130)			0.18 mg/L	09/19/2009
	LCSD	0.108	60		3	(< 20)	0.18 mg/L	09/19/2009
N-Nitrosodiphenylamine	LCS	0.0855	86	(53-110)			0.1 mg/L	09/19/2009
	LCSD	0.0830	83		3	(< 20)	0.1 mg/L	09/19/2009
4-Bromophenyl-phenylether	LCS	0.0758	76	(52-110)			0.1 mg/L	09/19/2009
	LCSD	0.0736	74		3	(< 20)	0.1 mg/L	09/19/2009
Hexachlorobenzene	LCS	0.0867	87	(54-110)			0.1 mg/L	09/19/2009
	LCSD	0.0840	84		3	(< 20)	0.1 mg/L	09/19/2009
Pentachlorophenol	LCS	0.110	79	(51-115)			0.14 mg/L	09/19/2009
	LCSD	0.107	77		3	(< 20)	0.14 mg/L	09/19/2009
Phenanthrene	LCS	0.0909	91	(58-115)			0.1 mg/L	09/19/2009
	LCSD	0.0878	88		4	(< 20)	0.1 mg/L	09/19/2009
Anthracene	LCS	0.0909	91	(59-110)			0.1 mg/L	09/19/2009
	LCSD	0.0869	87		5	(< 20)	0.1 mg/L	09/19/2009
Di-n-butylphthalate	LCS	0.0827	83	(55-115)			0.1 mg/L	09/19/2009
	LCSD	0.0791	79		4	(< 20)	0.1 mg/L	09/19/2009
Fluoranthene	LCS	0.0890	89	(59-115)			0.1 mg/L	09/19/2009
	LCSD	0.0871	87		2	(< 20)	0.1 mg/L	09/19/2009

SGS Ref.#	922276 Lab Control Sample	**Printed Date/Time**	09/30/2009 9:54
	922277 Lab Control Sample Duplicate	**Prep Batch**	XXX21596
Client Name	Shaw Env & Infrastructure Inc.	**Method**	SW3520C
Project Name/#	RARE-AKTribal Landfill Sept.09	**Date**	09/08/2009
Matrix	Water (Surface, Eff., Ground)		

Parameter		QC Results	Pct Recov	LCS/LCSD Limits	RPD	RPD Limits	Spiked Amount	Analysis Date
Semivolatile Organic GC/MS								
Pyrene	LCS	0.0953	95	(62-128)			0.1 mg/L	09/19/2009
	LCSD	0.0922	92		3	(< 20)	0.1 mg/L	09/19/2009
Azobenzene	LCS	0.0849	85	(52-124)			0.1 mg/L	09/19/2009
	LCSD	0.0824	82		3	(< 20)	0.1 mg/L	09/19/2009
Butylbenzylphthalate	LCS	0.0943	94	(58-115)			0.1 mg/L	09/19/2009
	LCSD	0.0905	91		4	(< 20)	0.1 mg/L	09/19/2009
3,3-Dichlorobenzidine	LCS	0.0846	85	(53-110)			0.1 mg/L	09/19/2009
	LCSD	0.0786	79		8	(< 20)	0.1 mg/L	09/19/2009
Benzo(a)Anthracene	LCS	0.0931	93	(64-110)			0.1 mg/L	09/19/2009
	LCSD	0.0883	88		5	(< 20)	0.1 mg/L	09/19/2009
Chrysene	LCS	0.0923	92	(63-110)			0.1 mg/L	09/19/2009
	LCSD	0.0892	89		4	(< 20)	0.1 mg/L	09/19/2009
bis(2-Ethylhexyl)phthalate	LCS	0.0907	91	(59-125)			0.1 mg/L	09/19/2009
	LCSD	0.0862	86		5	(< 20)	0.1 mg/L	09/19/2009
di-n-Octylphthalate	LCS	0.0913	91	(52-131)			0.1 mg/L	09/19/2009
	LCSD	0.0879	88		4	(< 20)	0.1 mg/L	09/19/2009
Benzo[b]Fluoranthene	LCS	0.0928	93	(57-120)			0.1 mg/L	09/19/2009
	LCSD	0.0905	91		3	(< 20)	0.1 mg/L	09/19/2009
Benzo[k]fluoranthene	LCS	0.106	106	(58-124)			0.1 mg/L	09/19/2009
	LCSD	0.105	105		0	(< 20)	0.1 mg/L	09/19/2009
Benzo[a]pyrene	LCS	0.109	109	(58-110)			0.1 mg/L	09/19/2009
	LCSD	0.107	107		2	(< 20)	0.1 mg/L	09/19/2009
Indeno[1,2,3-c,d] pyrene	LCS	0.0669	67	(51-125)			0.1 mg/L	09/19/2009
	LCSD	0.0644	64		4	(< 20)	0.1 mg/L	09/19/2009
Dibenzo[a,h]anthracene	LCS	0.0707	71	(53-125)			0.1 mg/L	09/19/2009
	LCSD	0.0684	68		3	(< 20)	0.1 mg/L	09/19/2009
Benzo[g,h,i]perylene	LCS	0.0568	57	(48-123)			0.1 mg/L	09/19/2009
	LCSD	0.0543	54		4	(< 20)	0.1 mg/L	09/19/2009

SGS

SGS Ref.#	922276 Lab Control Sample	**Printed Date/Time**		09/30/2009	9:54
	922277 Lab Control Sample Duplicate	**Prep**	**Batch**	XXX21596	
Client Name	Shaw Env & Infrastructure Inc.		**Method**	SW3520C	
Project Name/#	RARE-AKTribal Landfill Sept.09		**Date**	09/08/2009	
Matrix	Water (Surface, Eff., Ground)				

Semivolatile Organic GC/MS

Parameter	QC Results	Pct Recov	LCS/LCSD Limits	RPD	RPD Limits	Spiked Amount	Analysis Date
Surrogates							
2-Fluorophenol <surr>	LCS	60	(21-88)				09/19/2009
	LCSD	59		2			09/19/2009
Phenol-d6 <surr>	LCS	70	(28-97)				09/19/2009
	LCSD	67		4			09/19/2009
Nitrobenzene-d5 <surr>	LCS	75	(41-110)				09/19/2009
	LCSD	74		0			09/19/2009
2-Fluorobiphenyl <surr>	LCS	80	(50-110)				09/19/2009
	LCSD	78		2			09/19/2009
2,4,6-Tribromophenol <surr>	LCS	89	(45-124)				09/19/2009
	LCSD	84		5			09/19/2009
Terphenyl-d14 <surr>	LCS	96	(52-135)				09/19/2009
	LCSD	93		3			09/19/2009

Batch	XMS5090
Method	SW8270D
Instrument	HP 5890 Series II MS4 SVPA

SGS

SGS Ref.#	923029 Lab Control Sample	**Printed Date/Time**	09/30/2009 9:54
		Prep	**Batch**
Client Name	Shaw Env & Infrastructure Inc.		**Method**
Project Name/#	RARE-AKTribal Landfill Sept.09		**Date**
Matrix	Water (Surface, Eff., Ground)		

QC results affect the following production samples:

1094697001, 1094697002, 1094697003

Parameter		QC Results	Pct Recov	LCS/LCSD Limits	RPD	RPD Limits	Spiked Amount	Analysis Date
Waters Department								
Total Dissolved Solids	LCS	405	98	(75-125)			413 mg/L	09/09/2009

Batch	WAT7807
Method	SM20 2540C
Instrument	

SGS

SGS Ref.#	923499 Lab Control Sample	**Printed Date/Time**	09/30/2009 9:54
		Prep	**Batch**
Client Name	Shaw Env & Infrastructure Inc.		**Method**
Project Name/#	RARE-AKTribal Landfill Sept.09		**Date**
Matrix	Water (Surface, Eff., Ground)		

QC results affect the following production samples:

1094697001

Parameter		QC Results	Pct Recov	LCS/LCSD Limits	RPD	RPD Limits	Spiked Amount	Analysis Date
Waters Department								
Total Organic Carbon	LCS	75.3	100	(90-110)			75 mg/L	09/11/2009

Batch	WTC1931
Method	SM 5310B
Instrument	TOC Analyzer

SGS

SGS Ref.#	923514 Lab Control Sample	**Printed Date/Time**	09/30/2009 9:54
		Prep	**Batch**
Client Name	Shaw Env & Infrastructure Inc.		**Method**
Project Name/#	RARE-AKTribal Landfill Sept.09		**Date**
Matrix	Water (Surface, Eff., Ground)		

QC results affect the following production samples:

1094697001, 1094697002, 1094697003

Parameter		QC Results	Pct Recov	LCS/LCSD Limits	RPD	RPD Limits	Spiked Amount	Analysis Date
Waters Department								
Total Organic Carbon	LCS	79.2	106	(90-110)			75 mg/L	09/12/2009

Batch	WTC1931
Method	SM 5310B
Instrument	TOC Analyzer

SGS Ref.# 923522 Lab Control Sample

Printed Date/Time 09/30/2009 9:54

Prep **Batch** MXX22208
Method METHOD
Date 09/10/2009

Client Name Shaw Env & Infrastructure Inc.
Project Name/# RARE-AKTribal Landfill Sept.09
Matrix Water (Surface, Eff., Ground)

QC results affect the following production samples:

1094697001, 1094697002

Parameter		QC Results	Pct Recov	LCS/LCSD Limits	RPD	RPD Limits	Spiked Amount	Analysis Date
Metals Department								
Mercury	LCS	4.18	105	(85-115)			4 ug/L	09/11/2009

Batch MCV4314
Method SW7470A/E245.1
Instrument PSA Millennium mercury AA

SGS

SGS Ref.#	924650 Lab Control Sample	**Printed Date/Time**	09/30/2009 9:54
		Prep **Batch**	
Client Name	Shaw Env & Infrastructure Inc.	**Method**	
Project Name/#	RARE-AKTribal Landfill Sept.09	**Date**	
Matrix	Water (Surface, Eff., Ground)		

QC results affect the following production samples:

1094697001, 1094697002, 1094697003

Parameter		QC Results	Pct Recov	LCS/LCSD Limits	RPD	RPD Limits	Spiked Amount	Analysis Date
Waters Department								
Alkalinity	LCS	253	101	(90-110)			250 mg/L	09/17/2009

Batch WTI3186
Method SM20 2320B
Instrument

SGS

SGS Ref.#	924740 Lab Control Sample	**Printed Date/Time**		09/30/2009 9:54
		Prep	**Batch**	TPHX1983
Client Name	Shaw Env & Infrastructure Inc.		**Method**	EXT_1664TP
Project Name/#	RARE-AKTribal Landfill Sept.09		**Date**	09/17/2009
Matrix	Water (Surface, Eff., Ground)			

QC results affect the following production samples:

1094697001, 1094697002, 1094697003

Parameter		QC Results	Pct Recov	LCS/LCSD Limits	RPD	RPD Limits	Spiked Amount	Analysis Date
Waters Department								
TPH Silica Gel HEM	LCS	18.6	93	(64-132)			20 mg/L	09/17/2009

Batch	TPH2166
Method	EPA 1664A
Instrument	

SGS Ref.# 926320 Lab Control Sample

Printed Date/Time 09/30/2009 9:54

Prep **Batch** MXX22266
Method METHOD
Date 09/23/2009

Client Name Shaw Env & Infrastructure Inc.
Project Name/# RARE-AKTribal Landfill Sept.09
Matrix Water (Surface, Eff., Ground)

QC results affect the following production samples:

1094697004, 1094697005

Parameter		QC Results	Pct Recov	LCS/LCSD Limits	RPD	RPD Limits	Spiked Amount	Analysis Date
Metals Department								
Mercury	LCS	3.86	96	(85-115)			4 ug/L	09/23/2009

Batch MCV4329
Method SW7470A/E245.1
Instrument PSA Millennium mercury AA

SGS Ref.#	927679 Lab Control Sample	**Printed Date/Time**		09/30/2009 9:54
		Prep	**Batch**	MXX22299
Client Name	Shaw Env & Infrastructure Inc.		**Method**	METHOD
Project Name/#	RARE-AKTribal Landfill Sept.09		**Date**	09/28/2009
Matrix	Water (Surface, Eff., Ground)			

QC results affect the following production samples:

1094697003

Parameter		QC Results	Pct Recov	LCS/LCSD Limits	RPD	RPD Limits	Spiked Amount	Analysis Date
Metals Department								
Mercury	LCS	4.22	105	(85-115)			4 ug/L	09/29/2009

Batch	MCV4342
Method	SW7470A/E245.1
Instrument	PSA Millennium mercury AA

SGS Ref.#	927686 Lab Control Sample	**Printed Date/Time**		09/30/2009 9:54
		Prep	**Batch**	MXX22299
Client Name	Shaw Env & Infrastructure Inc.		**Method**	METHOD
Project Name/#	RARE-AKTribal Landfill Sept.09		**Date**	09/28/2009
Matrix	Water (Surface, Eff., Ground)			

QC results affect the following production samples:

1094697003

Parameter		QC Results	Pct Recov	LCS/LCSD Limits	RPD	RPD Limits	Spiked Amount	Analysis Date
Metals Department								
Mercury	LCS	3.91	98	(85-115)			4 ug/L	09/29/2009

Batch	MCV4342
Method	SW7470A/E245.1
Instrument	PSA Millennium mercury AA

SGS Ref.# 923502 Matrix Spike
923503 Matrix Spike Duplicate

Printed Date/Time 09/30/2009 9:54
Prep **Batch**
Method
Date

Original 1094697001
Matrix Water (Surface, Eff., Ground)

QC results affect the following production samples:
1094697001, 1094697002

Parameter	Qualifiers	Original Result	QC Result	Pct Recov	MS/MSD Limits	RPD	RPD Limits	Spiked Amount		Analysis Date
Waters Department										
Total Organic Carbon	MS	ND	10.5	105	(75-125)			10.0	mg/L	09/11/2009
	MSD		10.8	108		3	(< 25)	10.0	mg/L	09/11/2009

Batch WTC1931
Method SM 5310B
Instrument TOC Analyzer

SGS

SGS Ref.#	923508	Matrix Spike	**Printed Date/Time**		09/30/2009 9:54
	923509	Matrix Spike Duplicate	**Prep**	**Batch**	
				Method	
				Date	
Original	1094697002				
Matrix	Water (Surface, Eff., Ground)				

QC results affect the following production samples:

1094697002, 1094697003

Parameter	Qualifiers	Original Result	QC Result	Pct Recov	MS/MSD Limits	RPD	RPD Limits	Spiked Amount		Analysis Date
Waters Department										
Total Organic Carbon	MS	3.77	12.8	91	(75-125)			10.0	mg/L	09/12/2009
	MSD		12.7	89		1	(< 25)	10.0	mg/L	09/12/2009

Batch	WTC1931
Method	SM 5310B
Instrument	TOC Analyzer

SGS Ref.#	923523	Matrix Spike	**Printed Date/Time**	09/30/2009 9:54
			Prep **Batch**	MXX22208
			Method	Digestion Mercury (W)
			Date	09/10/2009

Original 1094677002

Matrix Water (Surface, Eff., Ground)

QC results affect the following production samples:

1094697001, 1094697002

Parameter	Qualifiers	Original Result	QC Result	Pct Recov	MS/MSD Limits	RPD	RPD Limits	Spiked Amount		Analysis Date
Metals Department										
Mercury	MS	ND	8.42	105	(85-115)			8.00	ug/L	09/11/2009

Batch MCV4314

Method SW7470A/E245.1

Instrument PSA Millennium mercury AA

SGS Ref.#	923524	Matrix Spike	**Printed Date/Time**	09/30/2009 9:54
	923525	Matrix Spike Duplicate	**Prep** **Batch**	MXX22208
			Method	Digestion Mercury (W)
			Date	09/10/2009
Original	1094455001			
Matrix	Water (Surface, Eff., Ground)			

QC results affect the following production samples:

1094697001, 1094697002

Parameter	Qualifiers		Original Result	QC Result	Pct Recov	MS/MSD Limits	RPD	RPD Limits	Spiked Amount		Analysis Date
Metals Department											
Mercury		MS	ND	8.3	104	(85-115)			8.00	ug/L	09/11/2009
		MSD		9.06	113		9	(< 15)	8.00	ug/L	09/11/2009

Batch MCV4314

Method SW7470A/E245.1

Instrument PSA Millennium mercury AA

SGS Ref.#	924742	Matrix Spike	**Printed Date/Time** 09/30/2009 9:54
			Prep **Batch** TPHX1983
			Method Extraction for EPA 1664 TPH S
			Date 09/17/2009
Original	924738		
Matrix	Water (Surface, Eff., Ground)		

QC results affect the following production samples:

1094697001, 1094697002, 1094697003

Parameter	Qualifiers	Original Result	QC Result	Pct Recov	MS/MSD Limits	RPD	RPD Limits	Spiked Amount		Analysis Date
Waters Department										
TPH Silica Gel HEM	MS	ND	18.4	87	(64-132)			21.3	mg/L	09/17/2009

Batch TPH2166

Method EPA 1664A

Instrument

SGS Ref.#	926321	Matrix Spike	**Printed Date/Time**		09/30/2009 9:54
			Prep	**Batch**	MXX22266
				Method	Digestion Mercury (W)
				Date	09/23/2009
Original	926315				
Matrix	Water (Surface, Eff., Ground)				

QC results affect the following production samples:

1094697004, 1094697005

Parameter	Qualifiers	Original Result	QC Result	Pct Recov	MS/MSD Limits	RPD	RPD Limits	Spiked Amount		Analysis Date
Metals Department										
Mercury	MS	0.704	6.65	74*	(85-115)			8.00	ug/L	09/23/2009

Batch	MCV4329
Method	SW7470A/E245.1
Instrument	PSA Millennium mercury AA

SGS Ref.#	926322	Matrix Spike	**Printed Date/Time**		09/30/2009 9:54
	926323	Matrix Spike Duplicate	**Prep**	**Batch**	MXX22266
				Method	Digestion Mercury (W)
				Date	09/23/2009
Original	1094652001				
Matrix	Solid/Soil (Wet Weight)				

QC results affect the following production samples:

1094697004, 1094697005

Parameter	Qualifiers		Original Result	QC Result	Pct Recov	MS/MSD Limits	RPD	RPD Limits	Spiked Amount		Analysis Date

Metals Department

Parameter	Qualifiers		Original Result	QC Result	Pct Recov	MS/MSD Limits	RPD	RPD Limits	Spiked Amount		Analysis Date
Mercury		MS	ND	77.4	97	(85-115)			80.0	ug/L	09/23/2009
		MSD		78.9	99		2	(< 15)	80.0	ug/L	09/23/2009

Batch MCV4329
Method SW7470A/E245.1
Instrument PSA Millennium mercury AA

SGS

SGS Ref.#	927681	Matrix Spike	**Printed Date/Time**		09/30/2009 9:54
	927682	Matrix Spike Duplicate	**Prep**	**Batch**	MXX22299
				Method	Digestion Mercury (W)
				Date	09/28/2009
Original	1095908001				
Matrix	Water (Surface, Eff., Ground)				

QC results affect the following production samples:

1094697003

Parameter	Qualifiers		Original Result	QC Result	Pct Recov	MS/MSD Limits	RPD	RPD Limits	Spiked Amount		Analysis Date
Metals Department											
Mercury		MS	ND	7.96	100	(85-115)			8.00	ug/L	09/29/2009
		MSD		8.21	103		3	(< 15)	8.00	ug/L	09/29/2009

Batch MCV4342
Method SW7470A/E245.1
Instrument PSA Millennium mercury AA

SGS Ref.#	927689	Matrix Spike	**Printed Date/Time**		09/30/2009 9:54
	927690	Matrix Spike Duplicate	**Prep**	**Batch**	MXX22299
				Method	Digestion Mercury (W)
				Date	09/28/2009
Original	1095912001				
Matrix	Water (Surface, Eff., Ground)				

QC results affect the following production samples:

1094697003

Parameter	Qualifiers		Original Result	QC Result	Pct Recov	MS/MSD Limits	RPD	RPD Limits	Spiked Amount		Analysis Date
Metals Department											
Mercury		MS	ND	8.21	103	(85-115)			8.00	ug/L	09/29/2009
		MSD		8.17	102		0	(< 15)	8.00	ug/L	09/29/2009

Batch MCV4342
Method SW7470A/E245.1
Instrument PSA Millennium mercury AA

LSC Area Percent Report

Data Path : Z:\GC\Public\Public\2009\09\SPA\Data\091809A\
Data File : 1823A.D
Acq On : 19 Sep 2009 1:28 am
Operator : JDH
Sample : 1094697001
Misc : [SPA]
ALS Vial : 21 Sample Multiplier: 1

Integration Parameters: INTP22.P
Integrator: RTE
Smoothing : ON Filtering: 5
Sampling : 1 Min Area: 3 % of largest Peak
Start Thrs: 0.2 Max Peaks: 100
Stop Thrs : 0 Peak Location: TOP

If leading or trailing edge < 100 prefer < Baseline drop else tangent >
Peak separation: 5

Method : \\USFS700\ANK_INSTRUMENT_DATA\GC\PUBLIC\PUBLIC\2009\09\SPA\METHOD\SPA20090916.M
Title : SW-846 8270C / EPA 625

Signal : TIC

peak #	R.T. min	first scan	max scan	last scan	PK TY	peak height	corr. area	corr. % max.	% of total
1	3.608	161	172	195	rBV	1692977	7599721	41.19%	5.295%
2	4.377	267	276	291	rBV	3778585	8529117	46.23%	5.942%
3	4.703	315	320	334	rBV	5764343	12885707	69.84%	8.978%
4	5.221	381	390	398	rBV	3137959	4420835	23.96%	3.080%
5	6.013	491	497	529	rBV	11405420	16269333	88.19%	11.335%
6	7.478	689	695	702	rBV	6171828	7636174	41.39%	5.320%
7	8.581	835	844	868	rBV	10017952	18449065	100.00%	12.854%
8	9.973	1022	1032	1046	rBV	4673836	7613774	41.27%	5.305%
9	11.290	1199	1210	1216	rBV2	8360842	18415251	99.82%	12.830%
10	14.465	1629	1639	1652	rBV2	5417622	9977134	54.08%	6.951%
11	16.493	1900	1913	1925	rVB	6276823	17103118	92.70%	11.916%
12	16.693	1933	1940	1953	rVB	962890	1320887	7.16%	0.920%
13	19.098	2251	2265	2275	rBV	4851655	13309256	72.14%	9.273%

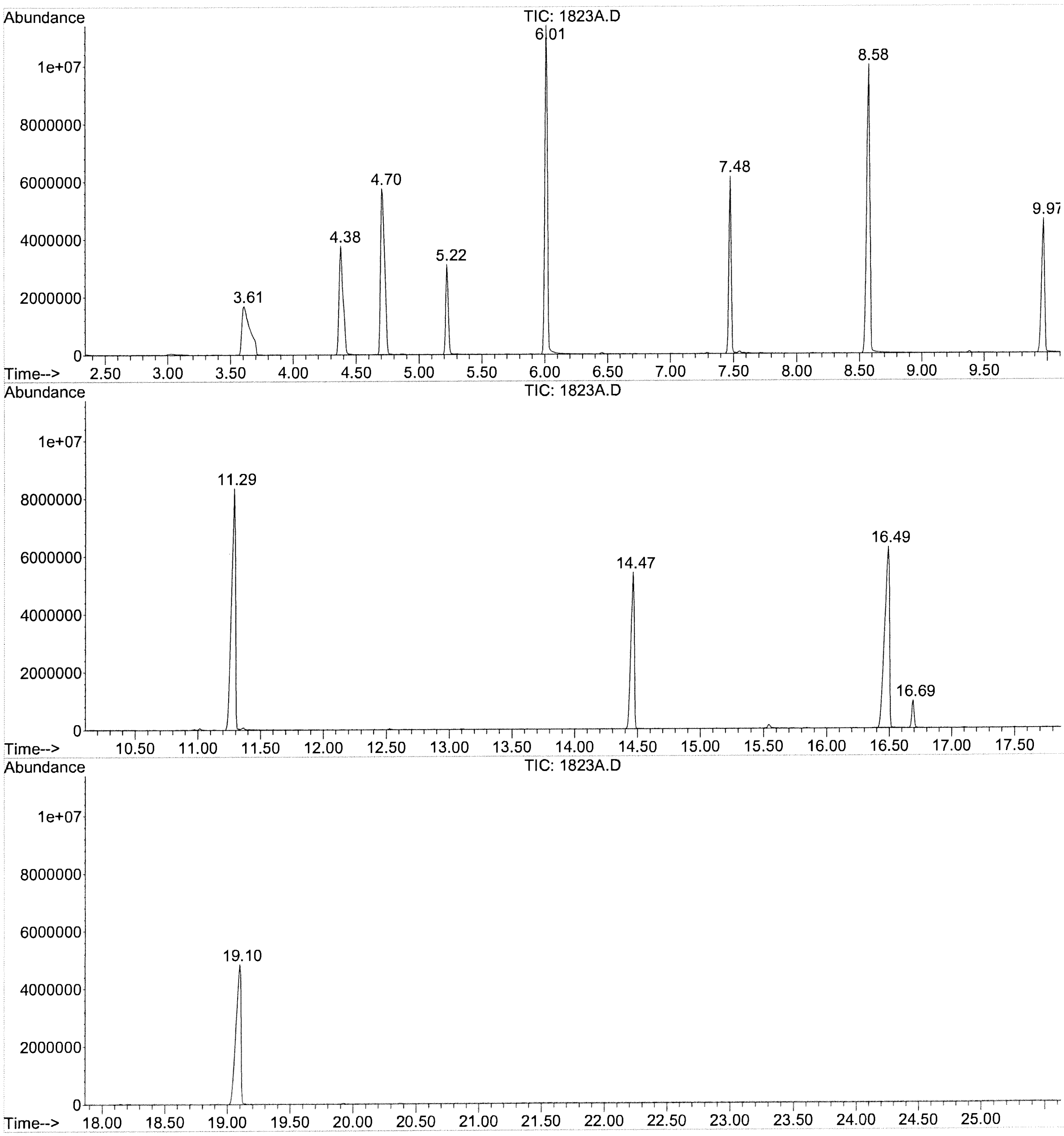
Sum of corrected areas: 143529372

LSC Report - Integrated Chromatogram

Data Path : Z:\GC\Public\Public\2009\09\SPA\Data\091809A\
Data File : 1823A.D
Acq On   : 19 Sep 2009   1:28 am
Operator : JDH
Sample   : 1094697001
Misc   : [SPA]
ALS Vial : 21   Sample Multiplier: 1

Quant Method : \\USFS700\ANK_INSTRUMENT_DATA\GC\PUBLIC\PUBLIC\2009\09\SPA\METHOD\SPA20090916.
...   M
Quant Title : SW-846 8270C / EPA 625

TIC Library   : \\USFS700\ANK_INSTRUMENT_DATA\GC\PUBLIC\MS_LIB\NIST02.L
TIC Integration Parameters: RTEINT.P



Tentatively Identified Compound (LSC) summary

```
Data Path : Z:\GC\Public\Public\2009\09\SPA\Data\091809A\\
Data File : 1823A.D
Acq On    : 19 Sep 2009   1:28 am kw 10/6/09
Operator  : JDHH
Sample    : 10946970011 kw 10/6/09
Misc      : [SPA]
ALS Vial  : 21   Sample Multiplier: 11

Quant Method : \\USFS700\ANK_INSTRUMENT_DATA\GC\PUBLIC\PUBLIC\2009\09\SPA\METHOD\SPA20090916..
...            MM
Quant Title  : SW-846 8270C / EPA 6255

TIC Library   : \\USFS700\ANK_INSTRUMENT_DATA\GC\PUBLIC\MS_LIB\NIST02.L
TIC Integration Parameters: RTEINT.PP

                                                    |--Internal Standard---|
TIC Top Hit name       RT  EstConc Units Response |#     RT      Resp  Conc|
--------------------------------------------------------------------------


 No Library Search Compounds Detected
 *******************************************************************
```

LSC Area Percent Report

Data Path : Z:\GC\Public\Public\2009\09\SPA\Data\091809A\
Data File : 1824A.D
Acq On : 19 Sep 2009 2:01 am
Operator : JDH
Sample : 1094697002
Misc : [SPA]
ALS Vial : 22 Sample Multiplier: 1

Integration Parameters: INTP22.P
Integrator: RTE
Smoothing : ON
Sampling : 1
Start Thrs: 0.2
Stop Thrs : 0

Filtering: 5
Min Area: 3 % of largest Peak
Max Peaks: 100
Peak Location: TOP

If leading or trailing edge < 100 prefer < Baseline drop else tangent >
Peak separation: 5

Method : \\USFS700\ANK_INSTRUMENT_DATA\GC\PUBLIC\PUBLIC\2009\09\SPA\METHOD\SPA20090916.M
Title : SW-846 8270C / EPA 625

Signal : TIC

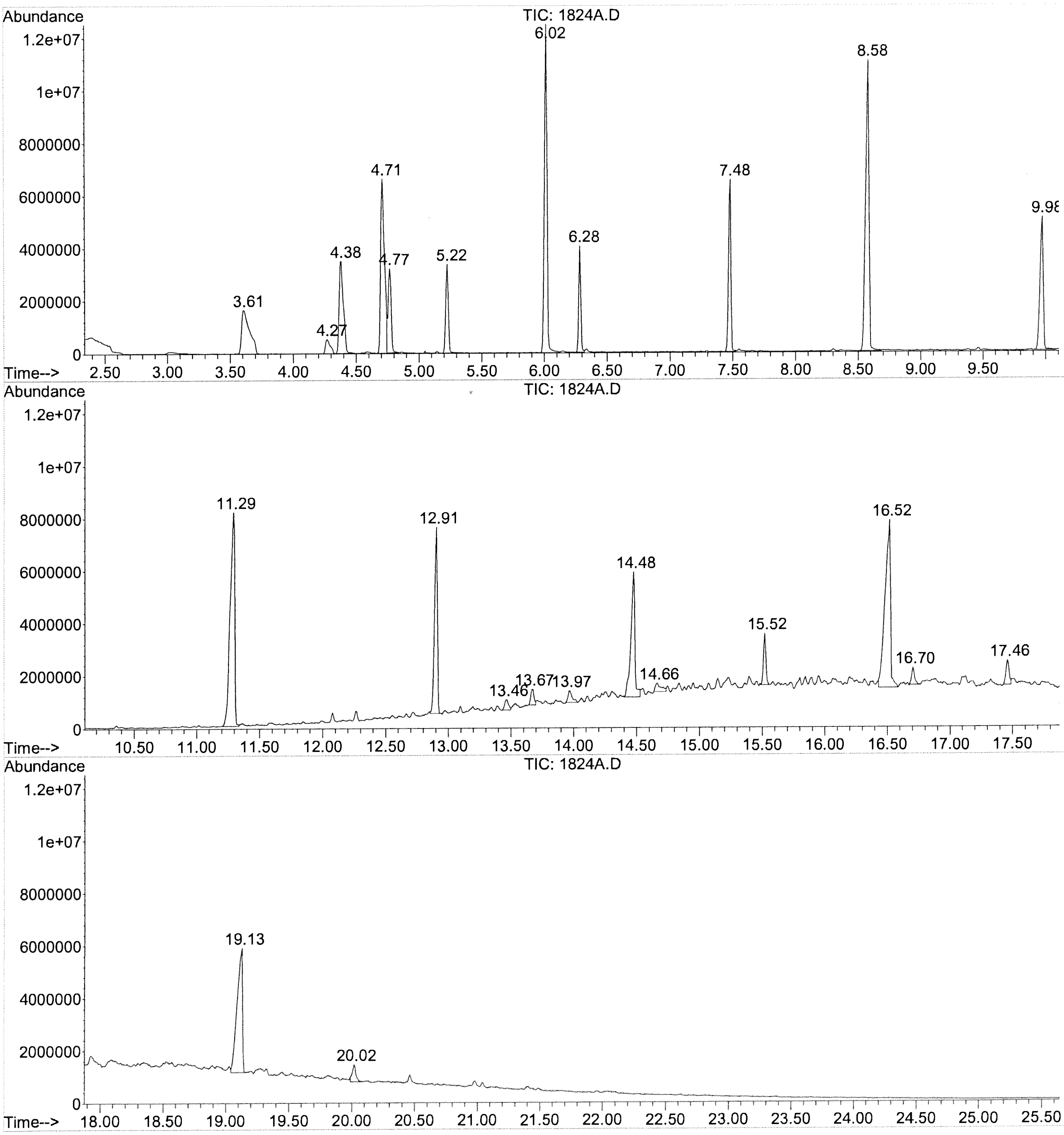
peak #	R.T. min	first scan	max scan	last scan	PK TY	peak height	corr. area	corr. % max.	% of total
1	3.611	160	173	196	rBV	1652721	7385960	35.55%	3.899%
2	4.270	253	262	271	rBV	540135	1419673	6.83%	0.749%
3	4.381	271	277	295	rVB	3509457	8359218	40.23%	4.412%
4	4.706	314	321	326	rBV	6649536	14364321	69.13%	7.582%
5	4.766	326	329	340	rVB	3213393	5382016	25.90%	2.841%
6	5.224	384	391	400	rBV	3387330	4724428	22.74%	2.494%
7	6.016	491	498	513	rBV	12534997	17853384	85.92%	9.424%
8	6.283	529	534	539	rBV	4071477	4454937	21.44%	2.351%
9	7.482	689	696	702	rBV	6585589	8778869	42.25%	4.634%
10	8.585	835	845	859	rBV	11125948	20777872	100.00%	10.967%
11	9.976	1023	1033	1047	rBV	5111489	8949915	43.07%	4.724%
12	11.293	1198	1211	1217	rBV2	8154211	20549069	98.90%	10.846%
13	12.907	1422	1429	1433	rVB	7097436	11793006	56.76%	6.225%
14	13.462	1500	1504	1509	rBV3	395870	849789	4.09%	0.449%
15	13.669	1528	1532	1536	rBV3	603558	1094197	5.27%	0.578%
16	13.965	1569	1572	1581	rVB2	454589	1060756	5.11%	0.560%
17	14.476	1631	1641	1648	rBV2	4769616	10654802	51.28%	5.624%
18	14.661	1663	1666	1676	rBV4	319709	1047968	5.04%	0.553%
19	15.519	1778	1782	1788	rVB	1960923	2549218	12.27%	1.346%
20	16.519	1905	1917	1926	rVB	6381806	19347441	93.12%	10.212%
21	16.704	1939	1942	1950	rVB	660793	1058243	5.09%	0.559%
22	17.459	2040	2044	2048	rBV2	931897	1723371	8.29%	0.910%
23	19.131	2258	2270	2274	rVB	4744895	13961459	67.19%	7.369%
24	20.019	2386	2390	2399	rVB3	654376	1313714	6.32%	0.693%

Sum of corrected areas: 189453626

Data Path : Z:\GC\Public\Public\2009\09\SPA\Data\091809A\
Data File : 1824A.D
Acq On : 19 Sep 2009 2:01 am
Operator : JDH
Sample : 1094697002
Misc : [SPA]
ALS Vial : 22 Sample Multiplier: 1

Quant Method : \\USFS700\ANK_INSTRUMENT_DATA\GC\PUBLIC\PUBLIC\2009\09\SPA\METHOD\SPA20090916.
... M
Quant Title : SW-846 8270C / EPA 625

TIC Library : \\USFS700\ANK_INSTRUMENT_DATA\GC\PUBLIC\MS_LIB\NIST02.L
TIC Integration Parameters: RTEINT.P



Library Search Compound Report

Data Path : Z:\GC\Public\Public\2009\09\SPA\Data\091809A\
Data File : 1824A.D
Acq On : 19 Sep 2009 2:01 am
Operator : JDH
Sample : 1094697002
Misc : [SPA]
ALS Vial : 22 Sample Multiplier: 1

Quant Method : \\USFS700\ANK_INSTRUMENT_DATA\GC\PUBLIC\PUBLIC\2009\09\SPA\METHOD\SPA20090916.
... M
Quant Title : SW-846 8270C / EPA 625

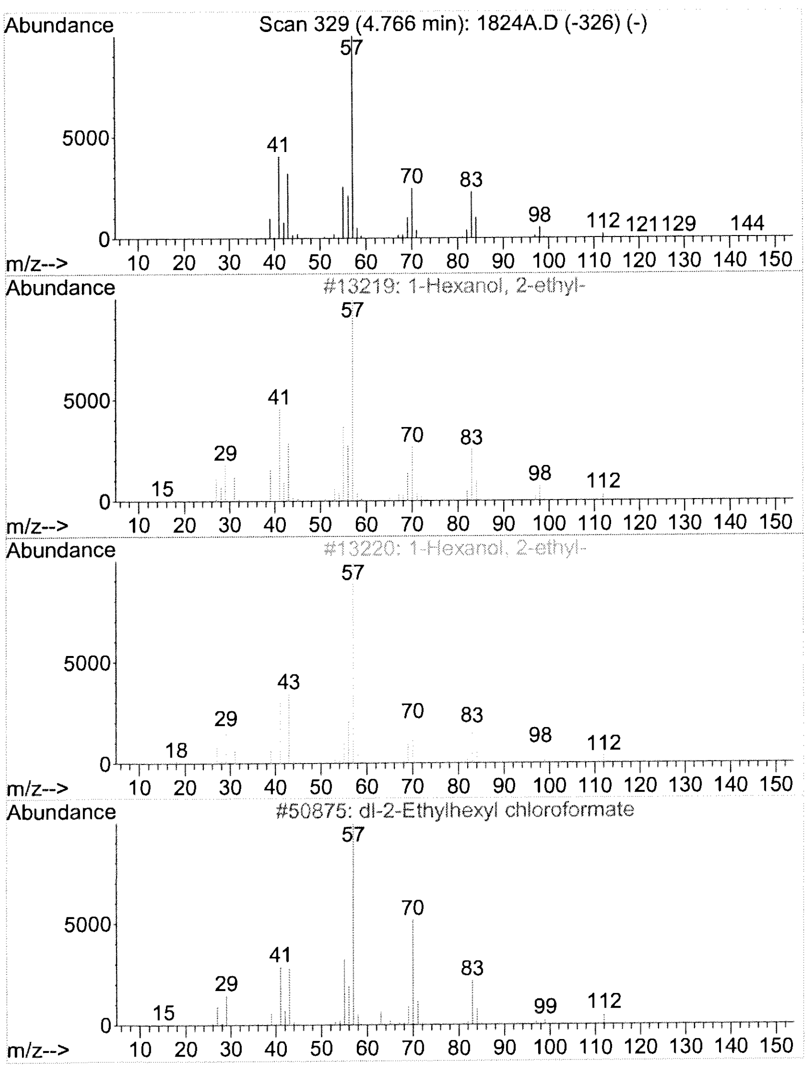
TIC Library : \\USFS700\ANK_INSTRUMENT_DATA\GC\PUBLIC\MS_LIB\NIST02.L
TIC Integration Parameters: RTEINT.P

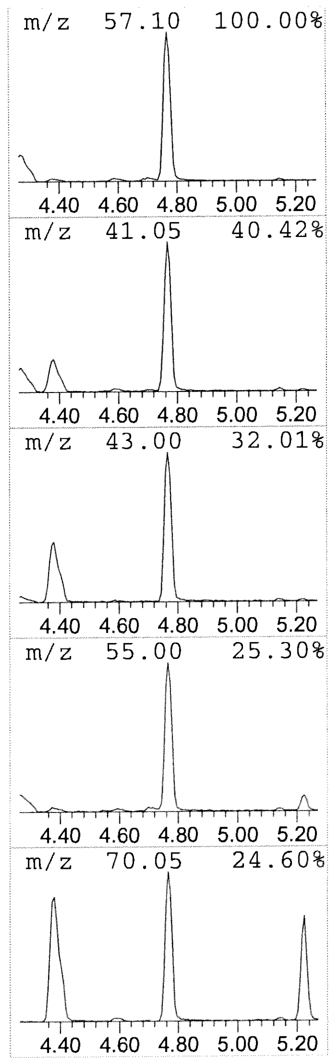
****

Peak Number 1 1-Hexanol, 2-ethyl- Concentration Rank 2

R.T.	EstConc	Area	Relative to ISTD	R.T.
4.77	59.95 mg/L	5382020	1,4-Dichlorobenzene-D4	4.71

Hit# of 5	Tentative ID	MW	MolForm	CAS#	Qual
1	1-Hexanol, 2-ethyl-	130	C8H18O	000104-76-7	78
2	1-Hexanol, 2-ethyl-	130	C8H18O	000104-76-7	78
3	dl-2-Ethylhexyl chloroformate	192	C9H17ClO2	024468-13-1	59
4	1-Hexanol, 2-ethyl-	130	C8H18O	000104-76-7	56
5	1-Hexanol, 2-ethyl-	130	C8H18O	000104-76-7	56

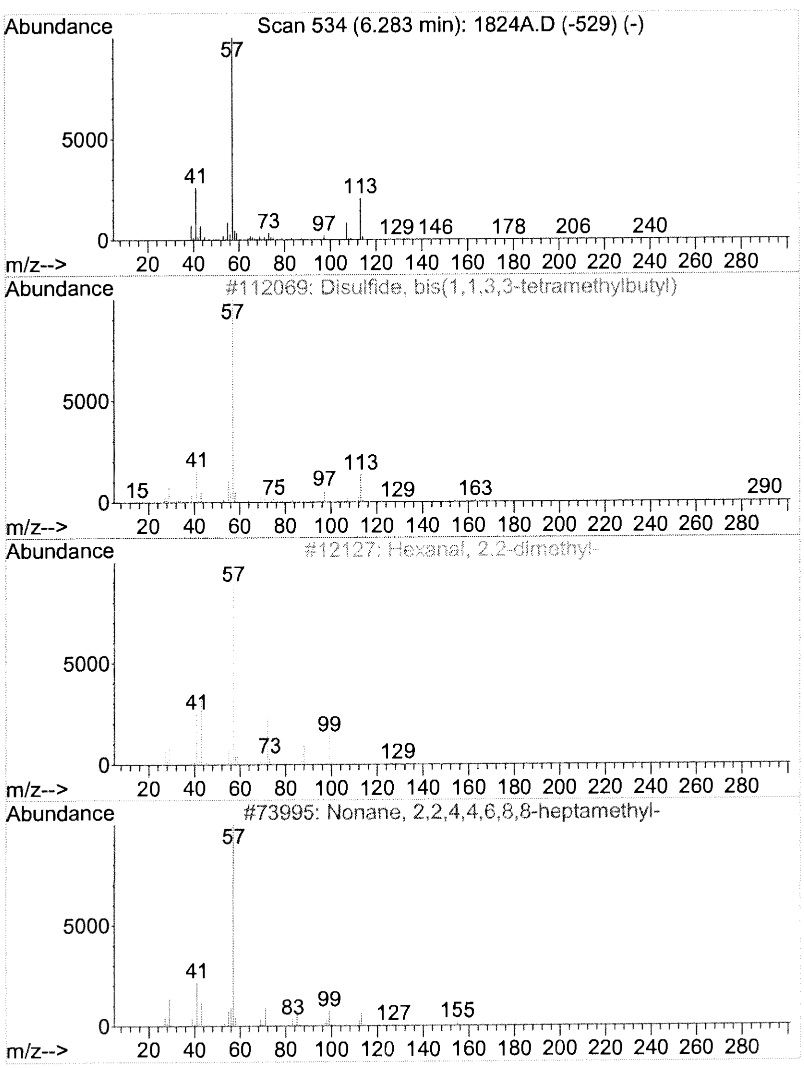


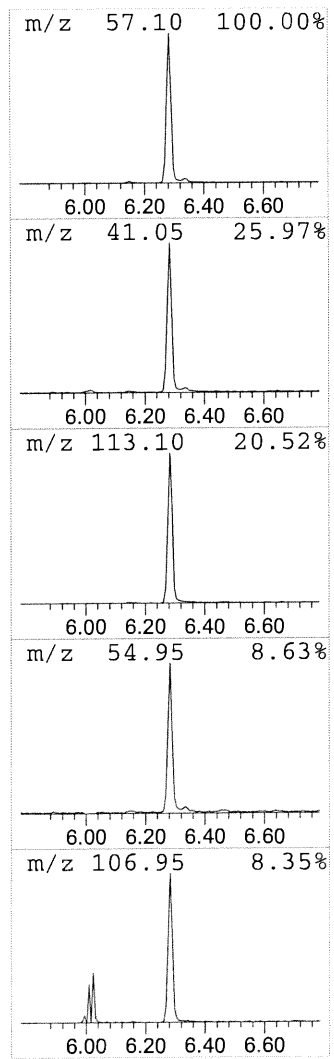


```
Data Path : Z:\GC\Public\Public\2009\09\SPA\Data\091809A\
Data File : 1824A.D
Acq On    : 19 Sep 2009   2:01 am
Operator  : JDH
Sample    : 1094697002
Misc      : [SPA]
ALS Vial  : 22   Sample Multiplier: 1

Quant Method : \\USFS700\ANK_INSTRUMENT_DATA\GC\PUBLIC\PUBLIC\2009\09\SPA\METHOD\SPA20090916.
...            M
Quant Title  : SW-846 8270C / EPA 625

TIC Library   : \\USFS700\ANK_INSTRUMENT_DATA\GC\PUBLIC\MS_LIB\NIST02.L
TIC Integration Parameters: RTEINT.P

*******************************************************************
Peak Number  2  Disulfide, bis(1,1,3,3-tetr...  Concentration Rank  3
```

R.T.	EstConc	Area	Relative to ISTD	R.T.
6.28	39.92 mg/L	4454940	Naphthalene-D8	6.02

Hit# of 5	Tentative ID	MW	MolForm	CAS#	Qual
1	Disulfide, bis(1,1,3,3-tetrameth...	290	C16H34S2	029956-99-8	38
2	Hexanal, 2,2-dimethyl-	128	C8H16O	000996-12-3	25
3	Nonane, 2,2,4,4,6,8,8-heptamethyl-	226	C16H34	004390-04-9	17
4	Thiolane-3,4-dicarbonitrile, 2,5...	386	C16H20F6N2S	1000260-74-6	17
5	Isobutyl ether	130	C8H18O	000628-55-7	12





Tentatively Identified Compound (LSC) summary

Data Path : Z:\GC\Public\Public\2009\09\SPA\Data\091809A\
Data File : 1824A.D
Acq On : 19 Sep 2009 2:01 am
Operator : JDH
Sample : 1094697002
Misc : [SPA]
ALS Vial : 22 Sample Multiplier: 1

Quant Method : \\USFS700\ANK_INSTRUMENT_DATA\GC\PUBLIC\PUBLIC\2009\09\SPA\METHOD\SPA20090916.M
Quant Title : SW-846 8270C / EPA 625

TIC Library : \\USFS700\ANK_INSTRUMENT_DATA\GC\PUBLIC\MS_LIB\NIST02.L
TIC Integration Parameters: RTEINT.P

TIC Top Hit name	RT	EstConc	Units	Response	--Internal Standard--- #	RT	Resp	Conc
1-Hexanol, 2-ethyl-	4.77	59.9	mg/L	5382020	1	4.71	14364300	160.0
Disulfide, bis(1,...	6.28	39.9	mg/L	4454940	2	6.02	17853400	160.0
~~Undecane, 6,6-dim...~~	12.91	91.8	mg/L	11793000	4	11.29	20549100	160.0
~~Ethanone, 1-(9,10...~~	15.52	21.1	mg/L	2549220	5	16.52	19347400	160.0

1094697

Kottsick, Jason L (Anchorage)

From: Crupi, Steve [steve.crupi@shawgrp.com]
Sent: Tuesday, September 08, 2009 11:35 AM
To: Kottsick, Jason L (Anchorage)
Cc: Long, Alesha (Anchorage); James, Jack; James, Rachel
Subject: RE: 1094697_RARE0909_COC4Sep09

Jason,

For the two -401 samples you received, please conduct a SVOC 8270 TIC search (in addition to the 'regular' analyte list) looking for and reporting ONLY the top ten TICs meeting the criteria for TIC identification (greater than 10% the nearest IS, etc.). Do not do a TIC search for the -501 samples.

For all future field samples on this project (samples ending in '001'), please conduct an SVOC 8270 TIC search (in addition to the 'regular' list) whenever SVOC 8270 is requested. I, and Jack, will try to remember to formally request TICs on the COC.

Steve

Steven R. Crupi
Project Manager
Shaw Alaska, Inc.
Shaw Environmental & Infrastructure
2000 W. Internat'l Airport Rd., C-1, Anchorage, AK 99502
(907) 249-6312 (direct)
(907) 243-6300 (general)

From: Kottsick, Jason L (Anchorage) [mailto:Jason.Kottsick@sgs.com]
Sent: Tuesday, September 08, 2009 10:37 AM
To: Crupi, Steve
Cc: Long, Alesha (Anchorage)
Subject: FW: 1094697_RARE0909_COC4Sep09

Jason Kottsick
Environmental Services
Project Manager

SGS - North America Inc.
200 West Potter Drive
US - 99518 - Anchorage, AK
Phone: (907) 562-2343
Fax: (907) 561-5301
E-mail: jason.kottsick@sgs.com

1094697

RARE - AK Tribal Landfills Project Chain of Custody

COC # SGSIf0909WG001 Cooler # 0909-101

NovaGold Project Sampling Event ID: **RARE - AK Tribal Landfills September 2009**

Destination Laboratory: **SGS-Anchorage**

Sample Collection Org.: **Shaw Alaska, Inc.**

Reporting and Invoicing Instructions:
E-mail receiving records, PDF report, and EDF to: jack.james@shawgrp.com
Send Hardcopy Report and invoice to: Shaw Alaska, Inc., Anchorage, AK; attn.Wayne Coppel

Sample ID	Location ID	Date	Time	Matrix	8270D - SVOC	E1664 - TPH	2320B, SM2540C - Alkalinity, TDS	SM5310 - TOC	E7470A - Total Hg					# bottles	MS/MSD Requested?
0909ERNOBPWG401	ERNOBP	9/3/09	16:00	WG	X	X	X	X	X		1 A-G			7	
0909ERWHBPWG401	ERWHBP	9/3/09	16:00	WG	X	X	X	X	X		2 A-G			7	

Notes:
Limited Volume for:
~~1 L for 8270D for 0909DIBLNKWG501~~
1.5 L for 8270D for 0909ERNOBPWG401 and 0909ERWHBPWG401

Comments:
AK Format Report for RARE Project.
Report Data to PQL.

Relinquished by (Signature)	Date:	Received by (Signature)	Date:
	9/4/2009		
Printed Name	**Time:**	**Printed Name**	**Time:**
Jack A. James (Shaw)	10:00		
Relinquished by (Signature)	**Date:**	**Received by (Signature)**	**Date:**
			9-4-09
Printed Name	**Time:**	**Printed Name**	**Time:**
		JAMES DOUCHTY	1235

AG Temperature Blank: 5.8

Cooler Temperature: ______

1094697

RARE - AK Tribal Landfills Project Chain of Custody

COC # SGSIf0909WG002 Cooler # 0909-102

NovaGold Project Sampling Event ID: **RARE - AK Tribal Landfills September 2009**

Destination Laboratory: **SGS-Anchorage**

Sample Collection Org.: **Shaw Alaska, Inc.**

Reporting and Invoicing Instructions:
E-mail receiving records, PDF report, and EDF to: jack.james@shawgrp.com
Send Hardcopy Report and invoice to: Shaw Alaska, Inc., Anchorage, AK; attn.Wayne Coppel

Required Analysis

Sample ID	Location ID	Date	Time	Matrix	8270D - SVOC	E1664 - TPH	2320B, SM2540C - Alkalinity, TDS	SM5310 - TOC	E7470A - Total Hg					# bottles	MS/MSD Requested?
0909DIBLNKWG501	DIBLNK	9/3/09	16:00	WG	X	X	X	X	X			3 A.F		6	

Notes:
Limited Volume for:
1 L for 8270D for 0909DIBLNKWG501
~~1.5 L for 8270D for 0909ERNOBPWG401 and 0909ERWHBPWG401~~

Comments:
AK Format Report for RARE Project.
Report Data to PQL.

Relinquished by (Signature)	Date:	Received by (Signature)	Date:
[signature]	9/4/2009		
Printed Name	**Time:**	**Printed Name**	**Time:**
Jack A. James (Shaw)	10:00		
Relinquished by (Signature)	**Date:**	**Received by (Signature)**	**Date:**
		[signature]	9/4/09
Printed Name	**Time:**	**Printed Name**	**Time:**
		JAMES DOUGHTY	1235

#6 Temperature Blank: 4.9 Cooler Temperature: ______

1094697

SGS

SAMPLE RECEIPT FORM

SGS WO#:

Yes	No	NA	
	✓		Are samples **RUSH**, priority or *w/in 72 hrs* of **hold time**?
		✓	If yes, have you done *e-mail ALERT notification*?
	✓		Are samples *within 24 hrs.* of **hold time** or **due date**?
		✓	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:**
		✓	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)

TAT (circle one): Standard -or- Rush

Received Date: 9-4-09

Received Time: 1235

Cooler ID	Temperature	Measured w/ (Therm/IR ID#)
0909-001	5.8 °C	#6
" -002	4.9 °C	#6
	°C	
	°C	

Note: Temperature readings include thermometer correction factors

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	
✓		Is received temperature ≤6°C?
✓		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: 2 FRONT & BACK TOP LID
✓		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?
	NA	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?

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:

Completed by (sign): [signature] **(print):** JAMES DOUGHTY

Login proof: Self-check completed [initials] **Peer-reviewer's Initials** [initials]

SGS

1094697

SAMPLE RECEIPT FORM (page 2)

SGS WO#:

#	Container ID	Matrix	Test	QC	TB	Container Volume: 1 L	500 mL	250 mL or 8oz	125 mL or 4oz	60 mL	40 mL	Other (specify)	Container Type: AG	CG	HDPE	Nalgene	Coli	Septa	Other (specify)	Preservative: None	HCl	HNO_3	H_2SO_4	MeOH	$Na_2S_2O_3$	NaOH	NaOH+ZnAc	Other (specify)	* Notes
1,2	A	1	TOTAL Hg					2							✓							✓							
	B		TOC					2					✓								✓								
	C		TDS ALK			2									✓					✓									
	D,E		TPH			4							✓								✓								
	F,G		SVOC 8270 D			4							✓							✓									
3	A	1	TOTAL Hg ★					1							✓							✓							
	B		TOC					1					✓								✓								
	C		TDS ALK			1									✓					✓									
	D,E		TPH			2							✓								✓								
	F		SVOC 8270D			1							✓							✓									
	G		★Pour off from bottle A for Total Hg					✓							✓							✓							
			9/25/09																										
			Bottle Totals			14		6																					

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

Completed by: ____________ Date: 9-4-09

Form # F004r20 revised 05/05/2009

1094697

SGS Environmental **CUSTODY SEAL**

Signature: ____ Date/Time: 9/4/09 10:00

0909-001

SGS Environmental **CUSTODY SEAL**

Signature: ____ Date/Time: 9/4/09 10:00

SGS Environmental **CUSTODY SEAL**

Signature: ____ Date/Time: 9/4/09 10:00

0909-002

SGS Environmental **CUSTODY SEAL**

Signature: ____ Date/Time: 9/4/09 10:00

RARE - AK Tribal Landfills Project Chain of Custody

1094697

COC # SGSIf0909WG003 Cooler # 0909-104

NovaGold Project Sampling Event ID: RARE - AK Tribal Landfills September 2009

Destination Laboratory: SGS-Anchorage

Sample Collection Org.: Shaw Alaska, Inc.

Reporting and Invoicing Instructions:
E-mail receiving records, PDF report, and EDF to: jack.james@shawgrp.com
Send Hardcopy Report and invoice to: Shaw Alaska, Inc., Anchorage, AK; attn.Wayne Coppel

Required Analysis

	Sample ID	Location ID	Date	Time	Matrix	E7470A - Total Hg									# bottles	MS/MSD Requested?
1 ⓪A	0909EEKPZ01WG001	PZ01	9/11/09	15:29	WG	X									1	
2 ⓪A	0909EEKPZ02WG001	PZ02	9/11/09	15:55	WG	X									1	

Notes:

Comments:
AK Format Report for RARE Project.
Report Data to PQL.
Please add samples to SDG 1094697

Relinquished by (Signature)	Date:	Received by (Signature)	Date:
	9/11/2009		
Printed Name	Time:	Printed Name	Time:
Jack A. James (Shaw)	18:30		
Relinquished by (Signature)	Date:	Received by (Signature)	Date:
			9/14/09
Printed Name	Time:	Printed Name	Time:
		JAMES DOOGHTY	1340

70d Temperature Blank: 0.9

Cooler Temperature: ______

SGS

1094697

SAMPLE RECEIPT FORM

SGS WO#:

Yes	No	NA	
	✓		Are samples **RUSH**, priority or *w/in 72 hrs* of **hold time**?
		✓	If yes, have you done *e-mail ALERT notification*?
	✓		Are samples *within 24 hrs.* of **hold time** or **due date**?
		✓	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:**
		✓	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)

TAT (circle one): Standard -or- Rush

Received Date: 9-14-09

Received Time: 1340

Cooler ID	Temperature	Measured w/ (Therm #)
0909-104	0.9 °C	70d
	°C	
	°C	
	°C	

Note: Temperature readings include thermometer correction factors

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	
✓		Is received temperature ≤6°C?
✓		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: 2 FRONT & BACK TOP LID
✓		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?
	NA	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: LAST ENTRY FOR THIS WO# 9-14 PER CLIENT

Completed by (sign): [signature] **(print):** JAMES DOCCETTY

Login proof: **Self-check completed** [initials] **Peer-reviewer's Initials** JD

SGS

1094697

1094697

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

						Container Volume							Container Type							Preservative								
#	Container ID	Matrix	Test	QC	TB	1L	500mL	250mL or 8oz	125mL or 4oz	60mL	40mL	Other:	AG	CG	HDPE	Nalgene	Coli	Septa	Other:	None	HCl	HNO3	H2SO4	NaOH	Ascorbic Acid	NH_4Cl	Other:	*Notes
4/5 ~~1/2~~	A	1	TOTAL Hg					2							✓							✓						
Bottle Totals								2																				

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

Completed by: [signature] Date: 9-14-09

F042r02 Revised 9/8/2009

1094697

Shaw Custody Seal

Date 9/11 Signed ______

COOLER # 0909-104

Shaw Custody Seal

Date 9/11 Signed ______

SGS

SGS North America Inc.
CHAIN OF CUSTODY RECORD

Locations Nationwide
- Alaska
- New Jersey
- North Carolina
- West Virginia
- Maryland
- New York
- Ohio

www.us.sgs.com

CLIENT: Shaw Env. & Infrastructure Inc.
CONTACT: Steve Crupi — PHONE NO: 249-6312
PROJECT: RARE — SITE/PWSID#:
REPORTS TO: Steve Crupi — EMAIL:
INVOICE TO: — QUOTE #:
P.O. #:

SGS Reference #: 1094697 — page 1 of 1

Preservatives Used: NONE
Analysis Required: UNDIGESTED 200.8LL

LAB NO.	SAMPLE IDENTIFICATION	DATE	TIME	MATRIX/ MATRIX CODE	# CONTAINERS	SAMPLE TYPE C= COMP G= GRAB MI= Multi Incremental Samples	UNDIGESTED 200.8LL								REMARKS/ LOC ID
-6	Blue Jug-Idaho	8/24/09	0800	1	1		X								

Collected/Relinquished By:(1)	Date	Time	Received By:
[signature]	8/24/09	0800	K. Waak 8/24/09 0830
Relinquished By: (2)	Date	Time	Received By:
Relinquished By: (3)	Date	Time	Received By:
Relinquished By: (4)	Date	Time	Received For Laboratory By:

DOD Project? YES NO
Cooler ID ______
Cooler Temp °C ______

Special Deliverable Requirements:

Requested Turnaround Time and-or Special Instructions:

Temperature Blank °C: ______ Therm # ______
or Ambient ☐

Chain of Custody Seal: (Circle)
INTACT BROKEN ABSENT

❑ 200 W. Potter Drive **Anchorage, AK 99518** Tel: (907) 562-2343 Fax: (907) 561-5301
❑ 5500 Business Drive **Wilmington, NC 28405** Tel: (910) 350-1903 Fax: (910) 350-1557

SGS

SGS North America Inc.
CHAIN OF CUSTODY RECORD

Locations Nationwide
- Alaska
- New Jersey
- North Carolina
- West Virginia
- Maryland
- New York
- Ohio

www.us.sgs.com

(1)
CLIENT: Shaw Env. & Infrastructure Inc.
CONTACT: Steve Crupi PHONE NO: 249-6312
PROJECT: RARE SITE/PWSID#:
REPORTS TO: Steve Crupi EMAIL:
INVOICE TO: QUOTE #:
P.O. #:

SGS Reference #: 1094697

page 1 of 1

Preservatives Used: NONE

(3) Analysis Required: UNDIGESTED 200.8LL

(2)

LAB NO.	SAMPLE IDENTIFICATION	DATE	TIME	MATRIX/ MATRIX CODE	# CONTAINERS	SAMPLE TYPE C= COMP G= GRAB MI= Multi Incremental Samples	UNDIGESTED 200.8LL									REMARKS/ LOC ID
-6	Blue Jug-Idaho	8/24/09	0800	1	1		X									

(5)

Collected/Relinquished By:(1)	Date	Time	Received By:
[signature]	8/24/09	0800	K. Wack 8/24/09 0830
Relinquished By: (2)	Date	Time	Received By:
Relinquished By: (3)	Date	Time	Received By:
Relinquished By: (4)	Date	Time	Received For Laboratory By:

(4)
DOD Project? YES NO
Cooler ID ______
Cooler Temp °C ______

Special Deliverable Requirements:

Requested Turnaround Time and-or Special Instructions:

Temperature Blank °C: ______ Therm # ______
or Ambient ☐

Chain of Custody Seal: (Circle)
INTACT BROKEN ABSENT

SGS North America Inc.
Alaska Division
Level II Laboratory Data Report

Project:	RARE-AK Tribal LF-Ekwok
Client:	Shaw Env & Infrastructure Inc.
SGS Work Order:	1103392

Released by:

Contents:

Note:
Unless otherwise noted, all quality assurance/quality control criteria is in compliance with the standards set forth by the proper regulatory authority, the SGS Quality Assurance Program Plan, and the National Environmental Accreditation Conference.

CASE NARRATIVE

Print Date: 7/21/2010

Client Name: Shaw Env & Infrastructure Inc.
Project Name: RARE-AK Tribal LF-Ekwok
Workorder No.: 1103392

Sample Comments

Refer to the sample receipt form for information on sample condition.

Lab Sample ID	Sample Type	Client Sample ID
974761	* MS	070310EX09BNW...(1103312004M:

245.1 - Mercury- MS recovery for mercury was outside of acceptance criteria. Post digestion spike was unsuccessful. Sample result was determined by MSA.

974762	* BND	070310EX09BN...(1103312004BND

245.1 - Mercury- MS recovery for mercury wasoutside of acceptance criteria. Post digestion spike was unsuccessful. Sample result was determined by MSA..

974765	* MS	60054108004(1103261002MS)

7470A - Mercury- MS/MSD recoveries for mercury were outside of acceptance criteria (biased low). Post digestion spike was successful.

974766	* MSD	60054108004(1103261002MSD)

7470A - Mercury- MS/MSD recoveries for mercury were outside of acceptance criteria (biased low). Post digestion spike was successful.

* QC comments may be associated with the field samples found in this report. When applicable, comments will be applied to associated field samples.

SGS

Laboratory Analytical Report

Client: **Shaw Env & Infrastructure Inc.**
2000 W. Int'l Airport, Ste C1
Anchorage, AK 99502

Attn: **Jack James**
T: F:
jack.james@shawgrp.com

Project: **RARE-AK Tribal LF-Ekwok**

Workorder No.: **1103392**

Certification:

This data package is in compliance with the terms and conditions of the contract, both technically and for completeness, unless otherwise noted on the sample data sheet(s) and/or case narrative. This certification applies only to the tested parameters and the specific sample(s) received at the laboratory. If you have any questions regarding this report, or if we can be of further assistance, please contact your SGS Project Manager.

Steve Crupi

steven.crupi@sgs.com
Project Manager

Contents (Bookmarked in PDF):

Print Date: 7/21/2010

Enclosed are the analytical results associated with the above work order. All results are intended to be used in their entirety and SGS is not responsible for use of less than the complete report. If you have any questions regarding this report, or if we can be of any other assistance, please contact your SGS Project Manager at 907-562-2343. All work is provided under SGS general terms and conditions (<http://www.sgs.com/terms_and_conditions.htm>), unless other written agreements have been accepted by both parties.

SGS maintains a formal Quality Assurance/Quality Control (QA/QC) program. A copy of our Quality Assurance Plan (QAP), which outlines this program, is available at your request. The laboratory certification numbers are AK00971 (DW Chemistry & Microbiology) & UST-005 (CS) for ADEC and AK100001 for NELAP (RCRA methods: 1020A, 1311, 3010A, 3050B, 3520C, 3550C, 5030B, 5035B, 6010B, 6020, 7470A, 7471B, 8021B, 8081B, 8082A, 8260B, 8270D, 8270D-SIM, 9040B, 9045C, 9056A, 9060A, AK101 and AK102/103). Except as specifically noted, all statements and data in this report are in conformance to the provisions set forth by the SGS QAP and, when applicable, the National Environmental Laboratory Accreditation Program and other regulatory authorities. The following descriptors or qualifiers may be found in your report:

*	The analyte has exceeded allowable regulatory or control limits.
!	Surrogate out of control limits.
B	Indicates the analyte is found in a blank associated with the sample.
CCV	Continuing Calibration Verification
CL	Control Limit
D	The analyte concentration is the result of a dilution.
DF	Dilution Factor
DL	Detection Limit (i.e., maximum method detection limit)
E	The analyte result is above the calibrated range.
F	Indicates value that is greater than or equal to the DL
GT	Greater Than
ICV	Initial Calibration Verification
J	The quantitation is an estimation.
JL	The analyte was positively identified, but the quantitation is a low estimation.
LCS(D)	Laboratory Control Spike (Duplicate)
LOD	Limit of Detection (i.e., 2xDL)
LOQ	Limit of Quantitation (i.e., reporting or practical quantitation limit)
LT	Less Than
M	A matrix effect was present.
MB	Method Blank
MS(D)	Matrix Spike (Duplicate)
ND	Indicates the analyte is not detected.
Q	QC parameter out of acceptance range.
R	Rejected
RL	Reporting Limit
RPD	Relative Percent Difference
U	Indicates the analyte was analyzed for but not detected.

Note: Sample summaries which include a result for "Total Solids" have already been adjusted for moisture content.
All DRO/RRO analyses are integrated per SOP.

SAMPLE SUMMARY

Print Date: 7/21/2010 9:07 am

Client Name: Shaw Env & Infrastructure Inc.
Project Name: RARE-AK Tribal LF-Ekwok
Workorder No.: 1103392

Analytical Methods

Method Description	Analytical Method
Mercury 7470	SW7470A/E245.1

Sample ID Cross Reference

Lab Sample ID	Client Sample ID
1103392001	070810EKWPZ02WG001

Shaw Env & Infrastructure Inc. Print Date: 7/21/2010 9:07 am

Client Sample ID: **070810EKWPZ02WG001**
SGS Ref. #: 1103392001
Project ID: RARE-AK Tribal LF-Ekwok
Matrix: Water (Surface, Eff., Ground)

Collection Date/Time: 07/08/10 13:18
Receipt Date/Time: 07/12/10 13:46
Location: PZ02

Metals Department

Parameter	Result	LOQ/CL	Units	DF	Analytical Batch	Prep Batch	Qualifiers
Mercury	0.200 U	0.200	ug/L	1	MCV4581	MXX23253	

Batch Information

Analytical Batch: MCV4581
Analytical Method: SW7470A/E245.1
Analysis Date/Time: 07/20/10 13:19
Dilution Factor: 1

Prep Batch: MXX23253
Prep Method: METHOD
Prep Date/Time: 07/19/10 17:10

Initial Prep Wt./Vol.: 25 mL
Prep Extract Vol.: 50 mL
Container ID:1103392001-A
Analyst: KAR

SGS

SGS Ref.#	974759	Method Blank	**Printed Date/Time**		07/21/2010 9:07
Client Name	Shaw Env & Infrastructure Inc.		**Prep**	**Batch**	MXX23253
Project Name/#	RARE-AK Tribal LF-Ekwok			**Method**	METHOD
Matrix	Water (Surface, Eff., Ground)			**Date**	07/19/2010

QC results affect the following production samples:

1103392001

Parameter	Results	LOQ/CL	DL	Units	Analysis Date
Metals Department					
Mercury	0.124 U	0.200	0.0620	ug/L	07/20/10

Batch MCV4581

Method SW7470A/E245.1

Instrument PSA Millennium mercury AA

SGS Ref.#	974760 Lab Control Sample	**Printed Date/Time**	07/21/2010 9:07
		Prep **Batch**	MXX23253
Client Name	Shaw Env & Infrastructure Inc.	**Method**	METHOD
Project Name/#	RARE-AK Tribal LF-Ekwok	**Date**	07/19/2010
Matrix	Water (Surface, Eff., Ground)		

QC results affect the following production samples:

1103392001

Parameter		QC Results	Pct Recov	LCS/LCSD Limits	RPD	RPD Limits	Spiked Amount	Analysis Date
Metals Department								
Mercury	LCS	3.51	88	(85-115)			4 ug/L	07/20/2010

Batch MCV4581
Method SW7470A/E245.1
Instrument PSA Millennium mercury AA

SGS

SGS Ref.#	974761	Matrix Spike
Original	1103312004	
Matrix	Water (Surface, Eff., Ground)	

Printed Date/Time		07/21/2010 9:07
Prep	**Batch**	MXX23253
	Method	Digestion Mercury (W)
	Date	07/19/2010

QC results affect the following production samples:

1103392001

Parameter	Qualifiers	Original Result	QC Result	Pct Recov	MS/MSD Limits	RPD	RPD Limits	Spiked Amount		Analysis Date
Metals Department										
Mercury	MS	(0.200) U	.428	5*	(85-115)			8.00	ug/L	07/20/2010

Batch MCV4581
Method SW7470A/E245.1
Instrument PSA Millennium mercury AA

SGS

SGS Ref.#	974762	Bench Spike DIGESTED	**Printed Date/Time**	07/21/2010 9:07
			Prep **Batch**	MXX23253
			Method	Digestion Mercury (W)
			Date	07/19/2010
Original	1103312004			
Matrix	Water (Surface, Eff., Ground)			

QC results affect the following production samples:

1103392001

Parameter	Qualifiers	Original Result	QC Result	Pct Recov	MS/MSD Limits	RPD	RPD Limits	Spiked Amount		Analysis Date
Metals Department										
Mercury	BND	(0.200) U	11.9	119*	(85-115)			10.0	ug/L	07/20/2010

Batch MCV4581

Method SW7470A/E245.1

Instrument PSA Millennium mercury AA

SGS

SGS Ref.#	974765	Matrix Spike	**Printed Date/Time**		07/21/2010 9:07
	974766	Matrix Spike Duplicate	**Prep**	**Batch**	MXX23253
				Method	Digestion Mercury (W)
				Date	07/19/2010
Original	1103261002				
Matrix	Water (Surface, Eff., Ground)				

QC results affect the following production samples:

1103392001

Parameter	Qualifiers		Original Result	QC Result	Pct Recov	MS/MSD Limits	RPD	RPD Limits	Spiked Amount		Analysis Date
Metals Department											
Mercury		MS	(0.124) U	6.54	82*	(85-115)			8.00	ug/L	07/20/2010
		MSD		6.27	78*		4	(< 15)	8.00	ug/L	07/20/2010

Batch	MCV4581
Method	SW7470A/E245.1
Instrument	PSA Millennium mercury AA

SGS Ref.#	974767	Bench Spike DIGESTED	**Printed Date/Time**	07/21/2010 9:07
			Prep **Batch**	MXX23253
			Method	Digestion Mercury (W)
			Date	07/19/2010
Original	1103261002			
Matrix	Water (Surface, Eff., Ground)			

QC results affect the following production samples:

1103392001

Parameter	Qualifiers	Original Result	QC Result	Pct Recov	MS/MSD Limits	RPD	RPD Limits	Spiked Amount		Analysis Date
Metals Department										
Mercury	BND	(0.124) U	7.25	91	(85-115)			8.00	ug/L	07/20/2010

Batch MCV4581

Method SW7470A/E245.1

Instrument PSA Millennium mercury AA

RARE - AK Tribal Landfills Project Chain of Custody

COC # SGSIf0710WG001 Cooler # 0710-001

Project Sampling Event ID: RARE - AK Tribal Landfills July 2010

Destination Laboratory: SGS-Anchorage

Sample Collection Org.: Shaw Alaska, Inc.

Reporting and Invoicing Instructions:
E-mail receiving records, PDF report, and EDF to: jack.james@shawgrp.com
Send Hardcopy Report and invoice to: Shaw Alaska, Inc., Anchorage, AK; attn.: Jack James

1103392

	Sample ID	Location ID	Date	Time	Matrix	E7470A - Total Hg									# bottles	MS/MSD Requested?
0A	070810EKWPZ02WG001	PZ02	7/8/10	13:18	WG	X									1	

Notes:
Bottle is approzimately half full. Please proceed with analysis.

Relinquished by (Signature)	Date:	Received by (Signature)	Date:
	7/12/2010		
Printed Name	**Time:**	**Printed Name**	**Time:**
Jack A. James (Shaw)	12:00		
Relinquished by (Signature)	**Date:**	**Received by (Signature)**	**Date:**
			July 12, 2010
Printed Name	**Time:**	**Printed Name**	**Time:**
		Annie Jan	13:46

Comments:
AK Format Report for RARE Project.
Report Data to PQL.
PO#: Contact Jack James prior to invoicing.

Temperature Blank: 0.3°C #202 Cooler Temperature: ______

SGS

1103392

SAMPLE RECEIPT FORM

Review Criteria:	Condition:	Comments/Action Taken:
Were **custody seals** intact? Note # & location if applicable. COC accompanied samples?	Yes No N/A Yes No N/A	1 Front & Back
Temperature blank compliant (i.e., 0-6°C after correction factor)? Cooler ID: 0710-001 @ 0.3°C w/ Therm.ID: 202 Cooler ID: ______ @ ______ w/ Therm.ID: ______ Cooler ID: ______ @ ______ w/ Therm.ID: ______ Cooler ID: ______ @ ______ w/ Therm.ID: ______ Cooler ID: ______ @ ______ w/ Therm.ID: ______ ***Note: If non-compliant, use form FS-0029 to document affected samples/analyses.*** If samples are received without a temperature blank, the "cooler temperature" will be documented in lieu of the temperature blank & "**COOLER TEMP**" will be noted to the right. In cases where neither a temp blank nor cooler temp can be obtained, note "ambient" or "chilled." If temperature(s) <0°C, were all containers ice free?	Yes No N/A Yes No N/A	
Delivery method (specify all that apply): Client USPS Alert Courier Road Runner AK Air Lynden Carlile ERA FedEx UPS NAC PenAir Other:	Note airbill/tracking # See Attached or N/A	

* For samples received with payment, note amount ($) and cash / check / CC (circle one). N/A

* For samples received in FBKS, ANCH staff will verify all criteria are reviewed. SRF Initiated by: N/A

Review Criteria:	Condition:	Comments/Action Taken:
Do samples **match COC** (i.e., sample IDs, dates/times collected)? Are analyses requested unambiguous?	Yes No N/A Yes No N/A	
Were samples in **good condition** (no leaks/cracks/breakage)? Packing material used (specify all that apply): Bubble wrap Separate plastic bags Vermiculite Other: Paper Boxes	Yes No N/A	
Were all VOA vials **free of headspace** (i.e., bubbles ≤6 mm)? Were all soil VOAs **field extracted** with MeOH+BFB?	Yes No N/A Yes No N/A	
Were **proper containers** (type/mass/volume/preservative) used? Were the bottles provided by SGS? (Note apparent exceptions.) Were **Trip Blanks** (VOAs, LL-Hg) in cooler with samples?	Yes No N/A Yes No N/A Yes No N/A	
For preserved waters (other than VOA vials, LL-Mercury or microbiological analyses), was **pH verified and compliant**? If pH was adjusted, were bottles flagged (i.e., stickers)? ***Refer to attached bottle sheet (form F066) for documentation.***	Yes No N/A Yes No N/A	
For **RUSH** or **SHORT HOLD TIME** samples, were the COC & this SRF flagged, bottles flagged (e.g., stickers) and lab notified?	Yes No N/A	
For client requested, **site-specific QC** (e.g., MS/MSD/DUP), were bottles flagged (e.g., stickers) and numbered accordingly?	Yes No N/A	
For **special handling** (e.g., "MI" or foreign soils, lab filter, limited volume, Ref Lab), were bottles/paperwork flagged (e.g., sticker)?	Yes No N/A	
Was **PEER REVIEW** of sample numbering completed (i.e., compare WO# on containers to COC, container ID on containers to COC, each container had a unique container ID)? Was the WO# recorded in Front Counter/Sample Receiving log?	Yes No N/A Yes No N/A	SRF Completed by: [illegible] Bottle Sheet by: [illegible] Peer Reviewed by [illegible]
For any questions answered "NO," was the PM notified?	Yes No N/A	PM = N/A

Additional notes (if applicable):

WO# (7 digits)	Sample # - Sample #		Container ID - Container ID		Matrix	QC	Preservative (CHECKED)	TEST GROUP	Notes: **ANOMALIES -** *e.g., preservative added* **or SPECIAL HANDLING -** *e.g., Multi-Incremental (MI), Field Filter (FF), Lab Filter (LF), use "same jar as" (SJA) for QC, 2xMeOH, bubbles, etc.*
SAMPLE ID					TYPE		CONTAINERS	ANALYSIS	Type comments below:
1103392	001	001	A	A	1 Water		HNO3 (pH <2)	W_Metals_Total/Diss.	

PRINT LABELS

1103392

F066_SRF-BottleTracking(electronic)_rev03-05212010

SGS

SGS North America Inc.
Alaska Division
Level II Laboratory Data Report

Project:	RARE-AK Ft. Yukon Tribal LF
Client:	Shaw Env & Infrastructure Inc.
SGS Work Order:	1103076

Released by:

Contents:

Note:
Unless otherwise noted, all quality assurance/quality control criteria is in compliance with the standards set forth by the proper regulatory authority, the SGS Quality Assurance Program Plan, and the National Environmental Accreditation Conference.

SGS

CASE NARRATIVE

Print Date: 7/12/2010

Client Name: Shaw Env & Infrastructure Inc.
Project Name: RARE-AK Ft. Yukon Tribal LF
Workorder No.: 1103076

Sample Comments

Refer to the sample receipt form for information on sample condition.

Lab Sample ID	Sample Type	Client Sample ID
970377	* LCS	LCS for HBN 470580 [XXX/22939]
	8270D - LCS recoveries for multiple analytes do not meet QC criteria (biased high). These analytes were not detected above the LOQ in the associated samples.	
970378	* LCSD	LCSD for HBN 470580 [XXX/22939
	8270D - LCS/LCSD RPDs for multiple analytes do not meet QC criteria. These analytes were not detected above the LOQ in the associated samples.	
970856	* MB	MB for HBN 478180 [WTC/1995]
	5310B - TOC was detected in the MB greater than half of the LOQ however less than the LOQ.	
971520	* CCV	CCV for HBN 489680 (XMS/5500)
	8270D - CCV recovery for 4-nitrophenol does not meet QC criteria (biased high). This analyte was not detected above the LOQ in the associated samples.	

* QC comments may be associated with the field samples found in this report. When applicable, comments will be applied to associated field samples.

Laboratory Analytical Report

Client: **Shaw Env & Infrastructure Inc.**
2000 W. Int'l Airport, Ste C1
Anchorage, AK 99502

Attn: **Jack James**
T: F:
jack.james@shawgrp.com

Project: **RARE-AK Ft. Yukon Tribal LF**

Workorder No.: **1103076**

Certification:

This data package is in compliance with the terms and conditions of the contract, both technically and for completeness, unless otherwise noted on the sample data sheet(s) and/or case narrative. This certification applies only to the tested parameters and the specific sample(s) received at the laboratory. If you have any questions regarding this report, or if we can be of further assistance, please contact your SGS Project Manager.

Steve Crupi

steven.crupi@sgs.com
Project Manager

Contents (Bookmarked in PDF):

Enclosed are the analytical results associated with the above work order. All results are intended to be used in their entirety and SGS is not responsible for use of less than the complete report. If you have any questions regarding this report, or if we can be of any other assistance, please contact your SGS Project Manager at 907-562-2343. All work is provided under SGS general terms and conditions (<http://www.sgs.com/terms_and_conditions.htm>), unless other written agreements have been accepted by both parties.

SGS maintains a formal Quality Assurance/Quality Control (QA/QC) program. A copy of our Quality Assurance Plan (QAP), which outlines this program, is available at your request. The laboratory certification numbers are AK00971 (DW Chemistry & Microbiology) & UST-005 (CS) for ADEC and AK100001 for NELAP (RCRA methods: 1020A, 1311, 3010A, 3050B, 3520C, 3550C, 5030B, 5035B, 6010B, 6020, 7470A, 7471B, 8021B, 8081B, 8082A, 8260B, 8270D, 8270D-SIM, 9040B, 9045C, 9056A, 9060A, AK101 and AK102/103). Except as specifically noted, all statements and data in this report are in conformance to the provisions set forth by the SGS QAP and, when applicable, the National Environmental Laboratory Accreditation Program and other regulatory authorities. The following descriptors or qualifiers may be found in your report:

*	The analyte has exceeded allowable regulatory or control limits.
!	Surrogate out of control limits.
B	Indicates the analyte is found in a blank associated with the sample.
CCV	Continuing Calibration Verification
CL	Control Limit
D	The analyte concentration is the result of a dilution.
DF	Dilution Factor
DL	Detection Limit (i.e., maximum method detection limit)
E	The analyte result is above the calibrated range.
F	Indicates value that is greater than or equal to the DL
GT	Greater Than
ICV	Initial Calibration Verification
J	The quantitation is an estimation.
JL	The analyte was positively identified, but the quantitation is a low estimation.
LCS(D)	Laboratory Control Spike (Duplicate)
LOD	Limit of Detection (i.e., 2xDL)
LOQ	Limit of Quantitation (i.e., reporting or practical quantitation limit)
LT	Less Than
M	A matrix effect was present.
MB	Method Blank
MS(D)	Matrix Spike (Duplicate)
ND	Indicates the analyte is not detected.
Q	QC parameter out of acceptance range.
R	Rejected
RL	Reporting Limit
RPD	Relative Percent Difference
U	Indicates the analyte was analyzed for but not detected.

Note: Sample summaries which include a result for "Total Solids" have already been adjusted for moisture content.
All DRO/RRO analyses are integrated per SOP.

SAMPLE SUMMARY

Print Date: 7/12/2010 3:23 pm

Client Name: Shaw Env & Infrastructure Inc.
Project Name: RARE-AK Ft. Yukon Tribal LF
Workorder No.: 1103076

Analytical Methods

Method Description	Analytical Method
Alkalinity as CaCO3 QC	SM20 2320B
Mercury 7470	SW7470A/E245.1
SW846-8270 SVOC by GC/MS (W) Liq/Liq ext	SW8270D
Total Dissolved Solids SM18 2540C	SM20 2540C
Total Organic Carbon	SM 5310B
TPH by EPA 1664	EPA 1664A

Sample ID Cross Reference

Lab Sample ID	Client Sample ID
1103076001	062310FYUPZ04WG001
1103076002	062310FYUSP01WS001

Detectable Results Summary

Print Date: 7/12/2010 3:23 pm

Client Sample ID: **062310FYUPZ04WG001**

SGS Ref. #: 1103076001

Waters Department

Parameter	Result	Units
Alkalinity	399	mg/L
Total Dissolved Solids	676	mg/L
Total Organic Carbon	59.4	mg/L

Client Sample ID: **062310FYUSP01WS001**

SGS Ref. #: 1103076002

Waters Department

Parameter	Result	Units
Alkalinity	318	mg/L
Total Dissolved Solids	2330	mg/L
Total Organic Carbon	22.2	mg/L

Shaw Env & Infrastructure Inc. Print Date: 7/12/2010 3:23 pm

Client Sample ID: **062310FYUPZ04WG001**
SGS Ref. #: 1103076001
Project ID: RARE-AK Ft. Yukon Tribal LF
Matrix: Water (Surface, Eff., Ground)

Collection Date/Time: 06/23/10 15:00
Receipt Date/Time: 06/25/10 15:30
Location: PZ04

Metals Department

Parameter	Result	LOQ/CL	Units	DF	Analytical Batch	Prep Batch	Qualifiers
Mercury	0.200 U	0.200	ug/L	1	MCV4567	MXX23182	

Batch Information

Analytical Batch: MCV4567
Analytical Method: SW7470A/E245.1
Analysis Date/Time: 07/07/10 15:35
Dilution Factor: 1

Prep Batch: MXX23182
Prep Method: METHOD
Prep Date/Time: 07/06/10 11:30

Initial Prep Wt./Vol.: 25 mL
Prep Extract Vol.: 50 mL
Container ID:1103076001-A
Analyst: RTS

Shaw Env & Infrastructure Inc. Print Date: 7/12/2010 3:23 pm

Client Sample ID: **062310FYUPZ04WG001**
SGS Ref. #: 1103076001
Project ID: RARE-AK Ft. Yukon Tribal LF
Matrix: Water (Surface, Eff., Ground)

Collection Date/Time: 06/23/10 15:00
Receipt Date/Time: 06/25/10 15:30
Location: PZ04

Waters Department

Parameter	Result	LOQ/CL	Units	DF	Analytical Batch	Prep Batch	Qualifiers
Alkalinity	399	10.0	mg/L	1	WTI3351		
Total Dissolved Solids	676	10.0	mg/L	1	WAT8246		
Total Organic Carbon	59.4	0.500	mg/L	1	WTC1995		
TPH Silica Gel HEM	32.0 U	32.0	mg/L	1	TPH2194	TPHX2011	

Batch Information

Analytical Batch: TPH2194
Analytical Method: EPA 1664A
Analysis Date/Time: 07/01/10 12:30
Dilution Factor: 1

Prep Batch: TPHX2011
Prep Method: EXT_1664TP
Prep Date/Time: 07/01/10 12:30

Initial Prep Wt./Vol.: 125 mL
Prep Extract Vol.: 50 mL
Container ID:1103076001-C
Analyst: RTS

Analytical Batch: WAT8246
Analytical Method: SM20 2540C
Analysis Date/Time: 06/29/10 12:00
Dilution Factor: 1

Initial Prep Wt./Vol.: 50 mL
Container ID:1103076001-E
Analyst: JJR

Analytical Batch: WTC1995
Analytical Method: SM 5310B
Analysis Date/Time: 07/01/10 11:28
Dilution Factor: 1

Initial Prep Wt./Vol.: 30 mL
Container ID:1103076001-B
Analyst: SHA

Analytical Batch: WTI3351
Analytical Method: SM20 2320B
Analysis Date/Time: 06/25/10 19:19
Dilution Factor: 1

Initial Prep Wt./Vol.: 50 mL
Container ID:1103076001-D
Analyst: LP

Shaw Env & Infrastructure Inc. Print Date: 7/12/2010 3:23 pm

Client Sample ID: **062310FYUPZ04WG001**
SGS Ref. #: 1103076001
Project ID: RARE-AK Ft. Yukon Tribal LF
Matrix: Water (Surface, Eff., Ground)

Collection Date/Time: 06/23/10 15:00
Receipt Date/Time: 06/25/10 15:30
Location: PZ04

Semivolatile Organic GC/MS

Parameter	Result	LOQ/CL	Units	DF	Analytical Batch	Prep Batch	Qualifiers
1,2,4-Trichlorobenzene	0.0769 U	0.0769	mg/L	1	XMS5496	XXX22939	
1,2-Dichlorobenzene	0.0769 U	0.0769	mg/L	1	XMS5496	XXX22939	
1,3-Dichlorobenzene	0.0769 U	0.0769	mg/L	1	XMS5496	XXX22939	
1,4-Dichlorobenzene	0.0769 U	0.0769	mg/L	1	XMS5496	XXX22939	
2,4,5-Trichlorophenol	0.0769 U	0.0769	mg/L	1	XMS5496	XXX22939	
2,4,6-Trichlorophenol	0.0769 U	0.0769	mg/L	1	XMS5496	XXX22939	
2,4-Dichlorophenol	0.0769 U	0.0769	mg/L	1	XMS5496	XXX22939	
2,4-Dimethylphenol	0.0769 U	0.0769	mg/L	1	XMS5496	XXX22939	
2,4-Dinitrophenol	0.385 U	0.385	mg/L	1	XMS5496	XXX22939	
2,4-Dinitrotoluene	0.0769 U	0.0769	mg/L	1	XMS5496	XXX22939	
2,6-Dinitrotoluene	0.0769 U	0.0769	mg/L	1	XMS5496	XXX22939	
2-Chloronaphthalene	0.0769 U	0.0769	mg/L	1	XMS5496	XXX22939	
2-Chlorophenol	0.0769 U	0.0769	mg/L	1	XMS5496	XXX22939	
2-Methyl-4,6-dinitrophenol	0.385 U	0.385	mg/L	1	XMS5496	XXX22939	
2-Methylnaphthalene	0.0769 U	0.0769	mg/L	1	XMS5496	XXX22939	
2-Methylphenol (o-Cresol)	0.0769 U	0.0769	mg/L	1	XMS5496	XXX22939	
2-Nitroaniline	0.0769 U	0.0769	mg/L	1	XMS5496	XXX22939	
2-Nitrophenol	0.0769 U	0.0769	mg/L	1	XMS5496	XXX22939	
3&4-Methylphenol (p&m-Cresol)	0.154 U	0.154	mg/L	1	XMS5496	XXX22939	
3,3-Dichlorobenzidine	0.0769 U	0.0769	mg/L	1	XMS5496	XXX22939	
3-Nitroaniline	0.0769 U	0.0769	mg/L	1	XMS5496	XXX22939	
4-Bromophenyl-phenylether	0.0769 U	0.0769	mg/L	1	XMS5496	XXX22939	
4-Chloro-3-methylphenol	0.0769 U	0.0769	mg/L	1	XMS5496	XXX22939	
4-Chloroaniline	0.0769 U	0.0769	mg/L	1	XMS5496	XXX22939	
4-Chlorophenyl-phenylether	0.0769 U	0.0769	mg/L	1	XMS5496	XXX22939	
4-Nitroaniline	0.0769 U	0.0769	mg/L	1	XMS5496	XXX22939	
4-Nitrophenol	0.385 U	0.385	mg/L	1	XMS5496	XXX22939	
Acenaphthene	0.0769 U	0.0769	mg/L	1	XMS5496	XXX22939	
Acenaphthylene	0.0769 U	0.0769	mg/L	1	XMS5496	XXX22939	
Aniline	0.385 U	0.385	mg/L	1	XMS5496	XXX22939	
Anthracene	0.0769 U	0.0769	mg/L	1	XMS5496	XXX22939	
Azobenzene	0.0769 U	0.0769	mg/L	1	XMS5496	XXX22939	
Benzo(a)Anthracene	0.0769 U	0.0769	mg/L	1	XMS5496	XXX22939	
Benzo[a]pyrene	0.0769 U	0.0769	mg/L	1	XMS5496	XXX22939	
Benzo[b]Fluoranthene	0.0769 U	0.0769	mg/L	1	XMS5496	XXX22939	
Benzo[g,h,i]perylene	0.0769 U	0.0769	mg/L	1	XMS5496	XXX22939	

SGS

Shaw Env & Infrastructure Inc. Print Date: 7/12/2010 3:23 pm

Client Sample ID: **062310FYUPZ04WG001**
SGS Ref. #: 1103076001
Project ID: RARE-AK Ft. Yukon Tribal LF
Matrix: Water (Surface, Eff., Ground)

Collection Date/Time: 06/23/10 15:00
Receipt Date/Time: 06/25/10 15:30
Location: PZ04

Semivolatile Organic GC/MS

Parameter	Result	LOQ/CL	Units	DF	Analytical Batch	Prep Batch	Qualifiers
Benzo[k]fluoranthene	0.0769 U	0.0769	mg/L	1	XMS5496	XXX22939	
Benzoic acid	0.385 U	0.385	mg/L	1	XMS5496	XXX22939	
Benzyl alcohol	0.0769 U	0.0769	mg/L	1	XMS5496	XXX22939	
Bis(2chloro1methylethyl)Ether	0.0769 U	0.0769	mg/L	1	XMS5496	XXX22939	
Bis(2-Chloroethoxy)methane	0.0769 U	0.0769	mg/L	1	XMS5496	XXX22939	
Bis(2-Chloroethyl)ether	0.0769 U	0.0769	mg/L	1	XMS5496	XXX22939	
bis(2-Ethylhexyl)phthalate	0.0769 U	0.0769	mg/L	1	XMS5496	XXX22939	
Butylbenzylphthalate	0.0769 U	0.0769	mg/L	1	XMS5496	XXX22939	
Chrysene	0.0769 U	0.0769	mg/L	1	XMS5496	XXX22939	
Dibenzo[a,h]anthracene	0.0769 U	0.0769	mg/L	1	XMS5496	XXX22939	
Dibenzofuran	0.0769 U	0.0769	mg/L	1	XMS5496	XXX22939	
Diethylphthalate	0.0769 U	0.0769	mg/L	1	XMS5496	XXX22939	
Dimethylphthalate	0.0769 U	0.0769	mg/L	1	XMS5496	XXX22939	
Di-n-butylphthalate	0.0769 U	0.0769	mg/L	1	XMS5496	XXX22939	
di-n-Octylphthalate	0.0769 U	0.0769	mg/L	1	XMS5496	XXX22939	
Fluoranthene	0.0769 U	0.0769	mg/L	1	XMS5496	XXX22939	
Fluorene	0.0769 U	0.0769	mg/L	1	XMS5496	XXX22939	
Hexachlorobenzene	0.0769 U	0.0769	mg/L	1	XMS5496	XXX22939	
Hexachlorobutadiene	0.0769 U	0.0769	mg/L	1	XMS5496	XXX22939	
Hexachlorocyclopentadiene	0.231 U	0.231	mg/L	1	XMS5496	XXX22939	
Hexachloroethane	0.0769 U	0.0769	mg/L	1	XMS5496	XXX22939	
Indeno[1,2,3-c,d] pyrene	0.0769 U	0.0769	mg/L	1	XMS5496	XXX22939	
Isophorone	0.0769 U	0.0769	mg/L	1	XMS5496	XXX22939	
Naphthalene	0.0769 U	0.0769	mg/L	1	XMS5496	XXX22939	
Nitrobenzene	0.0769 U	0.0769	mg/L	1	XMS5496	XXX22939	
N-Nitrosodimethylamine	0.0769 U	0.0769	mg/L	1	XMS5496	XXX22939	
N-Nitroso-di-n-propylamine	0.0769 U	0.0769	mg/L	1	XMS5496	XXX22939	
N-Nitrosodiphenylamine	0.0769 U	0.0769	mg/L	1	XMS5496	XXX22939	
Pentachlorophenol	0.385 U	0.385	mg/L	1	XMS5496	XXX22939	
Phenanthrene	0.0769 U	0.0769	mg/L	1	XMS5496	XXX22939	
Phenol	0.0769 U	0.0769	mg/L	1	XMS5496	XXX22939	
Pyrene	0.0769 U	0.0769	mg/L	1	XMS5496	XXX22939	
2,4,6-Tribromophenol <surr>	81.1	45-124	%	1	XMS5496	XXX22939	
2-Fluorobiphenyl <surr>	68.3	50-110	%	1	XMS5496	XXX22939	
2-Fluorophenol <surr>	58.7	21-88	%	1	XMS5496	XXX22939	
Nitrobenzene-d5 <surr>	55.3	41-110	%	1	XMS5496	XXX22939	
Phenol-d6 <surr>	58.9	28-97	%	1	XMS5496	XXX22939	

Client Sample ID: **062310FYUPZ04WG001**
SGS Ref. #: 1103076001
Project ID: RARE-AK Ft. Yukon Tribal LF
Matrix: Water (Surface, Eff., Ground)

Collection Date/Time: 06/23/10 15:00
Receipt Date/Time: 06/25/10 15:30
Location: PZ04

Semivolatile Organic GC/MS

Parameter	Result	LOQ/CL	Units	DF	Analytical Batch	Prep Batch	Qualifiers
Terphenyl-d14 <surr>	96.1	52-135	%	1	XMS5496	XXX22939	

Batch Information

Analytical Batch: XMS5496
Analytical Method: SW8270D
Analysis Date/Time: 07/02/10 00:54
Dilution Factor: 1

Prep Batch: XXX22939
Prep Method: SW3520C
Prep Date/Time: 06/30/10 11:30

Initial Prep Wt./Vol.: 130 mL
Prep Extract Vol.: 1 mL
Container ID:1103076001-F
Analyst: JDH

Client Sample ID: **062310FYUSP01WS001**
SGS Ref. #: 1103076002
Project ID: RARE-AK Ft. Yukon Tribal LF
Matrix: Water (Surface, Eff., Ground)

Collection Date/Time: 06/23/10 12:45
Receipt Date/Time: 06/25/10 15:30
Location: SP01

Metals Department

Parameter	Result	LOQ/CL	Units	DF	Analytical Batch	Prep Batch	Qualifiers
Mercury	0.200 U	0.200	ug/L	1	MCV4567	MXX23182	

Batch Information

Analytical Batch: MCV4567
Analytical Method: SW7470A/E245.1
Analysis Date/Time: 07/07/10 15:38
Dilution Factor: 1

Prep Batch: MXX23182
Prep Method: METHOD
Prep Date/Time: 07/06/10 11:30

Initial Prep Wt./Vol.: 25 mL
Prep Extract Vol.: 50 mL
Container ID:1103076002-A
Analyst: RTS

Shaw Env & Infrastructure Inc. Print Date: 7/12/2010 3:23 pm

Client Sample ID: **062310FYUSP01WS001**
SGS Ref. #: 1103076002
Project ID: RARE-AK Ft. Yukon Tribal LF
Matrix: Water (Surface, Eff., Ground)

Collection Date/Time: 06/23/10 12:45
Receipt Date/Time: 06/25/10 15:30
Location: SP01

Waters Department

Parameter	Result	LOQ/CL	Units	DF	Analytical Batch	Prep Batch	Qualifiers
Alkalinity	318	10.0	mg/L	1	WTI3351		
Total Dissolved Solids	2330	10.0	mg/L	1	WAT8246		
Total Organic Carbon	22.2	0.500	mg/L	1	WTC1995		
TPH Silica Gel HEM	32.0 U	32.0	mg/L	1	TPH2194	TPHX2011	

Batch Information

Analytical Batch: TPH2194
Analytical Method: EPA 1664A
Analysis Date/Time: 07/01/10 12:30
Dilution Factor: 1

Prep Batch: TPHX2011
Prep Method: EXT_1664TP
Prep Date/Time: 07/01/10 12:30

Initial Prep Wt./Vol.: 125 mL
Prep Extract Vol.: 50 mL
Container ID:1103076002-C
Analyst: RTS

Analytical Batch: WAT8246
Analytical Method: SM20 2540C
Analysis Date/Time: 06/29/10 12:00
Dilution Factor: 1

Initial Prep Wt./Vol.: 100 mL
Container ID:1103076002-E
Analyst: JJR

Analytical Batch: WTC1995
Analytical Method: SM 5310B
Analysis Date/Time: 07/01/10 11:42
Dilution Factor: 1

Initial Prep Wt./Vol.: 30 mL
Container ID:1103076002-B
Analyst: SHA

Analytical Batch: WTI3351
Analytical Method: SM20 2320B
Analysis Date/Time: 06/25/10 19:31
Dilution Factor: 1

Initial Prep Wt./Vol.: 50 mL
Container ID:1103076002-D
Analyst: LP

SGS

Shaw Env & Infrastructure Inc. Print Date: 7/12/2010 3:23 pm

Client Sample ID: **062310FYUSP01WS001**
SGS Ref. #: 1103076002
Project ID: RARE-AK Ft. Yukon Tribal LF
Matrix: Water (Surface, Eff., Ground)

Collection Date/Time: 06/23/10 12:45
Receipt Date/Time: 06/25/10 15:30
Location: SP01

Semivolatile Organic GC/MS

Parameter	Result	LOQ/CL	Units	DF	Analytical Batch	Prep Batch	Qualifiers
1,2,4-Trichlorobenzene	0.0800 U	0.0800	mg/L	1	XMS5496	XXX22939	
1,2-Dichlorobenzene	0.0800 U	0.0800	mg/L	1	XMS5496	XXX22939	
1,3-Dichlorobenzene	0.0800 U	0.0800	mg/L	1	XMS5496	XXX22939	
1,4-Dichlorobenzene	0.0800 U	0.0800	mg/L	1	XMS5496	XXX22939	
2,4,5-Trichlorophenol	0.0800 U	0.0800	mg/L	1	XMS5496	XXX22939	
2,4,6-Trichlorophenol	0.0800 U	0.0800	mg/L	1	XMS5496	XXX22939	
2,4-Dichlorophenol	0.0800 U	0.0800	mg/L	1	XMS5496	XXX22939	
2,4-Dimethylphenol	0.0800 U	0.0800	mg/L	1	XMS5496	XXX22939	
2,4-Dinitrophenol	0.400 U	0.400	mg/L	1	XMS5496	XXX22939	
2,4-Dinitrotoluene	0.0800 U	0.0800	mg/L	1	XMS5496	XXX22939	
2,6-Dinitrotoluene	0.0800 U	0.0800	mg/L	1	XMS5496	XXX22939	
2-Chloronaphthalene	0.0800 U	0.0800	mg/L	1	XMS5496	XXX22939	
2-Chlorophenol	0.0800 U	0.0800	mg/L	1	XMS5496	XXX22939	
2-Methyl-4,6-dinitrophenol	0.400 U	0.400	mg/L	1	XMS5496	XXX22939	
2-Methylnaphthalene	0.0800 U	0.0800	mg/L	1	XMS5496	XXX22939	
2-Methylphenol (o-Cresol)	0.0800 U	0.0800	mg/L	1	XMS5496	XXX22939	
2-Nitroaniline	0.0800 U	0.0800	mg/L	1	XMS5496	XXX22939	
2-Nitrophenol	0.0800 U	0.0800	mg/L	1	XMS5496	XXX22939	
3&4-Methylphenol (p&m-Cresol)	0.160 U	0.160	mg/L	1	XMS5496	XXX22939	
3,3-Dichlorobenzidine	0.0800 U	0.0800	mg/L	1	XMS5496	XXX22939	
3-Nitroaniline	0.0800 U	0.0800	mg/L	1	XMS5496	XXX22939	
4-Bromophenyl-phenylether	0.0800 U	0.0800	mg/L	1	XMS5496	XXX22939	
4-Chloro-3-methylphenol	0.0800 U	0.0800	mg/L	1	XMS5496	XXX22939	
4-Chloroaniline	0.0800 U	0.0800	mg/L	1	XMS5496	XXX22939	
4-Chlorophenyl-phenylether	0.0800 U	0.0800	mg/L	1	XMS5496	XXX22939	
4-Nitroaniline	0.0800 U	0.0800	mg/L	1	XMS5496	XXX22939	
4-Nitrophenol	0.400 U	0.400	mg/L	1	XMS5496	XXX22939	
Acenaphthene	0.0800 U	0.0800	mg/L	1	XMS5496	XXX22939	
Acenaphthylene	0.0800 U	0.0800	mg/L	1	XMS5496	XXX22939	
Aniline	0.400 U	0.400	mg/L	1	XMS5496	XXX22939	
Anthracene	0.0800 U	0.0800	mg/L	1	XMS5496	XXX22939	
Azobenzene	0.0800 U	0.0800	mg/L	1	XMS5496	XXX22939	
Benzo(a)Anthracene	0.0800 U	0.0800	mg/L	1	XMS5496	XXX22939	
Benzo[a]pyrene	0.0800 U	0.0800	mg/L	1	XMS5496	XXX22939	
Benzo[b]Fluoranthene	0.0800 U	0.0800	mg/L	1	XMS5496	XXX22939	
Benzo[g,h,i]perylene	0.0800 U	0.0800	mg/L	1	XMS5496	XXX22939	

Shaw Env & Infrastructure Inc. Print Date: 7/12/2010 3:23 pm

Client Sample ID: **062310FYUSP01WS001**
SGS Ref. #: 1103076002
Project ID: RARE-AK Ft. Yukon Tribal LF
Matrix: Water (Surface, Eff., Ground)

Collection Date/Time: 06/23/10 12:45
Receipt Date/Time: 06/25/10 15:30
Location: SP01

Semivolatile Organic GC/MS

Parameter	Result	LOQ/CL	Units	DF	Analytical Batch	Prep Batch	Qualifiers
Benzo[k]fluoranthene	0.0800 U	0.0800	mg/L	1	XMS5496	XXX22939	
Benzoic acid	0.400 U	0.400	mg/L	1	XMS5496	XXX22939	
Benzyl alcohol	0.0800 U	0.0800	mg/L	1	XMS5496	XXX22939	
Bis(2chloro1methylethyl)Ether	0.0800 U	0.0800	mg/L	1	XMS5496	XXX22939	
Bis(2-Chloroethoxy)methane	0.0800 U	0.0800	mg/L	1	XMS5496	XXX22939	
Bis(2-Chloroethyl)ether	0.0800 U	0.0800	mg/L	1	XMS5496	XXX22939	
bis(2-Ethylhexyl)phthalate	0.0800 U	0.0800	mg/L	1	XMS5496	XXX22939	
Butylbenzylphthalate	0.0800 U	0.0800	mg/L	1	XMS5496	XXX22939	
Chrysene	0.0800 U	0.0800	mg/L	1	XMS5496	XXX22939	
Dibenzo[a,h]anthracene	0.0800 U	0.0800	mg/L	1	XMS5496	XXX22939	
Dibenzofuran	0.0800 U	0.0800	mg/L	1	XMS5496	XXX22939	
Diethylphthalate	0.0800 U	0.0800	mg/L	1	XMS5496	XXX22939	
Dimethylphthalate	0.0800 U	0.0800	mg/L	1	XMS5496	XXX22939	
Di-n-butylphthalate	0.0800 U	0.0800	mg/L	1	XMS5496	XXX22939	
di-n-Octylphthalate	0.0800 U	0.0800	mg/L	1	XMS5496	XXX22939	
Fluoranthene	0.0800 U	0.0800	mg/L	1	XMS5496	XXX22939	
Fluorene	0.0800 U	0.0800	mg/L	1	XMS5496	XXX22939	
Hexachlorobenzene	0.0800 U	0.0800	mg/L	1	XMS5496	XXX22939	
Hexachlorobutadiene	0.0800 U	0.0800	mg/L	1	XMS5496	XXX22939	
Hexachlorocyclopentadiene	0.240 U	0.240	mg/L	1	XMS5496	XXX22939	
Hexachloroethane	0.0800 U	0.0800	mg/L	1	XMS5496	XXX22939	
Indeno[1,2,3-c,d] pyrene	0.0800 U	0.0800	mg/L	1	XMS5496	XXX22939	
Isophorone	0.0800 U	0.0800	mg/L	1	XMS5496	XXX22939	
Naphthalene	0.0800 U	0.0800	mg/L	1	XMS5496	XXX22939	
Nitrobenzene	0.0800 U	0.0800	mg/L	1	XMS5496	XXX22939	
N-Nitrosodimethylamine	0.0800 U	0.0800	mg/L	1	XMS5496	XXX22939	
N-Nitroso-di-n-propylamine	0.0800 U	0.0800	mg/L	1	XMS5496	XXX22939	
N-Nitrosodiphenylamine	0.0800 U	0.0800	mg/L	1	XMS5496	XXX22939	
Pentachlorophenol	0.400 U	0.400	mg/L	1	XMS5496	XXX22939	
Phenanthrene	0.0800 U	0.0800	mg/L	1	XMS5496	XXX22939	
Phenol	0.0800 U	0.0800	mg/L	1	XMS5496	XXX22939	
Pyrene	0.0800 U	0.0800	mg/L	1	XMS5496	XXX22939	
2,4,6-Tribromophenol <surr>	98.9	45-124	%	1	XMS5496	XXX22939	
2-Fluorobiphenyl <surr>	88.4	50-110	%	1	XMS5496	XXX22939	
2-Fluorophenol <surr>	73.1	21-88	%	1	XMS5496	XXX22939	
Nitrobenzene-d5 <surr>	76.1	41-110	%	1	XMS5496	XXX22939	
Phenol-d6 <surr>	73.8	28-97	%	1	XMS5496	XXX22939	

Shaw Env & Infrastructure Inc. Print Date: 7/12/2010 3:23 pm

Client Sample ID: **062310FYUSP01WS001**
SGS Ref. #: 1103076002
Project ID: RARE-AK Ft. Yukon Tribal LF
Matrix: Water (Surface, Eff., Ground)

Collection Date/Time: 06/23/10 12:45
Receipt Date/Time: 06/25/10 15:30
Location: SP01

Semivolatile Organic GC/MS

Parameter	Result	LOQ/CL	Units	DF	Analytical Batch	Prep Batch	Qualifiers
Terphenyl-d14 <surr>	99.2	52-135	%	1	XMS5496	XXX22939	

Batch Information

Analytical Batch: XMS5496
Analytical Method: SW8270D
Analysis Date/Time: 07/01/10 19:00
Dilution Factor: 1

Prep Batch: XXX22939
Prep Method: SW3520C
Prep Date/Time: 06/30/10 11:30

Initial Prep Wt./Vol.: 125 mL
Prep Extract Vol.: 1 mL
Container ID:1103076002-F
Analyst: JDH

SGS Ref.#	969795	Method Blank	**Printed Date/Time**	07/12/2010 15:23
Client Name	Shaw Env & Infrastructure Inc.		**Prep** **Batch**	
Project Name/#	RARE-AK Ft. Yukon Tribal LF		**Method**	
Matrix	Water (Surface, Eff., Ground)		**Date**	

QC results affect the following production samples:

1103076001, 1103076002

Parameter	Results	LOQ/CL	DL	Units	Analysis Date

Waters Department

Parameter	Results	LOQ/CL	DL	Units	Analysis Date
Alkalinity	6.20 U	10.0	3.10	mg/L	06/25/10

Batch WTI3351
Method SM20 2320B
Instrument Titration

SGS Ref.#	970376	Method Blank	**Printed Date/Time**		07/12/2010 15:23
Client Name	Shaw Env & Infrastructure Inc.		**Prep**	**Batch**	XXX22939
Project Name/#	RARE-AK Ft. Yukon Tribal LF			**Method**	SW3520C
Matrix	Water (Surface, Eff., Ground)			**Date**	06/30/2010

QC results affect the following production samples:

1103076001, 1103076002

Parameter	Results	LOQ/CL	DL	Units	Analysis Date

Semivolatile Organic GC/MS

SGS

SGS Ref.#	970376 Method Blank	**Printed Date/Time**	07/12/2010 15:23
Client Name	Shaw Env & Infrastructure Inc.	**Prep** **Batch**	XXX22939
Project Name/#	RARE-AK Ft. Yukon Tribal LF	**Method**	SW3520C
Matrix	Water (Surface, Eff., Ground)	**Date**	06/30/2010

Parameter	Results	LOQ/CL	DL	Units	Analysis Date
Semivolatile Organic GC/MS					
1,2,4-Trichlorobenzene	0.00620 U	0.0100	0.00310	mg/L	07/01/10
1,2-Dichlorobenzene	0.00620 U	0.0100	0.00310	mg/L	07/01/10
1,3-Dichlorobenzene	0.00620 U	0.0100	0.00310	mg/L	07/01/10
1,4-Dichlorobenzene	0.00620 U	0.0100	0.00310	mg/L	07/01/10
2,4,5-Trichlorophenol	0.00620 U	0.0100	0.00310	mg/L	07/01/10
2,4,6-Trichlorophenol	0.00620 U	0.0100	0.00310	mg/L	07/01/10
2,4-Dichlorophenol	0.00620 U	0.0100	0.00310	mg/L	07/01/10
2,4-Dimethylphenol	0.00620 U	0.0100	0.00310	mg/L	07/01/10
2,4-Dinitrophenol	0.0300 U	0.0500	0.0150	mg/L	07/01/10
2,4-Dinitrotoluene	0.00620 U	0.0100	0.00310	mg/L	07/01/10
2,6-Dinitrotoluene	0.00620 U	0.0100	0.00310	mg/L	07/01/10
2-Chloronaphthalene	0.00620 U	0.0100	0.00310	mg/L	07/01/10
2-Chlorophenol	0.00620 U	0.0100	0.00310	mg/L	07/01/10
2-Methyl-4,6-dinitrophenol	0.0300 U	0.0500	0.0150	mg/L	07/01/10
2-Methylnaphthalene	0.00620 U	0.0100	0.00310	mg/L	07/01/10
2-Methylphenol (o-Cresol)	0.00620 U	0.0100	0.00310	mg/L	07/01/10
2-Nitroaniline	0.00620 U	0.0100	0.00310	mg/L	07/01/10
2-Nitrophenol	0.00620 U	0.0100	0.00310	mg/L	07/01/10
3&4-Methylphenol (p&m-Cresol)	0.0124 U	0.0200	0.00620	mg/L	07/01/10
3,3-Dichlorobenzidine	0.00620 U	0.0100	0.00310	mg/L	07/01/10
3-Nitroaniline	0.00620 U	0.0100	0.00310	mg/L	07/01/10
4-Bromophenyl-phenylether	0.00620 U	0.0100	0.00310	mg/L	07/01/10
4-Chloro-3-methylphenol	0.00620 U	0.0100	0.00310	mg/L	07/01/10
4-Chloroaniline	0.00620 U	0.0100	0.00310	mg/L	07/01/10
4-Chlorophenyl-phenylether	0.00620 U	0.0100	0.00310	mg/L	07/01/10
4-Nitroaniline	0.00620 U	0.0100	0.00310	mg/L	07/01/10
4-Nitrophenol	0.0300 U	0.0500	0.0150	mg/L	07/01/10
Acenaphthene	0.00620 U	0.0100	0.00310	mg/L	07/01/10
Acenaphthylene	0.00620 U	0.0100	0.00310	mg/L	07/01/10
Aniline	0.0300 U	0.0500	0.0150	mg/L	07/01/10
Anthracene	0.00620 U	0.0100	0.00310	mg/L	07/01/10
Azobenzene	0.00620 U	0.0100	0.00310	mg/L	07/01/10
Benzo(a)Anthracene	0.00620 U	0.0100	0.00310	mg/L	07/01/10
Benzo[a]pyrene	0.00620 U	0.0100	0.00310	mg/L	07/01/10
Benzo[b]Fluoranthene	0.00620 U	0.0100	0.00310	mg/L	07/01/10
Benzo[g,h,i]perylene	0.00620 U	0.0100	0.00310	mg/L	07/01/10
Benzo[k]fluoranthene	0.00620 U	0.0100	0.00310	mg/L	07/01/10
Benzoic acid	0.0500 U	0.0500	0.0250	mg/L	07/01/10
Benzyl alcohol	0.00620 U	0.0100	0.00310	mg/L	07/01/10

SGS

SGS Ref.#	970376 Method Blank	**Printed Date/Time**		07/12/2010 15:23
Client Name	Shaw Env & Infrastructure Inc.	**Prep**	**Batch**	XXX22939
Project Name/#	RARE-AK Ft. Yukon Tribal LF		**Method**	SW3520C
Matrix	Water (Surface, Eff., Ground)		**Date**	06/30/2010

Parameter	Results	LOQ/CL	DL	Units	Analysis Date
Semivolatile Organic GC/MS					
Bis(2chloro1methylethyl)Ether	0.00620 U	0.0100	0.00310	mg/L	07/01/10
Bis(2-Chloroethoxy)methane	0.00620 U	0.0100	0.00310	mg/L	07/01/10
Bis(2-Chloroethyl)ether	0.00620 U	0.0100	0.00310	mg/L	07/01/10
bis(2-Ethylhexyl)phthalate	0.00620 U	0.0100	0.00310	mg/L	07/01/10
Butylbenzylphthalate	0.00620 U	0.0100	0.00310	mg/L	07/01/10
Chrysene	0.00620 U	0.0100	0.00310	mg/L	07/01/10
Dibenzo[a,h]anthracene	0.00620 U	0.0100	0.00310	mg/L	07/01/10
Dibenzofuran	0.00620 U	0.0100	0.00310	mg/L	07/01/10
Diethylphthalate	0.00620 U	0.0100	0.00310	mg/L	07/01/10
Dimethylphthalate	0.00620 U	0.0100	0.00310	mg/L	07/01/10
Di-n-butylphthalate	0.00620 U	0.0100	0.00310	mg/L	07/01/10
di-n-Octylphthalate	0.00620 U	0.0100	0.00310	mg/L	07/01/10
Fluoranthene	0.00620 U	0.0100	0.00310	mg/L	07/01/10
Fluorene	0.00620 U	0.0100	0.00310	mg/L	07/01/10
Hexachlorobenzene	0.00620 U	0.0100	0.00310	mg/L	07/01/10
Hexachlorobutadiene	0.00620 U	0.0100	0.00310	mg/L	07/01/10
Hexachlorocyclopentadiene	0.0188 U	0.0300	0.00940	mg/L	07/01/10
Hexachloroethane	0.00620 U	0.0100	0.00310	mg/L	07/01/10
Indeno[1,2,3-c,d] pyrene	0.00620 U	0.0100	0.00310	mg/L	07/01/10
Isophorone	0.00620 U	0.0100	0.00310	mg/L	07/01/10
Naphthalene	0.00620 U	0.0100	0.00310	mg/L	07/01/10
Nitrobenzene	0.00620 U	0.0100	0.00310	mg/L	07/01/10
N-Nitrosodimethylamine	0.00620 U	0.0100	0.00310	mg/L	07/01/10
N-Nitroso-di-n-propylamine	0.00620 U	0.0100	0.00310	mg/L	07/01/10
N-Nitrosodiphenylamine	0.00620 U	0.0100	0.00310	mg/L	07/01/10
Pentachlorophenol	0.0300 U	0.0500	0.0150	mg/L	07/01/10
Phenanthrene	0.00620 U	0.0100	0.00310	mg/L	07/01/10
Phenol	0.00620 U	0.0100	0.00310	mg/L	07/01/10
Pyrene	0.00620 U	0.0100	0.00310	mg/L	07/01/10
Surrogates					
2,4,6-Tribromophenol <surr>	73.4	45-124		%	07/01/10
2-Fluorobiphenyl <surr>	71.9	50-110		%	07/01/10
2-Fluorophenol <surr>	58.8	21-88		%	07/01/10
Nitrobenzene-d5 <surr>	63	41-110		%	07/01/10
Phenol-d6 <surr>	62.4	28-97		%	07/01/10
Terphenyl-d14 <surr>	91.5	52-135		%	07/01/10

SGS Ref.#	970376 Method Blank	**Printed Date/Time**		07/12/2010 15:23
Client Name	Shaw Env & Infrastructure Inc.	**Prep**	**Batch**	XXX22939
Project Name/#	RARE-AK Ft. Yukon Tribal LF		**Method**	SW3520C
Matrix	Water (Surface, Eff., Ground)		**Date**	06/30/2010

Parameter	Results	LOQ/CL	DL	Units	Analysis Date

Semivolatile Organic GC/MS

Batch	XMS5496
Method	SW8270D
Instrument	HP 6890/5973 SSA

SGS Ref.#	970482	Method Blank	**Printed Date/Time**	07/12/2010 15:23
Client Name	Shaw Env & Infrastructure Inc.		**Prep** **Batch**	
Project Name/#	RARE-AK Ft. Yukon Tribal LF		**Method**	
Matrix	Water (Surface, Eff., Ground)		**Date**	

QC results affect the following production samples:

1103076001, 1103076002

Parameter	Results	LOQ/CL	DL	Units	Analysis Date
Waters Department					
Total Dissolved Solids	6.20 U	10.0	3.10	mg/L	06/29/10

Batch WAT8246
Method SM20 2540C
Instrument

SGS

SGS Ref.#	970856	Method Blank	**Printed Date/Time**	07/12/2010 15:23
Client Name	Shaw Env & Infrastructure Inc.		**Prep** **Batch**	
Project Name/#	RARE-AK Ft. Yukon Tribal LF		**Method**	
Matrix	Water (Surface, Eff., Ground)		**Date**	

QC results affect the following production samples:

1103076001, 1103076002

Parameter	Results	LOQ/CL	DL	Units	Analysis Date
Waters Department					
Total Organic Carbon	0.418J	0.500	0.150	mg/L	07/01/10

Batch WTC1995
Method SM 5310B
Instrument TOC Analyzer

SGS Ref.#	970959 Method Blank	**Printed Date/Time**		07/12/2010 15:23
Client Name	Shaw Env & Infrastructure Inc.	**Prep**	**Batch**	TPHX2011
Project Name/#	RARE-AK Ft. Yukon Tribal LF		**Method**	EXT_1664TP
Matrix	Water (Surface, Eff., Ground)		**Date**	07/01/2010

QC results affect the following production samples:

1103076001, 1103076002

Parameter	Results	LOQ/CL	DL	Units	Analysis Date
Waters Department					
TPH Silica Gel HEM	2.40 U	4.00	1.20	mg/L	07/01/10
Batch TPH2194					
Method EPA 1664A					
Instrument					

SGS Ref.#	971763 Method Blank		**Printed Date/Time**		07/12/2010 15:23
Client Name	Shaw Env & Infrastructure Inc.		**Prep**	**Batch**	MXX23182
Project Name/#	RARE-AK Ft. Yukon Tribal LF			**Method**	METHOD
Matrix	Water (Surface, Eff., Ground)			**Date**	07/06/2010

QC results affect the following production samples:

1103076001, 1103076002

Parameter	Results	LOQ/CL	DL	Units	Analysis Date
Metals Department					
Mercury	0.124 U	0.200	0.0620	ug/L	07/07/10

Batch MCV4567

Method SW7470A/E245.1

Instrument PSA Millennium mercury AA

SGS Ref.#	969797	Duplicate	**Printed Date/Time**	07/12/2010 15:23
Client Name	Shaw Env & Infrastructure Inc.		**Prep** **Batch**	
Project Name/#	RARE-AK Ft. Yukon Tribal LF		**Method**	
Original	1103067001		**Date**	
Matrix	Water (Surface, Eff., Ground)			

QC results affect the following production samples:

1103076001, 1103076002

Parameter	Original Result	QC Result	Units	RPD	RPD Limits	Analysis Date
Waters Department						
Alkalinity	187	188	mg/L	0	(< 25)	06/25/2010

Batch WTI3351
Method SM20 2320B
Instrument Titration

SGS Ref.#	970484 Duplicate	**Printed Date/Time**		07/12/2010 15:23
Client Name	Shaw Env & Infrastructure Inc.	**Prep**	**Batch**	
Project Name/#	RARE-AK Ft. Yukon Tribal LF		**Method**	
Original	1102845008		**Date**	
Matrix	Water (Surface, Eff., Ground)			

QC results affect the following production samples:

1103076001, 1103076002

Parameter	Original Result	QC Result	Units	RPD	RPD Limits	Analysis Date
Waters Department						
Total Dissolved Solids	108	87.0	mg/L	22	(< 25)	06/29/2010

Batch WAT8246

Method SM20 2540C

Instrument

SGS Ref.#	970485 Duplicate	**Printed Date/Time**		07/12/2010 15:23
Client Name	Shaw Env & Infrastructure Inc.	**Prep**	**Batch**	
Project Name/#	RARE-AK Ft. Yukon Tribal LF		**Method**	
Original	1103098001		**Date**	
Matrix	Water (Surface, Eff., Ground)			

QC results affect the following production samples:

1103076001, 1103076002

Parameter	Original Result	QC Result	Units	RPD	RPD Limits	Analysis Date
Waters Department						
Total Dissolved Solids	202	193	mg/L	5	(< 25)	06/29/2010

Batch WAT8246
Method SM20 2540C
Instrument

SGS Ref.#	971768 Duplicate	**Printed Date/Time**		07/12/2010 15:23
Client Name	Shaw Env & Infrastructure Inc.	**Prep**	**Batch**	MXX23182
Project Name/#	RARE-AK Ft. Yukon Tribal LF		**Method**	METHOD
Original	1102849022		**Date**	7/6/2010 11:30:00AM
Matrix	Water (Surface, Eff., Ground)			

QC results affect the following production samples:

1103076001, 1103076002

Parameter	Original Result	QC Result	Units	RPD	RPD Limits	Analysis Date
Metals Department						
Mercury	0.124 U	0.124 U	ug/L	0		07/07/2010

Batch MCV4567
Method SW7470A/E245.1
Instrument PSA Millennium mercury AA

SGS Ref.#	971770	Duplicate	**Printed Date/Time**		07/12/2010 15:23
Client Name	Shaw Env & Infrastructure Inc.		**Prep**	**Batch**	MXX23182
Project Name/#	RARE-AK Ft. Yukon Tribal LF			**Method**	METHOD
Original	1102849057			**Date**	7/6/2010 11:30:00AM
Matrix	Water (Surface, Eff., Ground)				

QC results affect the following production samples:

1103076001, 1103076002

Parameter	Original Result	QC Result	Units	RPD	RPD Limits	Analysis Date
Metals Department						
Mercury	0.124 U	0.124 U	ug/L	0		07/07/2010

Batch MCV4567

Method SW7470A/E245.1

Instrument PSA Millennium mercury AA

SGS

SGS Ref.#	969796 Lab Control Sample	**Printed Date/Time**	07/12/2010 15:23
		Prep	**Batch**
Client Name	Shaw Env & Infrastructure Inc.		**Method**
Project Name/#	RARE-AK Ft. Yukon Tribal LF		**Date**
Matrix	Water (Surface, Eff., Ground)		

QC results affect the following production samples:

1103076001, 1103076002

Parameter		QC Results	Pct Recov	LCS/LCSD Limits	RPD	RPD Limits	Spiked Amount	Analysis Date
Waters Department								
Alkalinity	LCS	245	98	(85-115)			250 mg/L	06/25/2010

Batch	WTI3351
Method	SM20 2320B
Instrument	Titration

SGS Ref.#	970377	Lab Control Sample	**Printed Date/Time**		07/12/2010 15:23
	970378	Lab Control Sample Duplicate	**Prep**	**Batch**	XXX22939
Client Name	Shaw Env & Infrastructure Inc.			**Method**	SW3520C
Project Name/#	RARE-AK Ft. Yukon Tribal LF			**Date**	06/30/2010
Matrix	Water (Surface, Eff., Ground)				

QC results affect the following production samples:

1103076001, 1103076002

Parameter	QC Results	Pct Recov	LCS/LCSD Limits	RPD	RPD Limits	Spiked Amount	Analysis Date

Semivolatile Organic GC/MS

SGS

SGS Ref.#	970377 Lab Control Sample	**Printed Date/Time**	07/12/2010 15:23
	970378 Lab Control Sample Duplicate	**Prep** **Batch**	XXX22939
Client Name	Shaw Env & Infrastructure Inc.	**Method**	SW3520C
Project Name/#	RARE-AK Ft. Yukon Tribal LF	**Date**	06/30/2010
Matrix	Water (Surface, Eff., Ground)		

Parameter		QC Results	Pct Recov	LCS/LCSD Limits	RPD	RPD Limits	Spiked Amount	Analysis Date
Semivolatile Organic GC/MS								
1,2,4-Trichlorobenzene	LCS	0.0828	83	(37-104)			0.1 mg/L	07/01/2010
	LCSD	0.0849	85		3	(< 20)	0.1 mg/L	07/01/2010
1,2-Dichlorobenzene	LCS	0.0819	82	(35-99)			0.1 mg/L	07/01/2010
	LCSD	0.0869	87		6	(< 20)	0.1 mg/L	07/01/2010
1,3-Dichlorobenzene	LCS	0.0790	79	(32-98)			0.1 mg/L	07/01/2010
	LCSD	0.0854	85		8	(< 20)	0.1 mg/L	07/01/2010
1,4-Dichlorobenzene	LCS	0.0783	78	(32-97)			0.1 mg/L	07/01/2010
	LCSD	0.0836	84		7	(< 20)	0.1 mg/L	07/01/2010
2,4,5-Trichlorophenol	LCS	0.113	113 *	(50-110)			0.1 mg/L	07/01/2010
	LCSD	0.111	111 *		2	(< 20)	0.1 mg/L	07/01/2010
2,4,6-Trichlorophenol	LCS	0.110	110	(50-115)			0.1 mg/L	07/01/2010
	LCSD	0.109	109		2	(< 20)	0.1 mg/L	07/01/2010
2,4-Dichlorophenol	LCS	0.0929	93	(50-105)			0.1 mg/L	07/01/2010
	LCSD	0.0970	97		4	(< 20)	0.1 mg/L	07/01/2010
2,4-Dimethylphenol	LCS	0.0724	72	(32-86)			0.1 mg/L	07/01/2010
	LCSD	0.0694	69		4	(< 20)	0.1 mg/L	07/01/2010
2,4-Dinitrophenol	LCS	0.205	114	(29-130)			0.18 mg/L	07/01/2010
	LCSD	0.109	60		61 *	(< 20)	0.18 mg/L	07/01/2010
2,4-Dinitrotoluene	LCS	0.116	116 *	(55-115)			0.1 mg/L	07/01/2010
	LCSD	0.119	119 *		3	(< 20)	0.1 mg/L	07/01/2010
2,6-Dinitrotoluene	LCS	0.108	108	(55-115)			0.1 mg/L	07/01/2010
	LCSD	0.107	107		2	(< 20)	0.1 mg/L	07/01/2010
2-Chloronaphthalene	LCS	0.0834	83	(50-105)			0.1 mg/L	07/01/2010
	LCSD	0.0830	83		0	(< 20)	0.1 mg/L	07/01/2010
2-Chlorophenol	LCS	0.0903	90	(37-97)			0.1 mg/L	07/01/2010
	LCSD	0.0947	95		5	(< 20)	0.1 mg/L	07/01/2010
2-Methyl-4,6-dinitrophenol	LCS	0.234	130	(43-130)			0.18 mg/L	07/01/2010
	LCSD	0.133	74		55 *	(< 20)	0.18 mg/L	07/01/2010

SGS Ref.#	970377 Lab Control Sample	**Printed Date/Time**		07/12/2010 15:23
	970378 Lab Control Sample Duplicate	**Prep**	**Batch**	XXX22939
Client Name	Shaw Env & Infrastructure Inc.		**Method**	SW3520C
Project Name/#	RARE-AK Ft. Yukon Tribal LF		**Date**	06/30/2010
Matrix	Water (Surface, Eff., Ground)			

Semivolatile Organic GC/MS

Parameter		QC Results	Pct Recov		LCS/LCSD Limits	RPD		RPD Limits	Spiked Amount	Analysis Date
2-Methylnaphthalene	LCS	0.0933	93		(46-105)				0.1 mg/L	07/01/2010
	LCSD	0.0932	93			0		(< 20)	0.1 mg/L	07/01/2010
2-Methylphenol (o-Cresol)	LCS	0.0907	91		(38-99)				0.1 mg/L	07/01/2010
	LCSD	0.0698	70			26	*	(< 20)	0.1 mg/L	07/01/2010
2-Nitroaniline	LCS	0.111	111		(54-115)				0.1 mg/L	07/01/2010
	LCSD	0.108	108			2		(< 20)	0.1 mg/L	07/01/2010
2-Nitrophenol	LCS	0.0969	97		(40-109)				0.1 mg/L	07/01/2010
	LCSD	0.0926	93			5		(< 20)	0.1 mg/L	07/01/2010
3&4-Methylphenol (p&m-Cresol)	LCS	0.135	96		(38-105)				0.14 mg/L	07/01/2010
	LCSD	0.142	101			5		(< 20)	0.14 mg/L	07/01/2010
3,3-Dichlorobenzidine	LCS	0.116	116	*	(53-110)				0.1 mg/L	07/01/2010
	LCSD	0.0927	93			22	*	(< 20)	0.1 mg/L	07/01/2010
3-Nitroaniline	LCS	0.114	114		(54-125)				0.1 mg/L	07/01/2010
	LCSD	0.109	109			5		(< 20)	0.1 mg/L	07/01/2010
4-Bromophenyl-phenylether	LCS	0.0914	91		(52-110)				0.1 mg/L	07/01/2010
	LCSD	0.0856	86			7		(< 20)	0.1 mg/L	07/01/2010
4-Chloro-3-methylphenol	LCS	0.109	109		(50-110)				0.1 mg/L	07/01/2010
	LCSD	0.109	109			0		(< 20)	0.1 mg/L	07/01/2010
4-Chloroaniline	LCS	0.0853	85		(37-110)				0.1 mg/L	07/01/2010
	LCSD	0.0841	84			2		(< 20)	0.1 mg/L	07/01/2010
4-Chlorophenyl-phenylether	LCS	0.0977	98		(50-110)				0.1 mg/L	07/01/2010
	LCSD	0.0950	95			3		(< 20)	0.1 mg/L	07/01/2010
4-Nitroaniline	LCS	0.125	125	*	(52-120)				0.1 mg/L	07/01/2010
	LCSD	0.120	120			5		(< 20)	0.1 mg/L	07/01/2010
4-Nitrophenol	LCS	0.149	106		(42-112)				0.14 mg/L	07/01/2010
	LCSD	0.151	108			1		(< 20)	0.14 mg/L	07/01/2010
Acenaphthene	LCS	0.0974	97		(53-110)				0.1 mg/L	07/01/2010

SGS

SGS Ref.#	970377 Lab Control Sample	**Printed Date/Time**	07/12/2010 15:23
	970378 Lab Control Sample Duplicate	**Prep** **Batch**	XXX22939
Client Name	Shaw Env & Infrastructure Inc.	**Method**	SW3520C
Project Name/#	RARE-AK Ft. Yukon Tribal LF	**Date**	06/30/2010
Matrix	Water (Surface, Eff., Ground)		

Parameter		QC Results	Pct Recov		LCS/LCSD Limits	RPD	RPD Limits	Spiked Amount	Analysis Date
Semivolatile Organic GC/MS									
	LCSD	0.0926	93			5	(< 20)	0.1 mg/L	07/01/2010
Acenaphthylene	LCS	0.0997	100		(53-105)			0.1 mg/L	07/01/2010
	LCSD	0.0967	97			3	(< 20)	0.1 mg/L	07/01/2010
Aniline	LCS	0.0719	72		(21-119)			0.1 mg/L	07/01/2010
	LCSD	0.0693	69			4	(< 20)	0.1 mg/L	07/01/2010
Anthracene	LCS	0.111	111	*	(59-110)			0.1 mg/L	07/01/2010
	LCSD	0.107	107			4	(< 20)	0.1 mg/L	07/01/2010
Azobenzene	LCS	0.105	105		(52-124)			0.1 mg/L	07/01/2010
	LCSD	0.0966	97			8	(< 20)	0.1 mg/L	07/01/2010
Benzo(a)Anthracene	LCS	0.113	113	*	(64-110)			0.1 mg/L	07/01/2010
	LCSD	0.114	114	*		0	(< 20)	0.1 mg/L	07/01/2010
Benzo[a]pyrene	LCS	0.113	113	*	(58-110)			0.1 mg/L	07/01/2010
	LCSD	0.110	110			3	(< 20)	0.1 mg/L	07/01/2010
Benzo[b]Fluoranthene	LCS	0.105	105		(57-120)			0.1 mg/L	07/01/2010
	LCSD	0.100	100			4	(< 20)	0.1 mg/L	07/01/2010
Benzo[g,h,i]perylene	LCS	0.122	122		(48-123)			0.1 mg/L	07/01/2010
	LCSD	0.115	115			6	(< 20)	0.1 mg/L	07/01/2010
Benzo[k]fluoranthene	LCS	0.103	103		(58-124)			0.1 mg/L	07/01/2010
	LCSD	0.109	109			6	(< 20)	0.1 mg/L	07/01/2010
Benzoic acid	LCS	0.133	95		(20-101)			0.14 mg/L	07/01/2010
	LCSD	0.135	97			2	(< 20)	0.14 mg/L	07/01/2010
Benzyl alcohol	LCS	0.0932	93		(38-110)			0.1 mg/L	07/01/2010
	LCSD	0.0986	99			6	(< 20)	0.1 mg/L	07/01/2010
Bis(2chloro1methylethyl)Ether	LCS	0.0848	85		(36-103)			0.1 mg/L	07/01/2010
	LCSD	0.0866	87			2	(< 20)	0.1 mg/L	07/01/2010
Bis(2-Chloroethoxy)methane	LCS	0.0902	90		(46-105)			0.1 mg/L	07/01/2010
	LCSD	0.0893	89			1	(< 20)	0.1 mg/L	07/01/2010

SGS

SGS Ref.#	970377 Lab Control Sample	**Printed Date/Time**		07/12/2010	15:23
	970378 Lab Control Sample Duplicate	**Prep**	**Batch**	XXX22939	
Client Name	Shaw Env & Infrastructure Inc.		**Method**	SW3520C	
Project Name/#	RARE-AK Ft. Yukon Tribal LF		**Date**	06/30/2010	
Matrix	Water (Surface, Eff., Ground)				

Semivolatile Organic GC/MS

Parameter		QC Results	Pct Recov	LCS/LCSD Limits	RPD	RPD Limits	Spiked Amount	Analysis Date
Bis(2-Chloroethyl)ether	LCS	0.0831	83	(37-100)			0.1 mg/L	07/01/2010
	LCSD	0.0850	85		2	(< 20)	0.1 mg/L	07/01/2010
bis(2-Ethylhexyl)phthalate	LCS	0.118	118	(59-125)			0.1 mg/L	07/01/2010
	LCSD	0.121	121		3	(< 20)	0.1 mg/L	07/01/2010
Butylbenzylphthalate	LCS	0.117	117 *	(58-115)			0.1 mg/L	07/01/2010
	LCSD	0.122	122 *		4	(< 20)	0.1 mg/L	07/01/2010
Chrysene	LCS	0.107	107	(63-110)			0.1 mg/L	07/01/2010
	LCSD	0.105	105		2	(< 20)	0.1 mg/L	07/01/2010
Dibenzo[a,h]anthracene	LCS	0.118	118	(53-125)			0.1 mg/L	07/01/2010
	LCSD	0.115	115		3	(< 20)	0.1 mg/L	07/01/2010
Dibenzofuran	LCS	0.103	103	(55-105)			0.1 mg/L	07/01/2010
	LCSD	0.100	100		3	(< 20)	0.1 mg/L	07/01/2010
Diethylphthalate	LCS	0.111	111	(51-120)			0.1 mg/L	07/01/2010
	LCSD	0.110	110		1	(< 20)	0.1 mg/L	07/01/2010
Dimethylphthalate	LCS	0.106	106	(36-125)			0.1 mg/L	07/01/2010
	LCSD	0.103	103		2	(< 20)	0.1 mg/L	07/01/2010
Di-n-butylphthalate	LCS	0.112	112	(55-115)			0.1 mg/L	07/01/2010
	LCSD	0.109	109		3	(< 20)	0.1 mg/L	07/01/2010
di-n-Octylphthalate	LCS	0.117	117	(52-131)			0.1 mg/L	07/01/2010
	LCSD	0.122	122		4	(< 20)	0.1 mg/L	07/01/2010
Fluoranthene	LCS	0.113	113	(59-115)			0.1 mg/L	07/01/2010
	LCSD	0.113	113		1	(< 20)	0.1 mg/L	07/01/2010
Fluorene	LCS	0.0892	89	(56-110)			0.1 mg/L	07/01/2010
	LCSD	0.0891	89		0	(< 20)	0.1 mg/L	07/01/2010
Hexachlorobenzene	LCS	0.110	110	(54-110)			0.1 mg/L	07/01/2010
	LCSD	0.105	105		4	(< 20)	0.1 mg/L	07/01/2010
Hexachlorobutadiene	LCS	0.0882	88	(38-105)			0.1 mg/L	07/01/2010
	LCSD	0.0915	92		4	(< 20)	0.1 mg/L	07/01/2010

SGS

SGS Ref.#	970377 Lab Control Sample	**Printed Date/Time**		07/12/2010 15:23
	970378 Lab Control Sample Duplicate	**Prep**	**Batch**	XXX22939
Client Name	Shaw Env & Infrastructure Inc.		**Method**	SW3520C
Project Name/#	RARE-AK Ft. Yukon Tribal LF		**Date**	06/30/2010
Matrix	Water (Surface, Eff., Ground)			

Parameter		QC Results	Pct Recov	LCS/LCSD Limits	RPD	RPD Limits	Spiked Amount	Analysis Date
Semivolatile Organic GC/MS								
Hexachlorocyclopentadiene	LCS	0.0373	37	(10-58)			0.1 mg/L	07/01/2010
	LCSD	0.0265	27		34 *	(< 20)	0.1 mg/L	07/01/2010
Hexachloroethane	LCS	0.0785	79	(30-95)			0.1 mg/L	07/01/2010
	LCSD	0.0832	83		6	(< 20)	0.1 mg/L	07/01/2010
Indeno[1,2,3-c,d] pyrene	LCS	0.117	117	(51-125)			0.1 mg/L	07/01/2010
	LCSD	0.112	112		4	(< 20)	0.1 mg/L	07/01/2010
Isophorone	LCS	0.0937	94	(50-110)			0.1 mg/L	07/01/2010
	LCSD	0.0890	89		5	(< 20)	0.1 mg/L	07/01/2010
Naphthalene	LCS	0.0878	88	(45-100)			0.1 mg/L	07/01/2010
	LCSD	0.0833	83		5	(< 20)	0.1 mg/L	07/01/2010
Nitrobenzene	LCS	0.0899	90	(45-105)			0.1 mg/L	07/01/2010
	LCSD	0.0886	89		2	(< 20)	0.1 mg/L	07/01/2010
N-Nitrosodimethylamine	LCS	0.0843	84	(27-100)			0.1 mg/L	07/01/2010
	LCSD	0.0898	90		6	(< 20)	0.1 mg/L	07/01/2010
N-Nitroso-di-n-propylamine	LCS	0.0881	88	(42-108)			0.1 mg/L	07/01/2010
	LCSD	0.0848	85		4	(< 20)	0.1 mg/L	07/01/2010
N-Nitrosodiphenylamine	LCS	0.0895	90	(53-110)			0.1 mg/L	07/01/2010
	LCSD	0.0829	83		8	(< 20)	0.1 mg/L	07/01/2010
Pentachlorophenol	LCS	0.181	129 *	(51-115)			0.14 mg/L	07/01/2010
	LCSD	0.160	114		12	(< 20)	0.14 mg/L	07/01/2010
Phenanthrene	LCS	0.110	110	(58-115)			0.1 mg/L	07/01/2010
	LCSD	0.108	108		3	(< 20)	0.1 mg/L	07/01/2010
Phenol	LCS	0.0889	89	(26-92)			0.1 mg/L	07/01/2010
	LCSD	0.0914	91		3	(< 20)	0.1 mg/L	07/06/2010
Pyrene	LCS	0.111	111	(62-128)			0.1 mg/L	07/01/2010
	LCSD	0.112	112		1	(< 20)	0.1 mg/L	07/01/2010

Surrogates

SGS Ref.#	970377 Lab Control Sample	**Printed Date/Time**	07/12/2010 15:23
	970378 Lab Control Sample Duplicate	**Prep** **Batch**	XXX22939
Client Name	Shaw Env & Infrastructure Inc.	**Method**	SW3520C
Project Name/#	RARE-AK Ft. Yukon Tribal LF	**Date**	06/30/2010
Matrix	Water (Surface, Eff., Ground)		

Parameter		QC Results	Pct Recov	LCS/LCSD Limits	RPD	RPD Limits	Spiked Amount	Analysis Date
Semivolatile Organic GC/MS								
2,4,6-Tribromophenol <surr>	LCS		106	(45-124)				07/01/2010
	LCSD		100		6			07/01/2010
2-Fluorobiphenyl <surr>	LCS		86	(50-110)				07/01/2010
	LCSD		84		2			07/01/2010
2-Fluorophenol <surr>	LCS		71	(21-88)				07/01/2010
	LCSD		81		13			07/01/2010
Nitrobenzene-d5 <surr>	LCS		85	(41-110)				07/01/2010
	LCSD		85		0			07/01/2010
Phenol-d6 <surr>	LCS		81	(28-97)				07/01/2010
	LCSD		88		8			07/01/2010
Terphenyl-d14 <surr>	LCS		102	(52-135)				07/01/2010
	LCSD		107		5			07/01/2010

Batch XMS5496
Method SW8270D
Instrument HP 6890/5973 SSA

SGS Ref.# 970483 Lab Control Sample

Printed Date/Time 07/12/2010 15:23

Prep **Batch**
Method
Date

Client Name Shaw Env & Infrastructure Inc.
Project Name/# RARE-AK Ft. Yukon Tribal LF
Matrix Water (Surface, Eff., Ground)

QC results affect the following production samples:

1103076001, 1103076002

Parameter		QC Results	Pct Recov	LCS/LCSD Limits	RPD	RPD Limits	Spiked Amount	Analysis Date
Waters Department								
Total Dissolved Solids	LCS	312	95	(75-125)			330 mg/L	06/29/2010

Batch WAT8246
Method SM20 2540C
Instrument

SGS

SGS Ref.#	970854 Lab Control Sample	**Printed Date/Time**	07/12/2010 15:23
		Prep	**Batch**
Client Name	Shaw Env & Infrastructure Inc.		**Method**
Project Name/#	RARE-AK Ft. Yukon Tribal LF		**Date**
Matrix	Water (Surface, Eff., Ground)		

QC results affect the following production samples:

1103076001, 1103076002

Parameter		QC Results	Pct Recov	LCS/LCSD Limits	RPD	RPD Limits	Spiked Amount	Analysis Date
Waters Department								
Total Organic Carbon	LCS	77.1	103	(80-120)			75 mg/L	07/01/2010

Batch	WTC1995
Method	SM 5310B
Instrument	TOC Analyzer

SGS

SGS Ref.#	970960 Lab Control Sample	**Printed Date/Time**	07/12/2010 15:23
		Prep **Batch**	TPHX2011
Client Name	Shaw Env & Infrastructure Inc.	**Method**	EXT_1664TP
Project Name/#	RARE-AK Ft. Yukon Tribal LF	**Date**	07/01/2010
Matrix	Water (Surface, Eff., Ground)		

QC results affect the following production samples:

1103076001, 1103076002

Parameter		QC Results	Pct Recov	LCS/LCSD Limits	RPD	RPD Limits	Spiked Amount	Analysis Date
Waters Department								
TPH Silica Gel HEM	LCS	17.5	88	(64-132)			20 mg/L	07/01/2010

Batch TPH2194
Method EPA 1664A
Instrument

SGS

SGS Ref.#	971764 Lab Control Sample	**Printed Date/Time**	07/12/2010 15:23
		Prep **Batch**	MXX23182
Client Name	Shaw Env & Infrastructure Inc.	**Method**	METHOD
Project Name/#	RARE-AK Ft. Yukon Tribal LF	**Date**	07/06/2010
Matrix	Water (Surface, Eff., Ground)		

QC results affect the following production samples:

1103076001, 1103076002

Parameter		QC Results	Pct Recov	LCS/LCSD Limits	RPD	RPD Limits	Spiked Amount	Analysis Date
Metals Department								
Mercury	LCS	3.50	88	(85-115)			4 ug/L	07/07/2010

Batch	MCV4567
Method	SW7470A/E245.1
Instrument	PSA Millennium mercury AA

SGS

SGS Ref.#	970857	Matrix Spike	**Printed Date/Time**	07/12/2010 15:23
	970858	Matrix Spike Duplicate	**Prep** **Batch**	
			Method	
			Date	

Original 1103120003

Matrix Drinking Water

QC results affect the following production samples:

1103076001, 1103076002

Parameter	Qualifiers		Original Result	QC Result	Pct Recov	MS/MSD Limits	RPD	RPD Limits	Spiked Amount		Analysis Date
Waters Department											
Total Organic Carbon		MS	4.49	14.8	103	(75-125)			10.0	mg/L	07/01/2010
		MSD		14.8	103		0	(< 25)	10.0	mg/L	07/01/2010

Batch WTC1995

Method SM 5310B

Instrument TOC Analyzer

SGS

SGS Ref.#	970962	Matrix Spike	**Printed Date/Time**	07/12/2010 15:23
			Prep **Batch**	TPHX2011
			Method	Extraction for EPA 1664 TPH S
			Date	07/01/2010
Original	970958			
Matrix	Water (Surface, Eff., Ground)			

QC results affect the following production samples:

1103076001, 1103076002

Parameter	Qualifiers	Original Result	QC Result	Pct Recov	MS/MSD Limits	RPD	RPD Limits	Spiked Amount	Analysis Date
Waters Department									
TPH Silica Gel HEM	MS	2.08J	17.4	74	(64-132)			20.6 mg/L	07/01/2010

Batch TPH2194
Method EPA 1664A
Instrument

SGS

SGS Ref.#	971765	Matrix Spike	**Printed Date/Time**	07/12/2010 15:23
	971766	Matrix Spike Duplicate	**Prep** **Batch**	MXX23182
			Method	Digestion Mercury (W)
			Date	07/06/2010

Original 1102849005

Matrix Water (Surface, Eff., Ground)

QC results affect the following production samples:

1103076001, 1103076002

Parameter	Qualifiers		Original Result	QC Result	Pct Recov	MS/MSD Limits	RPD	RPD Limits	Spiked Amount		Analysis Date
Metals Department											
Mercury		MS	(0.124) U	8.27	103	(85-115)			8.00	ug/L	07/07/2010
		MSD		7.46	93		10	(< 15)	8.00	ug/L	07/07/2010

Batch MCV4567

Method SW7470A/E245.1

Instrument PSA Millennium mercury AA

SGS

SGS Ref.#	971767	Matrix Spike	**Printed Date/Time**	07/12/2010 15:23
			Prep **Batch**	MXX23182
			Method	Digestion Mercury (W)
			Date	07/06/2010
Original	1102849022			
Matrix	Water (Surface, Eff., Ground)			

QC results affect the following production samples:

1103076001, 1103076002

Parameter	Qualifiers	Original Result	QC Result	Pct Recov	MS/MSD Limits	RPD	RPD Limits	Spiked Amount	Analysis Date
Metals Department									
Mercury	MS	(0.124) U	8	100	(85-115)			8.00 ug/L	07/07/2010

Batch MCV4567

Method SW7470A/E245.1

Instrument PSA Millennium mercury AA

SGS

SGS Ref.#	971769	Matrix Spike	**Printed Date/Time**	07/12/2010 15:23
			Prep **Batch**	MXX23182
			Method	Digestion Mercury (W)
			Date	07/06/2010
Original	1102849057			
Matrix	Water (Surface, Eff., Ground)			

QC results affect the following production samples:

1103076001, 1103076002

Parameter	Qualifiers	Original Result	QC Result	Pct Recov	MS/MSD Limits	RPD	RPD Limits	Spiked Amount		Analysis Date
Metals Department										
Mercury	MS	(0.124) U	8.96	112	(85-115)			8.00	ug/L	07/07/2010

Batch MCV4567
Method SW7470A/E245.1
Instrument PSA Millennium mercury AA

RARE - AK Tribal Landfills Project Chain of Custody

COC # SGSIf0610WG001 Cooler # 0610-001

Project Sampling Event ID: RARE - AK Tribal Landfills June 2010

Destination Laboratory: SGS-Anchorage

Sample Collection Org.: Shaw Alaska, Inc.

Reporting and Invoicing Instructions:
E-mail receiving records, PDF report, and EDF to: jack.james@shawgrp.com
Send Hardcopy Report and invoice to: Shaw Alaska, Inc., Anchorage, AK; attn.: Jack James

Required Analysis

1103076

Sample ID	Location ID	Date	Time	Matrix	E7470A - Total Hg	8270D - SVOC	E1664 - TPH	2320B - Alkalinity	SM2540C - TDS	SM5310 - TOC				# bottles	MS/MSD Requested?
① AF062310FYUPZ04WG001	PZ04	6/23/10	15:00	WG	X	X	X	X	X	X				6	
② AF062310FYUSP01WS001	SP01	6/23/10	12:45	WS	X	X	X	X	X	X				6	

Notes:

Comments:
AK Format Report for RARE Project.
Report Data to PQL.
PO#: Contact Jack James prior to invoicing.

Relinquished by (Signature)	Date:	Received by (Signature)	Date:
	6/25/2010		
Printed Name	Time:	Printed Name	Time:
Jack A. James (Shaw)	8:30		
Relinquished by (Signature)	Date:	Received by (Signature)	Date:
			6/25/10
Printed Name	Time:	Printed Name	Time:
		Annie Adkins	1530

Temperature Blank:________ Cooler Temperature: ________

SGS

1103076

SAMPLE RECEIPT FORM

Review Criteria:	Condition:	Comments/Action Taken:
Were **custody seals** intact? Note # & location if applicable. COC accompanied samples?	Yes No N/A Yes No N/A	2 shaw custody seals 1 front, 1 side
Temperature blank compliant (i.e., 0-6°C after correction factor)? Cooler ID: 1 @ 5.9 w/ Therm.ID: 13D Cooler ID: ____ @ ____ w/ Therm.ID: ____ Cooler ID: ____ @ ____ w/ Therm.ID: ____ Cooler ID: ____ @ ____ w/ Therm.ID: ____ Cooler ID: ____ @ ____ w/ Therm.ID: ____ ***Note: If non-compliant, use form FS-0029 to document affected samples/analyses.*** If samples are received without a temperature blank, the "cooler temperature" will be documented in lieu of the temperature blank & "**COOLER TEMP**" will be noted to the right. In cases where neither a temp blank nor cooler temp can be obtained, note "ambient" or "chilled." If temperature(s) <0°C, were all containers ice free?	Yes No N/A Yes No N/A	
Delivery method (specify all that apply): Client USPS Alert Courier Road Runner AK Air Lynden Carlile ERA FedEx UPS NAC PenAir Other:	Note airbill/tracking # See Attached or N/A	

* For samples received with payment, note amount ($) and cash / check / CC (circle one). N/A

* For samples received in FBKS, ANCH staff will verify all criteria are reviewed. SRF Initiated by: N/A

Do samples **match COC** (i.e., sample IDs, dates/times collected)? Are analyses requested unambiguous?	Yes No N/A Yes No N/A	
Were samples in **good condition** (no leaks/cracks/breakage)? Packing material used (specify all that apply): Bubble wrap Separate plastic bags Vermiculite Other:	Yes No N/A	
Were all VOA vials **free of headspace** (i.e., bubbles ≤6 mm)? Were all soil VOAs **field extracted** with MeOH+BFB?	Yes No N/A Yes No N/A	
Were **proper containers** (type/mass/volume/preservative) used? Were the bottles provided by SGS? (Note apparent exceptions.) Were **Trip Blanks** (VOAs, LL-Hg) in cooler with samples?	Yes No N/A Yes No N/A Yes No N/A	
For preserved waters (other than VOA vials, LL-Mercury or microbiological analyses), was **pH verified and compliant**? If pH was adjusted, were bottles flagged (i.e., stickers)? ***Refer to attached bottle sheet (form F066) for documentation.***	Yes No N/A Yes No N/A	
For **RUSH** or **SHORT HOLD TIME** samples, were the COC & this SRF flagged, bottles flagged (e.g., stickers) and lab notified?	Yes No N/A	
For client requested, **site-specific QC** (e.g., MS/MSD/DUP), were bottles flagged (e.g., stickers) and numbered accordingly?	Yes No N/A	
For **special handling** (e.g., "MI" or foreign soils, lab filter, limited volume, Ref Lab), were bottles/paperwork flagged (e.g., sticker)?	Yes No N/A	
Was **PEER REVIEW** of sample numbering completed (i.e., compare WO# on containers to COC, container ID on containers to COC, each container had a unique container ID)? Was the WO# recorded in Front Counter/Sample Receiving log?	Yes No N/A Yes No N/A	SRF Completed by: KMB Bottle Sheet by: KMB Peer Reviewed by: ACK
For any questions answered "NO," was the PM notified?	Yes No N/A	PM = N/A

Additional notes (if applicable):

WO# (7 digits)	Sample #	Sample #	Container ID	Container ID	Matrix	QC	Preservative (CHECKED)	TEST GROUP	Notes: **ANOMALIES -** *e.g., preservative added* **or SPECIAL HANDLING -** *e.g., Multi-Incremental (MI), Field Filter (FF), Lab Filter (LF), use "same jar as" (SJA) for QC, 2xMeOH, bubbles, etc.*
SAMPLE ID					**TYPE**		**CONTAINERS**	**ANALYSIS**	Type comments below:
1103076	001	002	A	A	1 Water		HNO3 (pH <2)	W_Metals_Total/Diss.	
1103076	001	002	B	B	1 Water		HCl (pH <2)	W_TOC/DOC	
1103076	001	002	C	C	1 Water		HCl (pH <2)	W_Oil&Grease/TPH1664	Limited volume. Use the 125mL provided. kew 6/28/10
1103076	001	002	D	D	1 Water		N/A	W_Waters_Dept	
1103076	001	002	E	E	1 Water		N/A	W_Waters_Dept	
1103076	001	002	F	F	1 Water		N/A	W_SVOC	

PRINT LABELS

1103076

Shaw Custody Seal

Date 6/25/10 Signed

Shaw Custody Seal

Date 6/25/10 Signed

0610-001

1103076

SGS North America Inc.
Alaska Division
Level II Laboratory Data Report

Project:	RARE-AK Tribal LanfillsAug2010
Client:	Shaw Env & Infrastructure Inc.
SGS Work Order:	1104166

Released by:

Contents:

Note:
Unless otherwise noted, all quality assurance/quality control criteria is in compliance with the standards set forth by the proper regulatory authority, the SGS Quality Assurance Program Plan, and the National Environmental Accreditation Conference.

SGS

CASE NARRATIVE

Print Date: 8/23/2010

Client Name: Shaw Env & Infrastructure Inc.
Project Name: RARE-AK Tribal LanfillsAug2010
Workorder No.: 1104166

Sample Comments

Refer to the sample receipt form for information on sample condition.

Lab Sample ID	Sample Type	Client Sample ID
	*	

There were no analytical anomalies associated with the data reported herein.

* QC comments may be associated with the field samples found in this report. When applicable, comments will be applied to associated field samples.

Laboratory Analytical Report

Client: **Shaw Env & Infrastructure Inc.**
2000 W. Int'l Airport, Ste C1
Anchorage, AK 99502

Attn: **Jack James**
T: F:
jack.james@shawgrp.com

Project: **RARE-AK Tribal LanfillsAug2010**

Workorder No.: **1104166**

Certification:

This data package is in compliance with the terms and conditions of the contract, both technically and for completeness, unless otherwise noted on the sample data sheet(s) and/or case narrative. This certification applies only to the tested parameters and the specific sample(s) received at the laboratory. If you have any questions regarding this report, or if we can be of further assistance, please contact your SGS Project Manager.

Steve Crupi

steven.crupi@sgs.com
Project Manager

Contents (Bookmarked in PDF):

Print Date: 8/23/2010

Enclosed are the analytical results associated with the above work order. All results are intended to be used in their entirety and SGS is not responsible for use of less than the complete report. If you have any questions regarding this report, or if we can be of any other assistance, please contact your SGS Project Manager at 907-562-2343. All work is provided under SGS general terms and conditions (<http://www.sgs.com/terms_and_conditions.htm>), unless other written agreements have been accepted by both parties.

SGS maintains a formal Quality Assurance/Quality Control (QA/QC) program. A copy of our Quality Assurance Plan (QAP), which outlines this program, is available at your request. The laboratory certification numbers are AK00971 (DW Chemistry & Microbiology) & UST-005 (CS) for ADEC and AK100001 for NELAP (RCRA methods: 1020A, 1311, 3010A, 3050B, 3520C, 3550C, 5030B, 5035B, 6010B, 6020, 7470A, 7471B, 8021B, 8081B, 8082A, 8260B, 8270D, 8270D-SIM, 9040B, 9045C, 9056A, 9060A, AK101 and AK102/103). Except as specifically noted, all statements and data in this report are in conformance to the provisions set forth by the SGS QAP and, when applicable, the National Environmental Laboratory Accreditation Program and other regulatory authorities. The following descriptors or qualifiers may be found in your report:

*	The analyte has exceeded allowable regulatory or control limits.
!	Surrogate out of control limits.
B	Indicates the analyte is found in a blank associated with the sample.
CCV	Continuing Calibration Verification
CL	Control Limit
D	The analyte concentration is the result of a dilution.
DF	Dilution Factor
DL	Detection Limit (i.e., maximum method detection limit)
E	The analyte result is above the calibrated range.
F	Indicates value that is greater than or equal to the DL
GT	Greater Than
ICV	Initial Calibration Verification
J	The quantitation is an estimation.
JL	The analyte was positively identified, but the quantitation is a low estimation.
LCS(D)	Laboratory Control Spike (Duplicate)
LOD	Limit of Detection (i.e., 2xDL)
LOQ	Limit of Quantitation (i.e., reporting or practical quantitation limit)
LT	Less Than
M	A matrix effect was present.
MB	Method Blank
MS(D)	Matrix Spike (Duplicate)
ND	Indicates the analyte is not detected.
Q	QC parameter out of acceptance range.
R	Rejected
RL	Reporting Limit
RPD	Relative Percent Difference
U	Indicates the analyte was analyzed for but not detected.

Note: Sample summaries which include a result for "Total Solids" have already been adjusted for moisture content.
All DRO/RRO analyses are integrated per SOP.

SAMPLE SUMMARY

Print Date: 8/23/2010 11:07 am

Client Name: Shaw Env & Infrastructure Inc.
Project Name: RARE-AK Tribal LanfillsAug2010
Workorder No.: 1104166

Analytical Methods

Method Description	Analytical Method
Alkalinity as CaCO3 QC	SM20 2320B
Total Dissolved Solids SM18 2540C	SM20 2540C
Total Organic Carbon	SM 5310B
TPH by EPA 1664	EPA 1664A

Sample ID Cross Reference

Lab Sample ID	Client Sample ID
1104166001	081110EKWPZ02WG001
1104166002	081110EKWPZ03WG001

SGS

Detectable Results Summary

Print Date: 8/23/2010 11:07 am

Client Sample ID: **081110EKWPZ02WG001**
SGS Ref. #: 1104166001
Waters Department

Parameter	Result	Units
Alkalinity	13.1	mg/L
Total Dissolved Solids	24.0	mg/L

Client Sample ID: **081110EKWPZ03WG001**
SGS Ref. #: 1104166002
Waters Department

Parameter	Result	Units
TPH Silica Gel HEM	13.8	mg/L
Total Organic Carbon	23.3	mg/L

Shaw Env & Infrastructure Inc. Print Date: 8/23/2010 11:07 am

Client Sample ID: **081110EKWPZ02WG001**
SGS Ref. #: 1104166001
Project ID: RARE-AK Tribal LanfillsAug2010
Matrix: Water (Surface, Eff., Ground)

Collection Date/Time: 08/11/10 12:06
Receipt Date/Time: 08/12/10 16:52
Location: PZ02

Waters Department

Parameter	Result	LOQ/CL	Units	DF	Analytical Batch	Prep Batch	Qualifiers
Alkalinity	13.1	10.0	mg/L	1	WTI3389		
Total Dissolved Solids	24.0	10.0	mg/L	1	WAT8315		

Batch Information

Analytical Batch: WAT8315
Analytical Method: SM20 2540C
Analysis Date/Time: 08/13/10 14:00
Dilution Factor: 1
Initial Prep Wt./Vol.: 100 mL
Container ID:1104166001-A
Analyst: JJR

Analytical Batch: WTI3389
Analytical Method: SM20 2320B
Analysis Date/Time: 08/13/10 22:44
Dilution Factor: 1
Initial Prep Wt./Vol.: 50 mL
Container ID:1104166001-B
Analyst: LP

Shaw Env & Infrastructure Inc. Print Date: 8/23/2010 11:07 am

Client Sample ID: **081110EKWPZ03WG001**
SGS Ref. #: 1104166002
Project ID: RARE-AK Tribal LanfillsAug2010
Matrix: Water (Surface, Eff., Ground)

Collection Date/Time: 08/11/10 11:21
Receipt Date/Time: 08/12/10 16:52
Location: PZ03

Waters Department

Parameter	Result	LOQ/CL	Units	DF	Analytical Batch	Prep Batch	Qualifiers
Total Organic Carbon	23.3	0.500	mg/L	1	WTC1999		
TPH Silica Gel HEM	13.8	5.41	mg/L	1	TPH2199	TPHX2016	

Batch Information

Analytical Batch: TPH2199
Analytical Method: EPA 1664A
Analysis Date/Time: 08/19/10 09:00
Dilution Factor: 1

Prep Batch: TPHX2016
Prep Method: EXT_1664TP
Prep Date/Time: 08/19/10 09:00

Initial Prep Wt./Vol.: 740 mL
Prep Extract Vol.: 50 mL
Container ID:1104166002-B
Analyst: RTS

Analytical Batch: WTC1999
Analytical Method: SM 5310B
Analysis Date/Time: 08/16/10 12:21
Dilution Factor: 1

Initial Prep Wt./Vol.: 30 mL
Container ID:1104166002-A
Analyst: KAR

SGS

SGS Ref.#	981266	Method Blank	**Printed Date/Time**	08/23/2010 11:07
Client Name	Shaw Env & Infrastructure Inc.		**Prep**	**Batch**
Project Name/#	RARE-AK Tribal LanfillsAug2010			**Method**
Matrix	Water (Surface, Eff., Ground)			**Date**

QC results affect the following production samples:

1104166001

Parameter	Results	LOQ/CL	DL	Units	Analysis Date
Waters Department					
Alkalinity	6.20 U	10.0	3.10	mg/L	08/13/10
Batch WTI3389					
Method SM20 2320B					
Instrument Titration					

SGS Ref.#	981352	Method Blank	**Printed Date/Time**	08/23/2010 11:07
Client Name	Shaw Env & Infrastructure Inc.		**Prep** **Batch**	
Project Name/#	RARE-AK Tribal LanfillsAug2010		**Method**	
Matrix	Water (Surface, Eff., Ground)		**Date**	

QC results affect the following production samples:

1104166001

Parameter	Results	LOQ/CL	DL	Units	Analysis Date
Waters Department					
Total Dissolved Solids	6.20 U	10.0	3.10	mg/L	08/13/10
Batch WAT8315					
Method SM20 2540C					
Instrument					

SGS Ref.#	981623	Method Blank	**Printed Date/Time**	08/23/2010 11:07
Client Name	Shaw Env & Infrastructure Inc.		**Prep** **Batch**	
Project Name/#	RARE-AK Tribal LanfillsAug2010		**Method**	
Matrix	Water (Surface, Eff., Ground)		**Date**	

QC results affect the following production samples:

1104166002

Parameter	Results	LOQ/CL	DL	Units	Analysis Date
Waters Department					
Total Organic Carbon	0.300 U	0.500	0.150	mg/L	08/16/10

Batch WTC1999
Method SM 5310B
Instrument TOC Analyzer

SGS Ref.#	982798 Method Blank	**Printed Date/Time**		08/23/2010 11:07
Client Name	Shaw Env & Infrastructure Inc.	**Prep**	**Batch**	TPHX2016
Project Name/#	RARE-AK Tribal LanfillsAug2010		**Method**	EXT_1664TP
Matrix	Water (Surface, Eff., Ground)		**Date**	08/19/2010

QC results affect the following production samples:

1104166002

Parameter	Results	LOQ/CL	DL	Units	Analysis Date
Waters Department					
TPH Silica Gel HEM	2.40 U	4.00	1.20	mg/L	08/19/10
Batch TPH2199					
Method EPA 1664A					
Instrument					

SGS

SGS Ref.#	981268 Duplicate	**Printed Date/Time**	08/23/2010 11:07
Client Name	Shaw Env & Infrastructure Inc.	**Prep** **Batch**	
Project Name/#	RARE-AK Tribal LanfillsAug2010	**Method**	
Original	1104170001	**Date**	
Matrix	Water (Surface, Eff., Ground)		

QC results affect the following production samples:

1104166001

Parameter	Original Result	QC Result	Units	RPD	RPD Limits	Analysis Date
Waters Department						
Alkalinity	92.0	91.9	mg/L	0	(< 25)	08/13/2010

Batch WTI3389
Method SM20 2320B
Instrument Titration

SGS Ref.#	981354 Duplicate	**Printed Date/Time**	08/23/2010 11:07
Client Name	Shaw Env & Infrastructure Inc.	**Prep** **Batch**	
Project Name/#	RARE-AK Tribal LanfillsAug2010	**Method**	
Original	1104134001	**Date**	
Matrix	Water (Surface, Eff., Ground)		

QC results affect the following production samples:

1104166001

Parameter	Original Result	QC Result	Units	RPD	RPD Limits	Analysis Date
Waters Department						
Total Dissolved Solids	461	464	mg/L	1	(< 25)	08/13/2010

Batch WAT8315
Method SM20 2540C
Instrument

SGS Ref.#	981355 Duplicate	**Printed Date/Time**		08/23/2010 11:07
Client Name	Shaw Env & Infrastructure Inc.	**Prep**	**Batch**	
Project Name/#	RARE-AK Tribal LanfillsAug2010		**Method**	
Original	1104166001		**Date**	
Matrix	Water (Surface, Eff., Ground)			

QC results affect the following production samples:

1104166001

Parameter	Original Result	QC Result	Units	RPD	RPD Limits	Analysis Date
Waters Department						
Total Dissolved Solids	24.0	23.0	mg/L	4	(< 25)	08/13/2010

Batch WAT8315
Method SM20 2540C
Instrument

SGS

SGS Ref.#	981267 Lab Control Sample	**Printed Date/Time**	08/23/2010 11:07
		Prep	**Batch**
Client Name	Shaw Env & Infrastructure Inc.		**Method**
Project Name/#	RARE-AK Tribal LanfillsAug2010		**Date**
Matrix	Water (Surface, Eff., Ground)		

QC results affect the following production samples:

1104166001

Parameter		QC Results	Pct Recov	LCS/LCSD Limits	RPD	RPD Limits	Spiked Amount	Analysis Date
Waters Department								
Alkalinity	LCS	263	105	(85-115)			250 mg/L	08/13/2010

Batch	WTI3389
Method	SM20 2320B
Instrument	Titration

SGS Ref.#	981353 Lab Control Sample	**Printed Date/Time**	08/23/2010 11:07
		Prep **Batch**	
Client Name	Shaw Env & Infrastructure Inc.	**Method**	
Project Name/#	RARE-AK Tribal LanfillsAug2010	**Date**	
Matrix	Water (Surface, Eff., Ground)		

QC results affect the following production samples:

1104166001

Parameter		QC Results	Pct Recov	LCS/LCSD Limits	RPD	RPD Limits	Spiked Amount	Analysis Date
Waters Department								
Total Dissolved Solids	LCS	316	96	(75-125)			330 mg/L	08/13/2010

Batch WAT8315
Method SM20 2540C
Instrument

SGS Ref.#	981621 Lab Control Sample	**Printed Date/Time**	08/23/2010 11:07
		Prep **Batch**	
Client Name	Shaw Env & Infrastructure Inc.	**Method**	
Project Name/#	RARE-AK Tribal LanfillsAug2010	**Date**	
Matrix	Water (Surface, Eff., Ground)		

QC results affect the following production samples:

1104166002

Parameter		QC Results	Pct Recov	LCS/LCSD Limits	RPD	RPD Limits	Spiked Amount	Analysis Date
Waters Department								
Total Organic Carbon	LCS	85.2	114	(80-120)			75 mg/L	08/16/2010

Batch WTC1999
Method SM 5310B
Instrument TOC Analyzer

SGS

SGS Ref.#	982799 Lab Control Sample	**Printed Date/Time**		08/23/2010 11:07
		Prep	**Batch**	TPHX2016
Client Name	Shaw Env & Infrastructure Inc.		**Method**	EXT_1664TP
Project Name/#	RARE-AK Tribal LanfillsAug2010		**Date**	08/19/2010
Matrix	Water (Surface, Eff., Ground)			

QC results affect the following production samples:

1104166002

Parameter		QC Results	Pct Recov	LCS/LCSD Limits	RPD	RPD Limits	Spiked Amount	Analysis Date
Waters Department								
TPH Silica Gel HEM	LCS	16.5	83	(64-132)			20 mg/L	08/19/2010

Batch TPH2199
Method EPA 1664A
Instrument

SGS Ref.# 981626 Matrix Spike
981627 Matrix Spike Duplicate

Printed Date/Time 08/23/2010 11:07

Prep Batch
Method
Date

Original 1104166002

Matrix Water (Surface, Eff., Ground)

QC results affect the following production samples:

1104166002

Parameter	Qualifiers	Original Result	QC Result	Pct Recov	MS/MSD Limits	RPD	RPD Limits	Spiked Amount		Analysis Date
Waters Department										
Total Organic Carbon	MS	23.3	34.1	107	(75-125)			10.0	mg/L	08/16/2010
	MSD		32.8	94		4	(< 25)	10.0	mg/L	08/16/2010

Batch WTC1999
Method SM 5310B
Instrument TOC Analyzer

SGS Ref.#	982801	Matrix Spike	**Printed Date/Time**	08/23/2010 11:07
			Prep **Batch**	TPHX2016
			Method	Extraction for EPA 1664 TPH S
			Date	08/19/2010
Original	982795			
Matrix	Water (Surface, Eff., Ground)			

QC results affect the following production samples:

1104166002

Parameter	Qualifiers	Original Result	QC Result	Pct Recov	MS/MSD Limits	RPD	RPD Limits	Spiked Amount		Analysis Date
Waters Department										
TPH Silica Gel HEM	MS	(2.52) U	17.4	84	(64-132)			20.7	mg/L	08/19/2010

Batch TPH2199
Method EPA 1664A
Instrument

RARE - AK Tribal Landfills Project Chain of Custody

COC # SGSIf0810WG001 Cooler # 0810-001

Project Sampling Event ID: RARE - AK Tribal Landfills August 2010

Destination Laboratory: SGS-Anchorage

Sample Collection Org.: Shaw Alaska, Inc.

1104166

Reporting and Invoicing Instructions:
E-mail receiving records, PDF report, and EDF to: jack.james@shawgrp.com
Send Hardcopy Report and invoice to: Shaw Alaska, Inc., Anchorage, AK; attn.: Jack James

Sample ID	Location ID	Date	Time	Matrix	E1664 - TPH	SM5310 - TOC	2320B - Alkalinity	SM2540C - TDS						# bottles	MS/MSD Requested?
081110EKWPZ02WG001	PZ02	8/11/10	12:06	WG			X	X			① A-C			3	
081110EKWPZ03WG001	PZ03	8/11/10	11:21	WG	X	X					② A-B			~~3~~ 2	

[illegible] 8/12/10

Notes:
081110EKWPZ03WG001, volume contained in three bottles, please perform TPH first then TOC, composite bottles if necessary.
081110EKWPZ02WG001, volume contained in three bottles, please perform alkalinty first then TDS, composite bottles if necessary.

Relinquished by (Signature)	Date:	Received by (Signature)	Date:
	8/12/2010		
Printed Name	Time:	Printed Name	Time:
Jack A. James (Shaw)	12:30		

Relinquished by (Signature)	Date:	Received by (Signature)	Date:
			8/12/10
Printed Name	Time:	Printed Name	Time:
		Steven R. Crupi	16:52

Comments:
AK Format Report for RARE Project.
Report Data to PQL.
PO#: Contact Jack James prior to invoicing.

Temperature Blank: 4.9°C

Cooler Temperature: ______

Therm 92 d

SGS

1104166

SAMPLE RECEIPT FORM

Review Criteria:	Condition:	Comments/Action Taken:
Were **custody seals** intact? Note # & location, if applicable. COC accompanied samples?	Yes No N/A Yes No N/A	2 (1F, 1B)
Temperature blank compliant* (i.e., 0-6°C after correction factor)? ** Note: Exemption permitted for chilled samples collected less than 8 hours ago.* Cooler ID: 1 @ 4.9 w/ Therm.ID: 920 Cooler ID: ____ @ ____ w/ Therm.ID: ____ Cooler ID: ____ @ ____ w/ Therm.ID: ____ Cooler ID: ____ @ ____ w/ Therm.ID: ____ Cooler ID: ____ @ ____ w/ Therm.ID: ____ *Note: If non-compliant, use form FS-0029 to document affected samples/analyses.* If samples are received without a temperature blank, the "cooler temperature" will be documented in lieu of the temperature blank & "**COOLER TEMP**" will be noted to the right. In cases where neither a temp blank nor cooler temp can be obtained, note "ambient" or "chilled." **If temperature(s) <0°C, were all sample containers ice free?**	Yes No N/A Yes No N/A	
Delivery method (specify all that apply): Client USPS, Alert Courier, Road Runner, AK Air Lynden, Carlile, ERA, PenAir FedEx, UPS, NAC, Other:	Note airbill/tracking # See Attached or N/A	
→ For samples received with payment, note amount ($) and cash / check / CC (circle one). → For samples received in FBKS, ANCH staff will verify all criteria are reviewed.		SRF Initiated by: N/A N/A
Do samples **match COC*** (i.e., sample IDs, dates/times collected)? ** Note: Exemption permitted if collection times differ by less than an hour; in which case, the times on the COC will be used.* Are analyses requested unambiguous?	Yes No N/A Yes No N/A	
Were samples in **good condition** (no leaks/cracks/breakage)? Packing material used (specify all that apply): Bubble Wrap Separate plastic bags, Vermiculite, Other:	Yes No N/A	
Were all VOA vials **free of headspace** (i.e., bubbles ≤6 mm)? Were all soil VOAs **field extracted** with MeOH+BFB? Were the bottles provided by SGS? (Note apparent exceptions.)	Yes No N/A Yes No N/A	
Were **proper containers** (type/mass/volume/preservative*) used? ** Note: Exemption permitted for waters to be analyzed for metals.* Were **Trip Blanks** (i.e., VOAs, LL-Hg) in cooler with samples?	Yes No N/A Yes No N/A	*client only provided 1 jar for TPH analysis, PM is aware of this fact & wants to proceed.
For preserved waters (other than VOA vials, LL-Mercury or microbiological analyses), was **pH verified and compliant?** If pH was adjusted, were bottles flagged (i.e., stickers)? *Refer to attached bottle sheet (form F066) for documentation.*	Yes No N/A Yes No N/A	
For **RUSH** or **SHORT HOLD TIME** samples, were the COC & this SRF flagged, bottles flagged (e.g., stickers) and lab notified?	Yes No N/A	
For client requested, **site-specific QC** (e.g., MS/MSD/DUP), were bottles flagged (e.g., stickers) and numbered accordingly?	Yes No N/A	
For **special handling** (e.g., "MI" or foreign soils, lab filter, limited volume, Ref Lab), were bottles/paperwork flagged (e.g., sticker)?	Yes No N/A	
Was the WO# recorded in Front Counter/Sample Receiving log? **For any question answered "No," has the PM been notified and the problem resolved (or paperwork put in their bin)?**	Yes No N/A Yes No N/A	SRF Completed by: KMB Bottle Sheet by: KMB PM = Steve N/A
Was **PEER REVIEW** of sample numbering completed (i.e., compare WO# on containers to COC, container ID on containers to COC, unique lab ID on each container?)	Yes No N/A	Peer Reviewed by: [illegible] Metrics: 19:02

Additional notes (if applicable):

SAMPLE ID					TYPE		CONTAINERS	ANALYSIS	PRINT LABELS
WO# (7 digits)	Sample #	- Sample #	Container ID	- Container ID	Matrix	QC	Preservative (CHECKED)	TEST GROUP	**Notes: ANOMALIES -** *e.g., preservative added* **or SPECIAL HANDLING -** *e.g., Multi-Incremental (MI), Field Filter (FF), Lab Filter (LF), use "same jar as" (SJA) for QC, 2xMeOH, bubbles, etc.*
									Type comments below:
1104166	001	001	A	A	1 Water		N/A	W_Waters_Dept	
1104166	001	001	B	C	1 Water		N/A	W_Waters_Dept	extra volume
1104166	002	002	A	A	1 Water		HCl (pH <2)	W_TOC/DOC	
1104166	002	002	B	B	1 Water		HCl (pH <2)	W_Oil&Grease/TPH1664	

1104166

APPENDIX D
CDC AND ASTDR CHEMICAL HEALTH EFFECTS INDEX

ALUMINUM

CAS # 7429-90-5

Division of Toxicology and Environmental Medicine ToxFAQs™ September 2008

This fact sheet answers the most frequently asked health questions (FAQs) about aluminum. For more information, call the ATSDR Information Center at 1-800-232-4636. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Everyone is exposed to low levels of aluminum from food, air, water, and soil. Exposure to high levels of aluminum may result in respiratory and neurological problems. Aluminum (in compounds combined with other elements) has been found in at least 596 of the 1,699 National Priority List (NPL) sites identified by the Environmental Protection Agency (EPA).

What is aluminum?

Aluminum is the most abundant metal in the earth's crust. It is always found combined with other elements such as oxygen, silicon, and fluorine. Aluminum as the metal is obtained from aluminum-containing minerals. Small amounts of aluminum can be found dissolved in water.

Aluminum metal is light in weight and silvery-white in appearance. Aluminum is used for beverage cans, pots and pans, airplanes, siding and roofing, and foil. Aluminum is often mixed with small amounts of other metals to form aluminum alloys, which are stronger and harder.

Aluminum compounds have many different uses, for example, as alums in water-treatment and alumina in abrasives and furnace linings. They are also found in consumer products such as antacids, astringents, buffered aspirin, food additives, cosmetics, and antiperspirants.

What happens to aluminum when it enters the environment?

- ❏ Aluminum cannot be destroyed in the environment, it can only change its form.
- ❏ In the air, aluminum binds to small particles, which can stay suspended for many days.
- ❏ Under most conditions, a small amount of aluminum will dissolve in lakes, streams, and rivers.
- ❏ It can be taken up by some plants from soil.
- ❏ Aluminum is not accumulated to a significant extent in most plants or animals.

How might I be exposed to aluminum?

- ❏ Virtually all food, water, air, and soil contain some aluminum.
- ❏ The average adult in the U.S. eats about 7–9 mg aluminum per day in their food.
- ❏ Breathing higher levels of aluminum dust in workplace air.
- ❏ Living in areas where the air is dusty, where aluminum is mined or processed into aluminum metal, near certain hazardous waste sites, or where aluminum is naturally high.
- ❏ Eating substances containing high levels of aluminum (such as antacids) especially when eating or drinking citrus products at the same time.
- ❏ Children and adults may be exposed to small amounts of aluminum from vaccinations.
- ❏ Very little enters your body from aluminum cooking utensils.

How can aluminum affect my health?

Only very small amounts of aluminum that you may inhale, ingest, or have skin contact with will enter the bloodstream.

Exposure to aluminum is usually not harmful, but exposure to high levels can affect your health. Workers who breathe large amounts of aluminum dusts can have lung problems, such as coughing or abnormal chest X-rays. Some workers who breathe aluminum dusts or aluminum fumes have decreased performance in some tests that measure functions of the nervous system.

Some people with kidney disease store a lot of aluminum in their bodies and sometimes develop bone or brain diseases which may be caused by the excess aluminum. Some studies show that people exposed to high levels of aluminum may develop Alzheimer's disease, but other studies have not found this to be true. We do not know for certain whether aluminum causes Alzheimer's disease.

Studies in animals show that the nervous system is a sensitive target of aluminum toxicity. Obvious signs of damage were not seen in animals after high oral doses of aluminum. However, the animals did not perform as well in tests that measured the strength of their grip or how much they moved around.

We do not know if aluminum will affect reproduction in people. Aluminum does not appear to affect fertility in animals.

How likely is aluminum to cause cancer?

The Department of Health and Human Services (DHHS) and the EPA have not evaluated the carcinogenic potential of aluminum in humans. Aluminum has not been shown to cause cancer in animals.

How can aluminum affect children?

Children with kidney problems who were given aluminum in their medical treatments developed bone diseases. It does not appear that children are more sensitive to aluminum than adults.

We do not know if aluminum will cause birth defects in people. Birth defects have not been seen in animals. Aluminum in large amounts has been shown to be harmful to unborn and developing animals because it can cause delays in skeletal and neurological development.

Aluminum is found in breast milk, but only a small amount of this aluminum will enter the infant's body through breastfeeding.

How can families reduce the risks of exposure to aluminum?

❏ Since aluminum is so common and widespread in the environment, families cannot avoid exposure to aluminum.

❏ Avoid taking large quantities of aluminum-containing antacids and buffered aspirin and take these medications as directed.

❏ Make sure all medications have child-proof caps so children will not accidentally eat them.

Is there a medical test to determine whether I have been exposed to aluminum?

All people have small amounts of aluminum in their bodies. Aluminum can be measured in blood, bones, feces, or urine. Urine and blood aluminum measurements can tell you whether you have been exposed to larger-than-normal amounts of aluminum. Measuring bone aluminum can also indicate exposure to high levels, but this requires a bone biopsy.

Has the federal government made recommendations to protect human health?

The EPA has recommended a Secondary Maximum Contaminant Level (SMCL) of 0.05–0.2 milligrams per liter (mg/L) for aluminum in drinking water. The SMCL is not based on levels that will affect humans or animals. It is based on taste, smell, or color.

The Occupational Health and Safety Administration (OSHA) has limited workers' exposure to aluminum in dusts to 15 milligrams per cubic meter (mg/m^3) (total dust) and 5 mg/m^3 (respirable fraction) of air for an 8-hour workday, 40-hour workweek.

The Food and Drug Administration (FDA) has determined that aluminum used as food additives and medicinals such as antacids are generally safe.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2008. Toxicological Profile for Aluminum. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology and Environmental Medicine, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-800-232-4636, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html. ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

Arsenic and Drinking Water from Private Wells

What is arsenic?

Arsenic is an element that occurs naturally in rocks and soil and is used for a variety of purposes within industry and agriculture. It is also a byproduct of copper smelting, mining, and coal burning. Arsenic can combine with other elements to make chemicals used to preserve wood and to kill insects on cotton and other agricultural crops.

For more information about arsenic illnesses and treatment, please visit CDC-ATSDR's arsenic (http://www.atsdr.cdc.gov/tfacts2.html) page.

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Where and how does arsenic get into drinking water?

Arsenic can enter the water supply from natural deposits in the earth or from industrial and agricultural pollution. It is widely believed that naturally occurring arsenic dissolves out of certain rock formations when ground water levels drop significantly. Some industries in the United States release thousands of pounds of arsenic into the environment every year. Once released, arsenic remains in the environment for a long time. Arsenic is removed from the air by rain, snow, and gradual settling. Once on the ground or in surface water, arsenic can slowly enter ground water. High arsenic levels in private wells may come from certain arsenic containing fertilizers used in the past or industrial waste. It may also indicate improper well construction or overuse of chemical fertilizers or herbicides in the past.

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How can I find out whether there is arsenic in my drinking water?

If you suspect a problem and your drinking water comes from a private well, you may contact your state certification officer (http://www.epa.gov/ogwdw/labs/index.html) (http://www.cdc.gov/Other/disclaimer.html) for a list of laboratories in your area that will perform tests on drinking water for a fee.

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How do I remove arsenic from my drinking water?

Heating or boiling your water will not remove arsenic. Because some of the water evaporates during the boiling process, the arsenic concentrations can actually increase slightly as the water is boiled. Additionally, chlorine (bleach) disinfection will not remove arsenic.

You may wish to consider water treatment methods such as reverse osmosis, ultra-filtration, distillation, or ion exchange. Typically these methods are used to treat water at only one faucet. Contact your local health department for recommended procedures. If you want to know more about these and other treatment options, please contact NSF International (http://nsf.org/certified/consumer/listings_advanced.asp?companyname=&productname=&programcode=WATER_FILTER&) (http://www.cdc.gov/Other/disclaimer.html) , an organization that focuses on public health and safety through standards development, product certification, education, and risk management. Remember to have your well water tested regularly (/healthywater/drinking/private/wells/testing.html) , at least once a year, to make sure the problem is controlled.

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Content source: Centers for Disease Control and Prevention

Centers for Disease Control and Prevention 1600 Clifton Rd. Atlanta, GA 30333, USA
800-CDC-INFO (800-232-4636) TTY: (888) 232-6348, New Hours of Operation 8am-8pm ET/Monday-Friday
Closed Holidays - cdcinfo@cdc.gov

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

ARSENIC

CAS # 7440-38-2

Division of Toxicology and Environmental Medicine ToxFAQs™ **August 2007**

This fact sheet answers the most frequently asked health questions (FAQs) about arsenic. For more information, call the ATSDR Information Center at 1-800-232-4636. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to higher than average levels of arsenic occur mostly in the workplace, near hazardous waste sites, or in areas with high natural levels. At high levels, inorganic arsenic can cause death. Exposure to lower levels for a long time can cause a discoloration of the skin and the appearance of small corns or warts. Arsenic has been found in at least 1,149 of the 1,684 National Priority List sites identified by the Environmental Protection Agency (EPA).

What is arsenic?

Arsenic is a naturally occurring element widely distributed in the earth's crust. In the environment, arsenic is combined with oxygen, chlorine, and sulfur to form inorganic arsenic compounds. Arsenic in animals and plants combines with carbon and hydrogen to form organic arsenic compounds.

Inorganic arsenic compounds are mainly used to preserve wood. Copper chromated arsenate (CCA) is used to make "pressure-treated" lumber. CCA is no longer used in the U.S. for residential uses; it is still used in industrial applications. Organic arsenic compounds are used as pesticides, primarily on cotton fields and orchards.

What happens to arsenic when it enters the environment?

❑ Arsenic occurs naturally in soil and minerals and may enter the air, water, and land from wind-blown dust and may get into water from runoff and leaching.
❑ Arsenic cannot be destroyed in the environment. It can only change its form.
❑ Rain and snow remove arsenic dust particles from the air.
❑ Many common arsenic compounds can dissolve in water. Most of the arsenic in water will ultimately end up in soil or sediment.
❑ Fish and shellfish can accumulate arsenic; most of this arsenic is in an organic form called arsenobetaine that is much less harmful.

How might I be exposed to arsenic?

❑ Ingesting small amounts present in your food and water or breathing air containing arsenic.
❑ Breathing sawdust or burning smoke from wood treated with arsenic.
❑ Living in areas with unusually high natural levels of arsenic in rock.
❑ Working in a job that involves arsenic production or use, such as copper or lead smelting, wood treating, or pesticide application.

How can arsenic affect my health?

Breathing high levels of inorganic arsenic can give you a sore throat or irritated lungs.

Ingesting very high levels of arsenic can result in death. Exposure to lower levels can cause nausea and vomiting, decreased production of red and white blood cells, abnormal heart rhythm, damage to blood vessels, and a sensation of "pins and needles" in hands and feet.

Ingesting or breathing low levels of inorganic arsenic for a long time can cause a darkening of the skin and the appearance of small "corns" or "warts" on the palms, soles, and torso.

Skin contact with inorganic arsenic may cause redness and swelling.

Almost nothing is known regarding health effects of organic arsenic compounds in humans. Studies in animals show that some simple organic arsenic compounds are less toxic than inorganic forms. Ingestion of methyl and dimethyl compounds can cause diarrhea and damage to the kidneys

How likely is arsenic to cause cancer?

Several studies have shown that ingestion of inorganic arsenic can increase the risk of skin cancer and cancer in the liver, bladder, and lungs. Inhalation of inorganic arsenic can cause increased risk of lung cancer. The Department of Health and Human Services (DHHS) and the EPA have determined that inorganic arsenic is a known human carcinogen. The International Agency for Research on Cancer (IARC) has determined that inorganic arsenic is carcinogenic to humans.

How can arsenic affect children?

There is some evidence that long-term exposure to arsenic in children may result in lower IQ scores. There is also some evidence that exposure to arsenic in the womb and early childhood may increase mortality in young adults.

There is some evidence that inhaled or ingested arsenic can injure pregnant women or their unborn babies, although the studies are not definitive. Studies in animals show that large doses of arsenic that cause illness in pregnant females, can also cause low birth weight, fetal malformations, and even fetal death. Arsenic can cross the placenta and has been found in fetal tissues. Arsenic is found at low levels in breast milk.

How can families reduce the risks of exposure to arsenic?

❏ If you use arsenic-treated wood in home projects, you should wear dust masks, gloves, and protective clothing to decrease exposure to sawdust.

❏ If you live in an area with high levels of arsenic in water or soil, you should use cleaner sources of water and limit contact with soil.

❏ If you work in a job that may expose you to arsenic, be aware that you may carry arsenic home on your clothing, skin, hair, or tools. Be sure to shower and change clothes before going home.

Is there a medical test to determine whether I've been exposed to arsenic?

There are tests available to measure arsenic in your blood, urine, hair, and fingernails. The urine test is the most reliable test for arsenic exposure within the last few days. Tests on hair and fingernails can measure exposure to high levels of arsenic over the past 6-12 months. These tests can determine if you have been exposed to above-average levels of arsenic. They cannot predict whether the arsenic levels in your body will affect your health.

Has the federal government made recommendations to protect human health?

The EPA has set limits on the amount of arsenic that industrial sources can release to the environment and has restricted or cancelled many of the uses of arsenic in pesticides. EPA has set a limit of 0.01 parts per million (ppm) for arsenic in drinking water.

The Occupational Safety and Health Administration (OSHA) has set a permissible exposure limit (PEL) of 10 micrograms of arsenic per cubic meter of workplace air (10 $\mu g/m^3$) for 8 hour shifts and 40 hour work weeks.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2007. Toxicological Profile for Arsenic (Update). Atlanta, GA: U.S. Department of Public Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology and Environmental Medicine, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-800-232-4636, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html. ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

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BERYLLIUM

CAS #7440-41-7

Division of Toxicology ToxFAQs™ **September 2002**

This fact sheet answers the most frequently asked health questions (FAQs) about beryllium. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: People working or living near beryllium industries have the greatest potential for exposure to beryllium. Lung damage has been observed in people exposed to high levels of beryllium in the air. About 1-15% of all people occupationally-exposed to beryllium in air become sensitive to beryllium and may develop chronic beryllium disease (CBD), an irreversible and sometimes fatal scarring of the lungs. CBD may be completely asymptomatic or begin with coughing, chest pain, shortness of breath, weakness, and/or fatigue. Beryllium has been found in at least 535 of the 1,613 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What is beryllium?

Beryllium is a hard, grayish metal naturally found in mineral rocks, coal, soil, and volcanic dust. Beryllium ore is mined, and the beryllium is purified for use in nuclear weapons and reactors, aircraft and space vehicle structures, instruments, x-ray machines, and mirrors. Beryllium oxide is used to make speciality ceramics for electrical and high-technology applications. Beryllium alloys are used in automobiles, computers, sports equipment (golf clubs), and dental bridges.

What happens to beryllium when it enters the environment?

❏ Beryllium dust enters the air from burning coal and oil. This beryllium dust will eventually settle over the land and water.
❏ It enters water from erosion of rocks and soil, and from industrial waste. Some beryllium compounds will dissolve in water, but most stick to particles and settle to the bottom.
❏ Most beryllium in soil does not dissolve in water and remains bound to soil.
❏ Beryllium does not accumulate in the food chain.

How might I be exposed to beryllium?

❏ The general population is normally exposed to low levels of beryllium in air, food, and water.
❏ People working in industries where beryllium is mined, processed, machined, or converted into metal, alloys, and other chemicals may be exposed to high levels of beryllium. People living near these industries may also be exposed to higher than normal levels of beryllium in air.
❏ People living near uncontrolled hazardous waste sites may be exposed to higher than normal levels of beryllium.

How can beryllium affect my health?

Beryllium can be harmful if you breathe it. The effects depend on how much you are exposed to, for how long, and individual susceptibility. If beryllium air levels are high enough (greater than 1000 $\mu g/m^3$), an acute condition can result. This condition resembles pneumonia and is called acute beryllium disease Occupational and community air standards are effective in preventing acute lung damage.

Some exposed workers (1-15%) become sensitive to beryllium. These individuals may develop an inflammatory reaction in the respiratory system. This condition is called chronic beryllium disease (CBD), and can occur years after exposure to higher than normal levels of beryllium (greater than 0.2 $\mu g/m^3$). This disease can make you feel weak and tired, and can cause difficulty in breathing. It can also result in anorexia, weight loss, and may also lead to right side heart enlargement and heart disease in advanced cases. Some people who are sensitized to beryllium may not have any symptoms. The general population is unlikely to develop chronic beryllium disease because ambient air levels of beryllium are normally very low (0.00003-0.0002 ug/m^3).

Swallowing beryllium has not been reported to cause effects in humans because very little beryllium is absorbed from the stomach and intestines. Ulcers have been seen in dogs ingesting beryllium in the diet. Beryllium contact with skin that has been scraped or cut may cause rashes or ulcers.

How likely is beryllium to cause cancer?

Long term exposure to beryllium can increase the risk of developing lung cancer in people.

The Department of Health and Human Services (DHHS) and the International Agency for Research on Cancer (IARC) have determined that beryllium is a human carcinogen. The EPA has determined that beryllium is a probable human carcinogen. EPA has estimated that lifetime exposure to 0.04 ug/m^3 beryllium can result in a one in a thousand chance of developing cancer.

How can beryllium affect children?

It is likely that the health effects seen in children exposed to beryllium will be similar to the effects seen in adults. We do not know whether children differ from adults in their susceptibility to beryllium.

We do not know if exposure to beryllium will result in birth defects or other developmental effects in people. The studies on developmental effects in animals are not conclusive.

How can families reduce the risk of exposure to beryllium?

❏ Individuals working at facilities that use beryllium should make sure that contaminated clothing and objects are not brought home.

❏ Children should avoid playing in soils near uncontrolled hazardous waste sites where beryllium may have been discarded.

Is there a medical test to show whether I've been exposed to beryllium?

Beryllium can be measured in samples from your blood, urine, skin, or lungs. These tests are rarely done because they are not reliable measures of your exposure over time. Also, these tests do not show if you have become sensitized to beryllium.

Another test, the beryllium lymphocyte proliferation test (BeLPT), can help your doctor decide if you are sensitized to beryllium. This test is only done in a few specialized laboratories, but doctors familiar with the test can collect blood samples and send them for testing by overnight carrier. The BeLPT is most often done for people who work with beryllium. It is also useful for separating chronic beryllium disease from diagnoses that resemble it (for example, sarcoidosis). Depending on your exposure history, clinical findings, and test results, your doctor may also recommend additional specialized testing.

Has the federal government made recommendations to protect human health?

The EPA restricts the amount of beryllium that industries may release into the air to 0.01 ug/m^3, averaged over a 30-day period.

The Occupational Safety and Health Administration (OSHA) sets a limit of 2 ug/m^3 for an 8-hour work shift measured as a personal sample.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2002. Toxicological Profile for Beryllium Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html. ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

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CADMIUM

CAS # 7440-43-9

Division of Toxicology and Environmental Medicine ToxFAQs™ **September 2008**

This fact sheet answers the most frequently asked health questions (FAQs) about cadmium. For more information, call the ATSDR Information Center at 1-800-232-4636. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to cadmium happens mostly in the workplace where cadmium products are made. The general population is exposed from breathing cigarette smoke or eating cadmium contaminated foods. Cadmium damages the kidneys, lungs, and bones. Cadmium has been found in at least 1,014 of the 1,669 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What is cadmium?

Cadmium is a natural element in the earth's crust. It is usually found as a mineral combined with other elements such as oxygen (cadmium oxide), chlorine (cadmium chloride), or sulfur (cadmium sulfate, cadmium sulfide).

All soils and rocks, including coal and mineral fertilizers, contain some cadmium. Most cadmium used in the United States is extracted during the production of other metals like zinc, lead, and copper. Cadmium does not corrode easily and has many uses, including batteries, pigments, metal coatings, and plastics.

What happens to cadmium when it enters the environment?

❑ Cadmium enters soil, water, and air from mining, industry, and burning coal and household wastes.
❑ Cadmium does not break down in the environment, but can change forms.
❑ Cadmium particles in air can travel long distances before falling to the ground or water.
❑ Some forms of cadmium dissolve in water.
❑ Cadmium binds strongly to soil particles.
❑ Fish, plants, and animals take up cadmium from the environment.

How might I be exposed to cadmium?

❑ Eating foods containing cadmium; low levels are found in all foods (highest levels are found in shellfish, liver, and kidney meats).
❑ Smoking cigarettes or breathing cigarette smoke.
❑ Breathing contaminated workplace air.
❑ Drinking contaminated water.
❑ Living near industrial facilities which release cadmium into the air.

How can cadmium affect my health?

Breathing high levels of cadmium can severely damage the lungs. Eating food or drinking water with very high levels severely irritates the stomach, leading to vomiting and diarrhea.

Long-term exposure to lower levels of cadmium in air, food, or water leads to a buildup of cadmium in the kidneys and possible kidney disease. Other long-term effects are lung damage and fragile bones.

How likely is cadmium to cause cancer?

The Department of Health and Human Services (DHHS) has determined that cadmium and cadmium compounds are known human carcinogens.

How can cadmium affect children?

The health effects in children are expected to be similar to the effects seen in adults (kidney, lung, and bone damage depending on the route of exposure).

A few studies in animals indicate that younger animals absorb more cadmium than adults. Animal studies also indicate that the young are more susceptible than adults to a loss of bone and decreased bone strength from exposure to cadmium.

We don't know if cadmium causes birth defects in people. The babies of animals exposed to high levels of cadmium during pregnancy had changes in behavior and learning ability. There is also some information from animal studies that high enough exposures to cadmium before birth can reduce body weights and affect the skeleton in the developing young.

How can families reduce the risks of exposure to cadmium?

❑ In the home, store substances that contain cadmium safely, and keep nickel-cadmium batteries out of reach of young children.
❑ Cadmium is a component of tobacco smoke. Avoid smoking in enclosed spaces like inside the home or car in order to limit exposure to children and other family members.
❑ If you work with cadmium, use all safety precautions to avoid carrying cadmium-containing dust home from work on your clothing, skin, hair, or tools.
❑ A balanced diet can reduce the amount of cadmium taken into the body from food and drink.

Is there a medical test to determine whether I've been exposed to cadmium?

Cadmium can be measured in blood, urine, hair, or nails. Urinary cadmium has been shown to accurately reflect the amount of cadmium in the body.

The amount of cadmium in your blood shows your recent exposure to cadmium. The amount of cadmium in your urine shows both your recent and your past exposure.

Has the federal government made recommendations to protect human health?

The EPA has determined that exposure to cadmium in drinking water at concentrations of 0.04 ppm for up to 10 days is not expected to cause any adverse effects in a child.

The EPA has determined that lifetime exposure to 0.005 ppm cadmium is not expected to cause any adverse effects.

The FDA has determined that the cadmium concentration in bottled drinking water should not exceed 0.005 ppm.

The Occupational Health and Safety Administration (OSHA) has limited workers' exposure to an average of 5 $\mu g/m^3$ for an 8-hour workday, 40-hour workweek.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2008. Toxicological Profile for Cadmium (Draft for Public Comment). Atlanta, GA: U.S. Department of Public Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology and Environmental Medicine, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-800-232-4636, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html. ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

CHROMIUM

CAS # 7440-47-3

Division of Toxicology and Environmental Medicine ToxFAQs™ September 2008

This fact sheet answers the most frequently asked health questions (FAQs) about chromium. For more information, call the ATSDR Information Center at 1-800-232-4636. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to chromium occurs from ingesting contaminated food or drinking water or breathing contaminated workplace air. Chromium(VI) at high levels can damage the nose and cause cancer. Ingesting high levels of chromium(VI) may result in anemia or damage to the stomach or intestines. Chromium(III) is an essential nutrient. Chromium has been found in at least 1,127 of the 1,669 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What is chromium?

Chromium is a naturally occurring element found in rocks, animals, plants, and soil. It can exist in several different forms. Depending on the form it takes, it can be a liquid, solid, or gas. The most common forms are chromium(0), chromium(III), and chromium(VI). No taste or odor is associated with chromium compounds.

The metal chromium, which is the chromium(0) form, is used for making steel. Chromium(VI) and chromium(III) are used for chrome plating, dyes and pigments, leather tanning, and wood preserving.

What happens to chromium when it enters the environment?

❑ Chromium can be found in air, soil, and water after release from the manufacture, use, and disposal of chromium-based products, and during the manufacturing process.
❑ Chromium does not usually remain in the atmosphere, but is deposited into the soil and water.
❑ Chromium can easily change from one form to another in water and soil, depending on the conditions present.
❑ Fish do not accumulate much chromium in their bodies from water.

How might I be exposed to chromium?

❑ Eating food containing chromium(III).
❑ Breathing contaminated workplace air or skin contact during use in the workplace.
❑ Drinking contaminated well water.
❑ Living near uncontrolled hazardous waste sites containing chromium or industries that use chromium.

How can chromium affect my health?

Chromium(III) is an essential nutrient that helps the body use sugar, protein, and fat.

Breathing high levels of chromium(VI) can cause irritation to the lining of the nose, nose ulcers, runny nose, and breathing problems, such as asthma, cough, shortness of breath, or wheezing. The concentrations of chromium in air that can cause these effects may be different for different types of chromium compounds, with effects occurring at much lower concentrations for chromium(VI) compared to chromium(III).

The main health problems seen in animals following ingestion of chromium(VI) compounds are irritation and ulcers in the stomach and small intestine and anemia. Chromium(III) compounds are much less toxic and do not appear to cause these problems.

Sperm damage and damage to the male reproductive system have also been seen in laboratory animals exposed to chromium(VI).

Skin contact with certain chromium(VI) compounds can cause skin ulcers. Some people are extremely sensitive to chromium(VI) or chromium(III). Allergic reactions consisting of severe redness and swelling of the skin have been noted.

How likely is chromium to cause cancer?

The Department of Health and Human Services (DHHS), the International Agency for Reseach on Cancer (IARC), and the EPA have determined that chromium(VI) compounds are known human carcinogens. In workers, inhalation of chromium(VI) has been shown to cause lung cancer. Chromium(VI) also causes lung cancer in animals. An increase in stomach tumors was observed in humans and animals exposed to chromium(VI) in drinking water.

How can chromium affect children?

It is likely that health effects seen in children exposed to high amounts of chromium will be similar to the effects seen in adults.

We do not know if exposure to chromium will result in birth defects or other developmental effects in people. Some developmental effects have been observed in animals exposed to chromium(VI).

How can families reduce the risks of exposure to chromium?

❑ Children should avoid playing in soils near uncontrolled hazardous waste sites where chromium may have been discarded.
❑ Chromium is a component of tobacco smoke. Avoid smoking in enclosed spaces like inside the home or car in order to limit exposure to children and other family members.
❑ Although chromium(III) is an essential nutrient, you should avoid excessive use of dietary supplements containing chromium.

Is there a medical test to determine whether I've been exposed to chromium?

Since chromium(III) is an essential element and naturally occurs in food, there will always be some level of chromium in your body. Chromium can be measured in hair, urine, and blood.

Higher than normal levels of chromium in blood or urine may indicate that a person has been exposed to chromium. However, increases in blood and urine chromium levels cannot be used to predict the kind of health effects that might develop from that exposure.

Has the federal government made recommendations to protect human health?

The EPA has determined that exposure to chromium in drinking water at concentrations of 1 mg/L for up to 10 days is not expected to cause any adverse effects in a child.

The FDA has determined that the chromium concentration in bottled drinking water should not exceed 1 mg/L.

The Occupational Health and Safety Administration (OSHA) has limited workers' exposure to an average of 0.005 mg/m^3 chromium(VI), 0.5 mg/m^3 chromium(III), and 1.0 mg/m^3 chromium(0) for an 8-hour workday, 40-hour workweek.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2008. Toxicological Profile for Chromium (Draft for Public Comment). Atlanta, GA: U.S. Department of Public Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology and Environmental Medicine, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-800-232-4636, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html. ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

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Private Well Water and Fluoride

This fact sheet addresses questions that consumers may have on fluoride levels in groundwater from private wells.

How do I know if my water is from a public water system or a private well?
The U.S. Environmental Protection Agency defines a Public Water System as a system that serves 25 or more people per day. If you have water service from a well that has a limited delivery, such as to your house but not to your neighbor's house, then you likely have a private well.

What are the governmental regulations for private wells?
Although most U.S. households are connected to a public water system, the U.S. Geological Survey report "**Estimated Use of Water in the United States in 2005**" estimates that 14% of United States residents rely on private wells that are not regulated by the EPA Safe Drinking Water Act. In most states, private wells are not regulated by governmental regulatory entities. Therefore, it is the responsibility of the homeowner to know and understand the quality of the water from their well. The U.S. Environmental Protection Agency suggests that all wells be tested for quality once every three years since influences to well water quality can change over time. Contact your public health office for their advice on testing of private wells in your state or area. Additional information on testing well water quality in private wells serving homes can be found on the **U.S. Environmental Protection Agency Web site**.

My home gets its water from a private well. What do I need to know about fluoride and groundwater from a well?
Fluoride is present in virtually all waters at some level, and it is important to know the fluoride content of your water, particularly if you have children. A **2008 U.S. Geological Survey** study found that 4% of sampled wells had natural fluoride levels above the EPA Secondary Maximum Contaminant Level (SMCL) of 2 mg/L. A smaller set of 1.2% of all wells exceeded the Maximum Contaminant Level (MCL) of 4 mg/L. If you have a home well, the EPA recommends having a sample of your water analyzed by a laboratory at least once every three years. Check with your dentist, physician, or public health department to learn how to have your home well water tested.

What should I do if the water from my well has less fluoride than the recommended level of 0.7 mg/L? Can I add fluoride?
The recommended fluoride level in drinking water for good oral health is 0.7 mg/L (milligrams per liter). If fluoride levels in your drinking water are lower than 0.7 mg/L, your child's dentist or pediatrician should evaluate whether your child could benefit from daily fluoride supplements. (The prescription dosage of fluoride supplements should be consistent with the **schedule*** (PDF–431K) established by the American Dental Association (ADA) Council on Scientific Affairs.) Their recommendation will depend on your child's risk of developing tooth decay, as well as exposure to other sources of fluoride, such as drinking water at school or daycare, and fluoride toothpaste. It is

not feasible to add fluoride to an individual residence's well.

What should I do if the water from my well has fluoride levels that are higher than the recommended level of 0.7 mg/L?
In some regions in the United States, community drinking water and private wells can contain levels of naturally occurring fluoride that are greater than the level recommended by the CDC for preventing tooth decay. Consuming water with fluoride between 0.6 and 2.0 mg/L results in reduced tooth decay, but consumption of water with fluoride exceeding 2.0 mg/L may increase the potential for **dental fluorosis**.

The U.S. Environmental Protection Agency (EPA) currently has a non-enforceable recommended guideline for fluoride of 2.0 mg/L to protect against dental fluorosis. If your home is served by a private well that has fluoride levels exceeding this recommended guideline, but lower than 4.0 mg/L, then it is best to provide children under 8 years of age with an alternative water source, such as bottled water with a low fluoride content.

Continue to test your well water's quality every three years as recommended by EPA.

What should I do if my well water was measured as having too much fluoride (level greater than 4 mg/L)?
It is unusual to have the fluoride content of water exceed 4 mg/L. If a laboratory report indicates that you have such excessive fluoride content, it is recommended that the water be retested. At least four samples should be collected, a minimum of one week apart, and the results compared. If one sample is above 4 mg/L and the other samples are less than 4 mg/L, then the high value may have been an erroneous measurement. If all samples register excessive levels greater than 4 mg/L, then you may want to consider investigating alternate sources of water for drinking and cooking, or installing a device to remove the fluoride from your home water source. Physical contact with high fluoride content water, such as bathing or dishwashing, is safe since fluoride does not pass through the skin.

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What are the health risks of consuming water with fluoride levels greater than 4 mg/L?
Children aged 8 years and younger have an increased chance of developing severe tooth dental fluorosis. Consumption over a lifetime may increase the likelihood of bone fractures, and may result in skeletal fluorosis, a painful or even crippling disease. The U.S. Environmental Protection Agency has determined that safe exposure of fluoride is below 4 mg/L in drinking water to avoid those effects.

Will using a home water filtration system take the fluoride out of my home's water?
Removal of fluoride from water is difficult. Most home point-of-use treatment systems that are installed at single faucets use activated carbon filtration, which does not remove the fluoride. Reverse osmosis point-of-use devices can effectively remove fluoride, although the amount may vary given individual circumstances. For a home point-of-use device to claim a reduction in fluoride, it must meet National Sanitation Foundation (NSF) Standard 58 criteria for fluoride removal. Standard 58 requires that a device must achieve a 1.5 milligrams per liter (mg/L) concentration in the product water if the original concentration was 8.0 mg/L, or approximately 80 percent removal. This percentage removal may not be consistent at lower concentrations of fluoride. Check with the manufacturer of the individual product for specific product information.

Fluoride is not released from water when it is boiled or frozen. One exception would be a water distillation system. These systems heat water to the boiling point and then collect water vapor as it evaporates. Water distillation systems are typically used in laboratories. For home use, these systems can be expensive and may present safety and maintenance concerns.

Can I use water with fluoride for preparing infant formula?
Yes, you can use well water for preparing infant formula. It is important, however, to ensure that the well water has been recently tested to verify safety. EPA suggests that well water should be tested a minimum of once every three years for micro-organisms and other substances. In addition, parents of young children should also have their well water tested for fluoride content.

For more information on private well testing, contact your local health department or visit the **EPA Web site**. Parents and caregivers should speak with their pediatrician to review the results of the private well testing and to determine if the well water should be boiled prior to mixing the formula. If you are advised to boil the water, be sure to boil the water only one time so that you don't concentrate substances by the boiling process itself.

If your child is exclusively consuming infant formula reconstituted with well water, and if that water contains fluoride, there is an increased chance for dental fluorosis. To lessen this chance, parents can use low-fluoride bottled water some of the time to mix infant formula; these bottled water are labeled as de-ionized, purified, demineralized, or distilled. For more information, see **Overview: Infant Formula and Fluorosis**.

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Page Located on the Web at http://www.cdc.gov/fluoridation/fact_sheets/wellwater.htm

FLUORIDES, HYDROGEN FLUORIDE, AND FLUORINE

CAS # 7681-49-4, 7664-39-3, 7782-41-4

Division of Toxicology ToxFAQs™ **September 2003**

This fact sheet answers the most frequently asked health questions (FAQs) about fluorides, hydrogen fluoride, and fluorine. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because these substances may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Fluorides are naturally occurring compounds. Low levels of fluorides can help prevent dental cavities. At high levels, fluorides can result in tooth and bone damage. Hydrogen fluoride and fluorine are naturally-occurring gases that are very irritating to the skin, eyes, and respiratory tract. These substances have been found in at least 188 of the 1,636 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What are fluorides, hydrogen fluoride, and fluorine?

Fluorides, hydrogen fluoride, and fluorine are chemically related. Fluorine is a naturally-occurring, pale yellow-green gas with a sharp odor. It combines with metals to make fluorides such as sodium fluoride and calcium fluoride, both white solids. Sodium fluoride dissolves easily in water, but calcium fluoride does not. Fluorine also combines with hydrogen to make hydrogen fluoride, a colorless gas. Hydrogen fluoride dissolves in water to form hydrofluoric acid.

Fluorine and hydrogen fluoride are used to make certain chemical compounds. Hydrofluoric acid is used for etching glass. Other fluoride compounds are used in making steel, chemicals, ceramics, lubricants, dyes, plastics, and pesticides.

Fluorides are often added to drinking water supplies and to a variety of dental products, including toothpaste and mouth rinses, to prevent dental cavities.

What happens to fluorides, hydrogen fluoride, and fluorine when they enter the environment?

❑Fluorine cannot be destroyed in the environment; it can only change its form. Fluorine forms salts with minerals in soil.
❑Hydrogen fluoride gas will be absorbed by rain and into clouds and fog to form hydrofluoric acid, which will fall to the ground.
❑Fluorides released to the air from volcanoes and industry are carried by wind and rain to nearby water, soil, and food sources.
❑Fluorides in water and soil will form strong associations with sediment or soil particles.
❑Fluorides will accumulate in plants and animals. In animals, the fluoride accumulates primarily in the bones or shell rather than in soft tissues.

How might I be exposed to fluorides, hydrogen fluoride, and fluorine?

❑The general population can be exposed to fluorides in contaminated air, food, drinking water and soil.
❑People living in communities with fluoridated water or high levels of naturally-occurring fluoride may be exposed to higher levels.
❑People who work or live near industries where fluoride-containing substances are used may be exposed to higher levels.

How can fluorides, hydrogen fluoride, and fluorine affect my health?

Small amounts of fluoride help prevent tooth cavities, but high levels can harm your health. In adults, exposure to high levels of fluoride can result in denser bones. However, if exposure is high enough, these bones may be more fragile and brittle and there may be a greater risk of breaking the bone. In animals, exposure to extremely high doses of fluoride can result in decreased fertility and sperm and testes damage.

Fluorine and hydrogen fluoride are very irritating to the skin, eyes, and respiratory tract. At high levels, such as may occur through exposure from an industrial accident, hydrogen fluoride may also damage the heart.

How likely are fluorides, hydrogen fluoride, and fluorine to cause cancer?

Most of the studies of people living in areas with fluoridated water or naturally high levels of fluoride in drinking water did not find an association between fluoride and cancer risk. Two animal cancer studies were inconclusive. The international Agency for Research on Cancer (IARC) has determined that the carcinogenicity of fluoride to humans is not classifiable.

How can fluorides, hydrogen fluoride, and fluorine affect children?

When used appropriately, fluoride is both safe and effective in preventing and controlling cavities. Drinking or eating excessive fluoride during the time teeth are being formed (before 8 years of age) can cause visible changes in teeth. This condition is called dental fluorosis. At very high concentrations of fluoride, the teeth can become more fragile and sometimes can break.

No studies have addressed whether low levels of fluoride will cause birth defects in humans. Birth defects have not been found in most studies of animals.

How can families reduce the risk of exposure to fluorides, hydrogen fluoride, and fluorine?

In the home, children may be exposed to high levels of fluorides if they swallow dental products containing fluoridated toothpaste, gels, or rinses. Parents should supervise brushing and place at most, a small pea size dab of toothpaste on the brush and teach children not to swallow dental products. People who live in areas with high levels of naturally-occurring fluoride in the water should use alternative sources of dinking water, such as bottled water.

Is there a medical test to show whether I've been exposed to fluoride, hydrogen fluoride, and fluorine?

Tests are available to measure fluoride levels in urine; these tests can determine if you have been exposed to higher-than-normal levels of fluorides. The urine test must be performed soon after exposure because fluoride that is not stored in bones leaves the body within a few days. The test cannot be performed in the doctor's office, but can be done at most laboratories that test for chemical exposure. The urine fluoride test cannot be used to predict the nature or severity of toxic effects. Bone sampling can be done in special cases to measure long-term exposure to fluorides.

Has the federal government made recommendations to protect human health?

The EPA has set a maximum amount of fluoride allowable in drinking water of 4.0 milligrams per liter of water (4.0 mg/L). For the prevention of dental decay, the Public Health Service (PHS) has, since 1962, recommended that public water supplies contain between 0.7 and 1.2 milligrams of fluoride per liter of drinking water.

The Occupational Safety and Health Administration (OSHA) has set limits of 0.2 milligrams per cubic meter (0.2 mg/m^3) for fluorine, 2.0 mg/m^3 for hydrogen fluoride, and 2.5 mg/m^3 for fluoride in workroom air to protect workers during an 8-hour shift over a 40-hour work week.

Source of Information

Agency for Toxic Substances and Disease Registry (ATSDR). 2003. Toxicological Profile for Fluorides, Hydrogen Fluoride, and Fluorine. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html. ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

Centers for Disease Control and Prevention
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Lead and Drinking Water from Private Wells

What is lead?

Lead is a naturally occurring bluish-gray metal found in small amounts on the earth's outer layer. Lead can be found in all parts of our environment. Much of it comes from human activities including burning fossil fuels, mining, and manufacturing.

Lead is found in many different materials. It can still be found in lead-based paint, batteries, ammunition, metal products such as solder and pipes, and devices to shield X-rays. Because of health concerns, the amount of lead found in gasoline, paints and ceramic products, caulking, and pipe solder has been reduced in recent years. As a result, the amount of lead in our blood now is much less than it was 30 years ago.

For more information about lead illnesses and treatment, please visit CDC-ATSDR's lead (http://www.atsdr.cdc.gov/tfacts13.html) page.

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Where and how does lead get into drinking water?

Lead rarely occurs naturally in water; it usually gets into the water from the delivery system. Lead pipes are the main contributor to high lead levels in tap water. Other sources include parts of the water delivery system such as lead solder used to join copper pipes, brass in faucets, coolers, and valves. Although brass usually contains low lead levels, the lead can still dissolve into the water, especially when the fixtures are new. Private wells more than 20 years old may contain lead in the "packer" element that is used to help seal the well above the well screen. Some brands of older submersible pumps used in wells may also contain leaded-brass components. Corrosion of pipes and fixture parts can cause the lead to get into tap water.

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How can I find out whether there is lead in my drinking water?

If you suspect a problem and your drinking water comes from a private well, you may contact your state certification officer (http://www.epa.gov/ogwdw/labs/index.html) (http://www.cdc.gov/Other/disclaimer.html) for a list of laboratories in your area that will perform tests on drinking water for a fee.

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How do I remove lead from my drinking water?

First, try to identify and remove the lead source. If you have a private well, check both the well and the pump for potential lead sources. A licensed well water contractor can help you determine if any of the well components are a source of lead.

Heating or boiling your water will not remove lead. Because some of the water evaporates during the boiling process, the lead concentration of the water can actually increase slightly as the water is boiled.

If it is not possible or cost-effective to remove the lead source, flushing the water system before using the water for drinking or cooking may be an option. Any time a particular faucet has not been used for several hours (approximately 6 or more), you can flush the system by running the water for about 1-2 minutes or until the water becomes as cold as it will get. Flush each faucet individually before using the water for drinking or cooking. You can use the water flushed from the tap to water plants, wash dishes or clothing, or clean. Avoid cooking with or drinking hot tap water because hot water dissolves lead more readily than cold water does. Do not use hot tap water to make cereals, drinks or mix baby formula. You may draw cold water after flushing the tap and then heat it if needed.

You may also wish to consider water treatment methods such as reverse osmosis, distillation, and carbon filters specially designed to remove lead. Typically these methods are used to treat water at only one faucet. Contact your local health department for recommended procedures. If you want to know more about these filters, please contact NSF International (http://nsf.org/certified/consumer/listings_advanced.asp?companyname=&productname=&programcode=WATER_FILTER&) (http://www.cdc.gov/Other/disclaimer.html) , an organization for public health and safety through standards development, product certification, education, and risk management. Remember to have your well water tested regularly (/healthywater/drinking/private/wells/testing.html) , at least once a year, to make sure the problem is controlled.

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Centers for Disease Control and Prevention 1600 Clifton Rd. Atlanta, GA 30333, USA
800-CDC-INFO (800-232-4636) TTY: (888) 232-6348, New Hours of Operation 8am-8pm ET/Monday-Friday Closed Holidays - cdcinfo@cdc.gov

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

LEAD

CAS # 7439-92-1

Division of Toxicology and Environmental Medicine ToxFAQs™ August 2007

This fact sheet answers the most frequently asked health questions (FAQs) about lead. For more information, call the ATSDR Information Center at 1-800-232-4636. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to lead can happen from breathing workplace air or dust, eating contaminated foods, or drinking contaminated water. Children can be exposed from eating lead-based paint chips or playing in contaminated soil. Lead can damage the nervous system, kidneys, and reproductive system. Lead has been found in at least 1,272 of the 1,684 National Priority List sites identified by the Environmental Protection Agency (EPA).

What is lead?

Lead is a naturally occurring bluish-gray metal found in small amounts in the earth's crust. Lead can be found in all parts of our environment. Much of it comes from human activities including burning fossil fuels, mining, and manufacturing.

Lead has many different uses. It is used in the production of batteries, ammunition, metal products (solder and pipes), and devices to shield X-rays. Because of health concerns, lead from paints and ceramic products, caulking, and pipe solder has been dramatically reduced in recent years. The use of lead as an additive to gasoline was banned in 1996 in the United States.

What happens to lead when it enters the environment?

❏ Lead itself does not break down, but lead compounds are changed by sunlight, air, and water.
❏ When lead is released to the air, it may travel long distances before settling to the ground.
❏ Once lead falls onto soil, it usually sticks to soil particles.
❏ Movement of lead from soil into groundwater will depend on the type of lead compound and the characteristics of the soil.

How might I be exposed to lead?

❏ Eating food or drinking water that contains lead. Water pipes in some older homes may contain lead solder. Lead can leach out into the water.
❏ Spending time in areas where lead-based paints have been used and are deteriorating. Deteriorating lead paint can contribute to lead dust.
❏ Working in a job where lead is used or engaging in certain hobbies in which lead is used, such as making stained glass.
❏ Using health-care products or folk remedies that contain lead.

How can lead affect my health?

The effects of lead are the same whether it enters the body through breathing or swallowing. Lead can affect almost every organ and system in your body. The main target for lead toxicity is the nervous system, both in adults and children. Long-term exposure of adults can result in decreased performance in some tests that measure functions of the nervous system. It may also cause weakness in fingers, wrists, or ankles. Lead exposure also causes small increases in blood pressure, particularly in middle-aged and older people and can cause anemia. Exposure to high lead levels can severely damage the brain and kidneys in adults or children and ultimately cause death. In pregnant women, high levels of exposure to lead may cause miscarriage. High-level exposure in men can damage the organs responsible for sperm production.

How likely is lead to cause cancer?

We have no conclusive proof that lead causes cancer in humans. Kidney tumors have developed in rats and mice that had been given large doses of some kind of lead compounds. The Department of Health and Human Services

(DHHS) has determined that lead and lead compounds are reasonably anticipated to be human carcinogens and the EPA has determined that lead is a probable human carcinogen. The International Agency for Research on Cancer (IARC) has determined that inorganic lead is probably carcinogenic to humans and that there is insufficient information to determine whether organic lead compounds will cause cancer in humans.

How can lead affect children?

Small children can be exposed by eating lead-based paint chips, chewing on objects painted with lead-based paint, or swallowing house dust or soil that contains lead.

Children are more vulnerable to lead poisoning than adults. A child who swallows large amounts of lead may develop blood anemia, severe stomachache, muscle weakness, and brain damage. If a child swallows smaller amounts of lead, much less severe effects on blood and brain function may occur. Even at much lower levels of exposure, lead can affect a child's mental and physical growth.

Exposure to lead is more dangerous for young and unborn children. Unborn children can be exposed to lead through their mothers. Harmful effects include premature births, smaller babies, decreased mental ability in the infant, learning difficulties, and reduced growth in young children. These effects are more common if the mother or baby was exposed to high levels of lead. Some of these effects may persist beyond childhood.

How can families reduce the risks of exposure to lead?

❏ Avoid exposure to sources of lead.

❏ Do not allow children to chew or mouth surfaces that may have been painted with lead-based paint.

❏ If you have a water lead problem, run or flush water that has been standing overnight before drinking or cooking with it.

❏ Some types of paints and pigments that are used as make-up or hair coloring contain lead. Keep these kinds of products away from children

❏ If your home contains lead-based paint or you live in an area contaminated with lead, wash children's hands and faces often to remove lead dusts and soil, and regularly clean the house of dust and tracked in soil.

Is there a medical test to determine whether I've been exposed to lead?

A blood test is available to measure the amount of lead in your blood and to estimate the amount of your recent exposure to lead. Blood tests are commonly used to screen children for lead poisoning. Lead in teeth or bones can be measured by X-ray techniques, but these methods are not widely available. Exposure to lead also can be evaluated by measuring erythrocyte protoporphyrin (EP) in blood samples. EP is a part of red blood cells known to increase when the amount of lead in the blood is high. However, the EP level is not sensitive enough to identify children with elevated blood lead levels below about 25 micrograms per deciliter (µg/dL). These tests usually require special analytical equipment that is not available in a doctor's office. However, your doctor can draw blood samples and send them to appropriate laboratories for analysis.

Has the federal government made recommendations to protect human health?

The Centers for Disease Control and Prevention (CDC) recommends that states test children at ages 1 and 2 years. Children should be tested at ages 3–6 years if they have never been tested for lead, if they receive services from public assistance programs for the poor such as Medicaid or the Supplemental Food Program for Women, Infants, and Children, if they live in a building or frequently visit a house built before 1950; if they visit a home (house or apartment) built before 1978 that has been recently remodeled; and/or if they have a brother, sister, or playmate who has had lead poisoning. CDC considers a blood lead level of 10 µg/dL to be a level of concern for children.

EPA limits lead in drinking water to 15 µg per liter.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2007. Toxicological Profile for lead (Update). Atlanta, GA: U.S. Department of Public Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology and Environmental Medicine, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-800-232-4636, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html. ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

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AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

MANGANESE

CAS # 7439-96-5

Division of Toxicology and Environmental Medicine ToxFAQs™ September 2008

This fact sheet answers the most frequently asked health questions (FAQs) about manganese. For more information, call the ATSDR Information Center at 1-800-232-4636. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Manganese is a trace element and eating a small amount from food or water is needed to stay healthy. Exposure to excess levels of manganese may occur from breathing air, particularly where manganese is used in manufacturing, and from drinking water and eating food. At high levels, it can cause damage to the brain. Manganese has been found in at least 869 of the 1,669 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What is manganese?

Manganese is a naturally occurring metal that is found in many types of rocks. Pure manganese is silver-colored, but does not occur naturally. It combines with other substances such as oxygen, sulfur, or chlorine. Manganese occurs naturally in most foods and may be added to some foods.

Manganese is used principally in steel production to improve hardness, stiffness, and strength. It may also be used as an additive in gasoline to improve the octane rating of the gas.

What happens to manganese when it enters the environment?

❏ Manganese can be released to the air, soil, and water from the manufacture, use, and disposal of manganese-based products.
❏ Manganese cannot break down in the environment. It can only change its form or become attached to or separated from particles.
❏ In water, manganese tends to attach to particles in the water or settle into the sediment.
❏ The chemical state of manganese and the type of soil determine how fast it moves through the soil and how much is retained in the soil.
❏ The manganese-containing gasoline additive may degrade in the environment quickly when exposed to sunlight, releasing manganese.

How might I be exposed to manganese?

❏ The primary way you can be exposed to manganese is by eating food or manganese-containing nutritional supplements. Vegetarians who consume foods rich in manganese such as grains, beans and nuts, as well as heavy tea drinkers, may have a higher intake of manganese than the average person.
❏ Certain occupations like welding or working in a factory where steel is made may increase your chances of being exposed to high levels of manganese.
❏ Manganese is routinely contained in groundwater, drinking water, and soil at low levels. Drinking water containing manganese or swimming or bathing in water containing manganese may expose you to low levels of this chemical.

How can manganese affect my health?

Manganese is an essential nutrient, and eating a small amount of it each day is important to stay healthy.

The most common health problems in workers exposed to high levels of manganese involve the nervous system. These health effects include behavioral changes and other nervous system effects, which include movements that may become slow and clumsy. This combination of symptoms when sufficiently severe is referred to as "manganism". Other less severe nervous system effects such as slowed hand movements have been observed in some workers exposed to lower concentrations in the work place.

Nervous system and reproductive effects have been observed in animals after high oral doses of manganese.

How likely is manganese to cause cancer?

The EPA concluded that existing scientific information cannot determine whether or not excess manganese can cause cancer.

How can manganese affect children?

Studies in children have suggested that extremely high levels of manganese exposure may produce undesirable effects on brain development, including changes in behavior and decreases in the ability to learn and remember. We do not know for certain that these changes were caused by manganese alone. We do not know if these changes are temporary or permanent. We do not know whether children are more sensitive than adults to the effects of manganese, but there is some indication from experiments in laboratory animals that they may be.

Studies of manganese workers have not found increases in birth defects or low birth weight in their offspring. No birth defects were observed in animals exposed to manganese.

How can families reduce the risks of exposure to manganese?

❏ Children are not likely to be exposed to harmful amounts of manganese in the diet. However, higher-than-usual amounts of manganese may be absorbed if their diet is low in iron. It is important to provide your child with a well-balanced diet.

❏ Workers exposed to high levels of airborne manganese in certain occupational settings may accumulate manganese dust on their work clothes. Manganese-contaminated work clothing should be removed before getting into your car or entering your home to help reduce the exposure hazard for yourself and your family.

Is there a medical test to determine whether I've been exposed to manganese?

Several tests are available to measure manganese in blood, urine, hair, or feces. Because manganese is normally present in our body, some is always found in tissues or fluids.

Because excess manganese is usually removed from the body within a few days, past exposures are difficult to measure with common laboratory tests.

Has the federal government made recommendations to protect human health?

The EPA has determined that exposure to manganese in drinking water at concentrations of 1 mg/L for up to 10 days is not expected to cause any adverse effects in a child.

The EPA has established that lifetime exposure to 0.3 mg/L manganese is not expected to cause any adverse effects.

The FDA has determined that the manganese concentration in bottled drinking water should not exceed 0.05 mg/L.

The Occupational Health and Safety Administration (OSHA) has established a ceiling limit (concentration that should not be exceeded at any time during exposure) of 5 mg/m^3 for manganese in workplace air.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2008. Toxicological Profile for Manganese (Draft for Public Comment). Atlanta, GA: U.S. Department of Public Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology and Environmental Medicine, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-800-232-4636, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html. ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

Centers for Disease Control and Prevention
CDC 24/7: Saving Lives. Protecting People. Saving Money through Prevention.

Nitrate and Drinking Water from Private Wells

What is nitrate?

Nitrate is a compound that is formed naturally when nitrogen combines with oxygen or ozone. Nitrogen is essential for all living things, but high levels of nitrate in drinking water can be dangerous to health, especially for infants and pregnant women. Nitrates are also made in large amounts by plants and animals, and are released in smoke and industrial or automotive exhaust.

For more information about nitrate illness and treatment, please visit EPA's nitrate (http://www.epa.gov/safewater/contaminants/dw_contamfs/nitrates.html) (http://www.cdc.gov/Other/disclaimer.html) page.

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Where and how does nitrate get into drinking water?

Nitrate can occur naturally in surface and groundwater at a level that does not generally cause health problems. High levels of nitrate in well water often result from improper well construction, well location, overuse of chemical fertilizers, or improper disposal of human and animal waste. Sources of nitrate that can enter your well include fertilizers, septic systems, animal feedlots, industrial waste, and food processing waste. Wells may be more vulnerable to such contamination after flooding, particularly if the wells are shallow, have been dug or bored, or have been submerged by floodwater for long periods of time.

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How can I find out whether there is nitrate in my drinking water?

If you suspect a problem and your drinking water comes from a private well, you may contact your state certification officer (http://www.epa.gov/ogwdw/labs/index.html) (http://www.cdc.gov/Other/disclaimer.html) for a list of laboratories in your area that will perform tests on drinking water for a fee.

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How do I remove nitrate from my drinking water?

Nitrate may be successfully removed from water using treatment processes such as ion exchange, distillation, and reverse osmosis. Contact your local health department for recommended procedures.

Heating or boiling your water will not remove nitrate. Because some of the water will evaporate during the boiling process, the nitrate levels of water can actually increase slightly in concentration if the water is boiled. Mechanical filters or chemical disinfection, such as chlorination, DO NOT remove nitrate from water.

Remember to have your well water tested regularly (/healthywater/drinking/private/wells/testing.html) , at least once a year, after installing a treatment system to make sure the problem is controlled.

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Centers for Disease Control and Prevention 1600 Clifton Rd. Atlanta, GA 30333, USA
800-CDC-INFO (800-232-4636) TTY: (888) 232-6348, New Hours of Operation 8am-8pm ET/Monday-Friday
Closed Holidays - cdcinfo@cdc.gov

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AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

NITRATES AND NITRITES

CAS # 84145-82-4, 14797-65-0

Division of Toxicology and Environmental Medicine ToxFAQs™ January 2011

This fact sheet answers the most frequently asked health questions (FAQs) about nitrates and nitrites. For more information, call the ATSDR Information Center at 1-800-232-4636. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because these substances may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Nitrates and nitrites occur in soil, in water, and in some foods. They are naturally occurring inorganic nitrogen ions. Nitrates are a natural part of the human diet. When drinking water or eating food from areas containing nitrogen-based fertilizers, people could be exposed to high nitrate and nitrite levels. The most serious health condition caused by high nitrate or nitrite exposure is acute acquired methemoglobinemia. Infants younger than 4 months of age exposed to high levels of nitrates/nitrites are especially prone to acute acquired methemoglobinemia, which is described more fully in this fact sheet in the section entitled "How can nitrates and nitrites affect my health?"

What are nitrates and nitrites?

Nitrate (NO_3^-) and nitrite (NO_2^-) are inorganic ions that occur naturally and are part of the nitrogen cycle. Nitrates (e.g., potassium nitrate and ammonium nitrate) are common ingredients of fertilizer that contains nitrogen.

What happens to nitrates and nitrites when they enter the environment?

- ❏ Nitrite oxidizes easily into nitrate. Nitrate thus more frequently occurs in groundwater and surface water.
- ❏ Nitrate-containing compounds in the soil are generally soluble, which means they dissolve easily in water. Nitrates thus flow easily into groundwater.
- ❏ Nitrates and nitrites both occur in soil and water. Microbes break down animal and human organic wastes in soil and water. This breakdown process converts wastes into ammonia, which then oxidizes into nitrite and nitrate.

How might I be exposed to nitrates and nitrites?

- ❏ You might be exposed to nitrates and nitrites as normal parts of a human diet. Vegetables such as cauliflower, spinach, collard greens, broccoli, beets, and root vegetables have naturally greater nitrate content than do other plant foods.
- ❏ You may be exposed to high amounts of nitrates/nitrites from soil and water contaminated by runoff from nitrogen-containing fertilizers (e.g., potassium nitrate and ammonium nitrate).
- ❏ You may be exposed to nitrates/nitrites from contaminated foodstuffs, from certain medications, and from certain inhalants that give off nitrite fumes.

How can nitrates and nitrites affect my health?

Excessive nitrate or nitrite exposure can result in acute acquired methemoglobinemia, a serious health condition.

Hemoglobin in blood carries oxygen from the lungs to tissues and helps carry carbon dioxide back to the lungs.

Hemoglobin in blood contains iron normally found in the Fe^{2+} (ferrous) state. But excessive nitrates or nitrites can alter the iron in hemoglobin to the Fe^{3+} (ferric) state. This forms methemoglobin, an abnormal form of hemoglobin. As methemoglobin forms, the blood loses its ability to carry oxygen to tissues (anoxia).

Methemoglobinemia is actually an excess of methemoglobin in the blood. Methemoglobinemia can cause cyanosis (blue skin) of limbs/trunk, weakness, and rapid heart rate. If methemoglobinemia progresses in severity, central nervous system depression can occur, as can headache, dizziness, fatigue, difficulty in breathing, and nausea. Finally, severe methemoglobinemia can cause lethargy, brief loss of consciousness, irregular heartbeat, shock, convulsions, coma, and even death. In fact, methemoglobin levels greater than 50% are potentially fatal (Nathan et al. 1977).

Nitrate and nitrite medications may cause hypotension (low blood pressure). But ingestion of nitrates and nitrites in food and water does not commonly result in hypotension.

Maternal exposure to environmental nitrates and nitrites may increase the risk of pregnancy complications such as anemia, abortion, premature labor, or preeclampsia.

Methemoglobinemia can also occur from other causes. Exposure to oxidizing drugs or chemicals, systemic acidosis (a generalized, abnormal increase in body fluid acidity), diarrhea, or some genetic disorders such as infant cyanosis (bluish discoloration of skin and mucus membranes) shortly after birth can all result in methemoglobinemia.

How likely are nitrates and nitrites to cause cancer?

The Department of Health and Human Services (DHHS), the International Agency for Research on Cancer (IARC), and the Environmental Protection Agency (EPA) have not classified nitrates and nitrites as to their human carcinogenicity.

Still, a metabolic pathway is available for nitrites to react with molecules in organisms to form N-nitroso compounds, some of which may cause cancer.

How can nitrates and nitrites affect children?

In some infants, fetal methemoglobinemia can be a significant problem. An infant's highly alkaline gastrointestinal system favors the growth of nitrate-reducing bacteria, particularly in the stomach and especially after ingestion of contaminated water. This can lead to conversion of nitrates into high levels of nitrites. These can change the hemoglobin in blood to methemoglobin. An adult stomach, however, is typically too acidic to allow for significant bacterial growth that would convert nitrates to nitrites.

Infants younger than 4 months of age are prone to nitrite exposure, especially infants who ingest formula diluted with water from nitrate-contaminated rural domestic wells. A portion of hemoglobin in young infants is still in the form of fetal hemoglobin. Nitrites can more readily generate met-hemoglobin from oxidized fetal hemoglobin than from adult hemoglobin. Thus, infants less than 4 months of age, and especially premature infants, are particularly susceptible to such exposure.

At or near the 30th week of pregnancy, an expectant mother and her fetus might be more sensitive to toxicity from nitrites or nitrates.

How can families reduce the risk of exposure to nitrates and nitrites?

❑ You should avoid exposure to water, soil, or food contaminated with high levels of nitrates and nitrites.

❑ If you have well water that comes from areas that contain large amounts of nitrogen-containing fertilizers, you should monitor the water closely.

Is there a medical test to determine whether I've been exposed to nitrates and nitrites?

No routine medical tests are available to determine nitrate and nitrite levels.

Routine blood tests are available to detect methemoglobinemia. But these tests cannot tell whether the high methemoglobin levels were caused by nitrates or nitrites.

Has the federal government made recommendations to protect human health?

The U.S. EPA has set an enforceable standard called a maximum contaminant level (MCL) for nitrates at 10 ppm and for nitrites at 1 ppm in drinking water. Public water supplies meeting certain criteria must follow these regulations.

The U.S. EPA has set a reference dose (RfD) for nitrate of 1.6 mg nitrate nitrogen/kg body weight per day (equivalent to about 7.0 mg nitrate ion/kg body weight per day).

The U.S. EPA has set an RfD of 0.1 mg nitrite nitrogen/kg body weight per day (equivalent to 0.33 mg nitrite ion/kg body weight per day).

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2007. Case Studies in Environmental Medicine, Nitrate/Nitrite Toxicity. Atlanta, GA: U.S. Department of Public Health and Human Services, Public Health Service.

Agency for Toxic Substances and Disease Registry (ATSDR). 2004. Interaction Profile for: cyanide, fluoride, nitrate, and uranium. Atlanta, GA: U.S. Department of Public Health and Human Services, Public Health Service.

Nathan DM; Siegel AJ, Bunn HF. 1977. Acute methemoglobinemia and hemolytic anemia with phenazopyridine. Arch Intern Med:137(11):1636-1638.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology and Environmental Medicine, 1600 Clifton Road NE, Mailstop F-62, Atlanta, GA 30333. Phone: 1-800-232-4636, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html. ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

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ZINC

CAS # 7440-66-6

Division of Toxicology ToxFAQs™ **August 2005**

This fact sheet answers the most frequently asked health questions (FAQs) about zinc. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Zinc is a naturally occurring element. Exposure to high levels of zinc occurs mostly from eating food, drinking water, or breathing workplace air that is contaminated. Low levels of zinc are essential for maintaining good health. Exposure to large amounts of zinc can be harmful. It can cause stomach cramps, anemia, and changes in cholesterol levels. Zinc has been found in at least 985 of the 1,662 National Priority List sites identified by the Environmental Protection Agency (EPA).

What is zinc?

Zinc is one of the most common elements in the earth's crust. It is found in air, soil, and water, and is present in all foods. Pure zinc is a bluish-white shiny metal.

Zinc has many commercial uses as coatings to prevent rust, in dry cell batteries, and mixed with other metals to make alloys like brass, and bronze. A zinc and copper alloy is used to make pennies in the United States.

Zinc combines with other elements to form zinc compounds. Common zinc compounds found at hazardous waste sites include zinc chloride, zinc oxide, zinc sulfate, and zinc sulfide. Zinc compounds are widely used in industry to make paint, rubber, dyes, wood preservatives, and ointments.

What happens to zinc when it enters the environment?

❏ Some is released into the environment by natural processes, but most comes from human activities like mining, steel production, coal burning, and burning of waste.
❏ It attaches to soil, sediments, and dust particles in the air.
❏ Rain and snow remove zinc dust particles from the air.
❏ Depending on the type of soil, some zinc compounds can move into the groundwater and into lakes, streams, and rivers.
❏ Most of the zinc in soil stays bound to soil particles and does not dissolve in water.
❏ It builds up in fish and other organisms, but it does not build up in plants.

How might I be exposed to zinc?

❏ Ingesting small amounts present in your food and water.
❏ Drinking contaminated water or a beverage that has been stored in metal containers or flows through pipes that have been coated with zinc to resist rust.
❏ Eating too many dietary supplements that contain zinc.
❏ Working on any of the following jobs: construction, painting, automobile mechanics, mining, smelting, and welding; manufacture of brass, bronze, or other zinc-containing alloys; manufacture of galvanized metals; and manufacture of machine parts, rubber, paint, linoleum, oilcloths, batteries, some kind of glass, ceramics, and dyes.

How can zinc affect my health?

Zinc is an essential element in our diet. Too little zinc can cause problems, but too much zinc is also harmful.

Harmful effects generally begin at levels 10-15 times higher than the amount needed for good health. Large doses taken by mouth even for a short time can cause stomach cramps, nausea, and vomiting. Taken longer, it can cause anemia and decrease the levels of your good cholesterol. We do not know if high levels of zinc affect reproduction in humans. Rats that were fed large amounts of zinc became infertile.

Inhaling large amounts of zinc (as dusts or fumes) can cause a specific short-term disease called metal fume fever. We do not know the long-term effects of breathing high levels of zinc.

Putting low levels of zinc acetate and zinc chloride on the skin of rabbits, guinea pigs, and mice caused skin irritation. Skin irritation will probably occur in people.

How likely is zinc to cause cancer?

The Department of Health and Human Services (DHHS) and the International Agency for Research on Cancer (IARC) have not classified zinc for carcinogenicity. Based on incomplete information from human and animal studies, the EPA has determined that zinc is not classifiable as to its human carcinogenicity.

How can zinc affect children?

Zinc is essential for proper growth and development of young children. It is likely that children exposed to very high levels of zinc will have similar effects as adults. We do not know whether children are more susceptible to the effects of excessive intake of zinc than the adults.

We do not know if excess zinc can cause developmental effects in humans. Animal studies have found decreased weight in the offspring of animals that ingested very high amounts of zinc.

How can families reduce the risks of exposure to zinc?

❏ Children living near waste sites that contain zinc may be exposed to higher levels of zinc through breathing contaminated air, drinking contaminated drinking water, touching or eating contaminated soil.
❏ Discourage your children from eating soil or putting their hands in their mouths and teach them to wash their hands frequently and before eating.
❏ If you use medicines or vitamin supplements containing zinc, make sure you use them appropriately and keep them out of the reach of children.

Is there a medical test to determine whether I've been exposed to zinc?

There are tests available to measure zinc in your blood, urine, hair, saliva, and feces. These tests are not usually done in the doctor's office because they require special equipment. High levels of zinc in the feces can mean high recent zinc exposure. High levels of zinc in the blood can mean high zinc consumption and/or high exposure. Tests to measure zinc in hair may provide information on long-term zinc exposure; however, the relationship between levels in your hair and the amount of zinc you were exposed to is not clear.

Has the federal government made recommendations to protect human health?

The EPA recommends that drinking water should contain no more than 5 milligrams per liter of water (5 mg/L) because of taste. The EPA requires that any release of 1,000 pounds (or in some cases 5,000 pounds) into the environment be reported to the agency.

To protect workers, the Occupational Safety and Health Administration (OSHA) has set an average limit of 1 mg/m^3 for zinc chloride fumes and 5 mg/m^3 for zinc oxide (dusts and fumes) in workplace air during an 8-hour workday, 40-hour workweek.

Similarly, the National Institute for Occupational Safety and Health (NIOSH) has set the same standards for up to a 10-hour workday over a 40-hour workweek.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2005. Toxicological Profile for Zinc (Update). Atlanta, GA: U.S. Department of Public Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html. ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

APPENDIX E
MICROBIAL REFERENCE TABLES

Table 1: EPA's section 304(a) ambient water quality criteria for bacteria. (1) Freshwaters:

A Indicator[d]	B Geometric mean	C Single sample maximum (per 100 ml)			
		C1 Designated bathing beach (75% confidence level)	C2 Moderate use costal recreation waters (82% confidence level)	C3 Light use coastal recreation waters (90% confidence level)	C4 Infrequent use coastal recreation waters (95% confidence level)
E. coli [e]	126/100 mil[a]	[b]235	[b]298	[b]409	[b]575
Enterococci[e]	33/100 ml[c]	[b]61	[b]78	[b]107	[b]151

Footnotes to table in paragraph (c)(1):
a. This value is for use with analytical methods 1103.1, 1603, or 1604 or any equivalent method that measures viable bacteria.
b. Calculated using the following: single sample maximum = geometric mean * 10^(confidence level factor * log standard deviation), where the confidence level factor is: 75%: 0.68; 82%: 0.94; 90%: 1.28; 95%: 1.65. The log standard deviation from EPA's epidemiological studies is 0.4.
c. This value is for use with analytical methods 1106.1 or 1600 or any equivalent method that measures viable bacteria.
d. The State may determine which of these indicators applies to its freshwater coastal recreation waters. Until a State makes that determination, *E. coli* will be the applicable indicator.
e. These values apply to *E. coli* or enterococci regardless of origin unless a sanitary survey shows that sources of the indicator bacteria are non-human and an epidemiological study shows that the indicator densities are not indicative of a human health risk.

Table 2: Alaska Water Quality Standards for Designated Uses

POLLUTANT & WATER USE CRITERIA	CRITERIA
(2) FECAL COLIFORM BACTERIA (FC), FOR FRESH WATER USES (See note 1)	
(A) Water Supply (i) drinking, culinary, and food processing	In a 30-day period, the geometric mean may not exceed 20 FC/100 ml, and not more than 10% of the samples may exceed 40 FC/100 ml. For groundwater, the FC concentration must be less than 1 FC/100 ml, using the fecal coliform Membrane Filter Technique, or less than 3 FC/100 ml, using the fecal coliform most probable number (MPN) technique
(A) Water Supply (ii) agriculture, including irrigation and stock watering	The geometric mean of samples taken in a 30-day period may not exceed 200 FC/100 ml, and not more than 10% of the samples may exceed 400 FC/100 ml. For products not normally cooked and for dairy sanitation of unpasteurized products, the criteria for drinking water supply, (2)(A)(i), apply.
(B) Water Recreation (i) contact recreation	In a 30-day period, the geometric mean of samples may not exceed 100 FC/100 ml, and not more than one sample, or more than 10% of the samples if there are more than 10 samples, may exceed 200 FC/100 ml.
(B) Water Recreation (ii) secondary recreation	In a 30-day period, the geometric mean of samples may not exceed 200 FC/100 ml, and not more than 10% of the total samples may exceed 400 FC/100 ml.

http://dec.alaska.gov/water/wqsar/wqs/pdfs/18_AAC_70_as_Amended_Through_May_26_2011.pdf

APPENDIX F
MICROBIAL FIGURES AND TABLES

APPENDIX F.i.
EKWOK MICROBIAL FIGURES AND TABLES

Ekwok

Figure 4: Cumulative *E.coli* (Spring A and Fall B) and *Enterococcus sp.* (Spring C and Fall D) microbial indicator organism density detected in landfill impacted and control surface water samples.

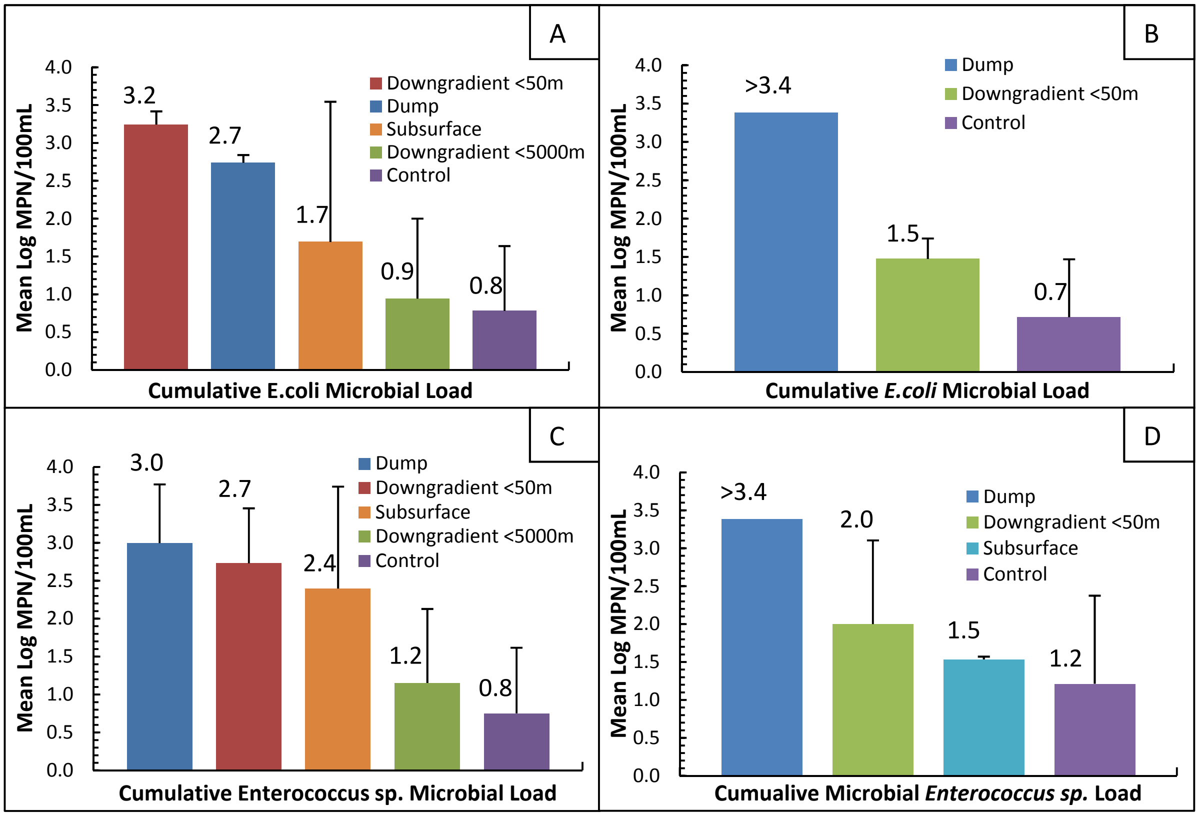

Table1: List of Ekwok tested microbial samples, which are exceeded the EPA recommended bacteria geometric mean for water quality criteria.

	Indicator	
Location	***E. coli*** **Recommended geometric mean 126/100 ml**	**Enterococci Recommended geometric mean 33/100 ml**
Dump Impacted Water Spring 2010	631/100mL	794/100mL
<50m downgradient Spring 2010	1585/100mL	126/100mL
Subsurface Water Spring 2010	2512/100mL	2512/100mL
Dump Impacted Water Fall 2010	2512/100mL	2512/100mL
<50m downgradient Fall 2010		316/100mL
Dump Impacted Water Spring 2011	398/100mL	2512/100mL
<50m downgradient Spring 2011	1585/100mL	2512/100mL
Dump Impacted Water Fall 2011	2512/100mL	2512/100mL
Total Number	7	8

APPENDIX F.ii.
EEK MICROBIAL FIGURES AND TABLES

Eek

Figure 1: Cumulative *E.coli* {Fall 2009-11 (A), Spring 2010-11(C)} and *Enterococcus sp.*{Fall 2009-11 (B), Spring 2010-11 (D)} microbial indicator organism load detected in impacted dump and control surface waters.

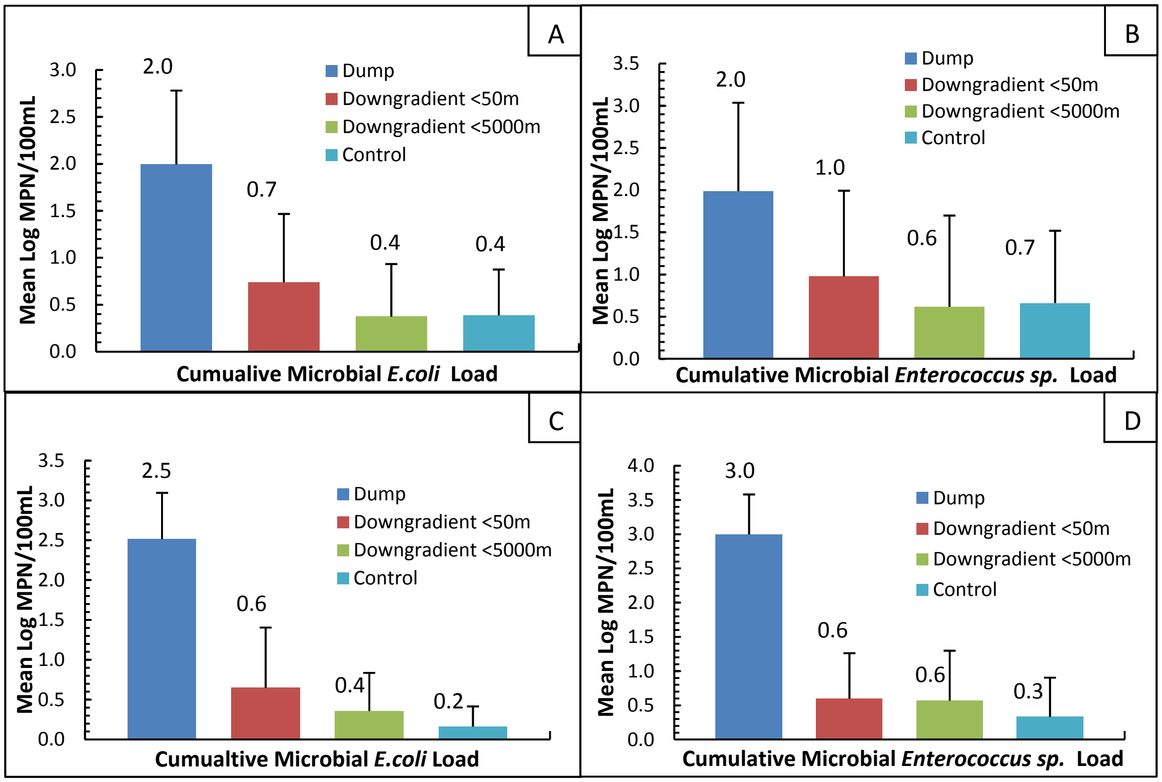

Table1: List of Eek tested microbial samples that exceeded the EPA recommended bacteria geometric mean for water quality criteria.

	Indicator	
Location	***E. coli*** **Recommended geometric mean 126/100 ml**	***Enterococci*** **Recommended geometric mean 33/100 ml**
Dump Impacted Water Fall 2009		200/100mL
Dump Impacted Water Spring 2010	501/100mL	2512/100mL
Dump Impacted Water Fall 2010	126/100mL	126/100mL
Dump Impacted Water Spring 2011	215/100mL	371/100mL
Dump Impacted Water Fall 2011		63/100mL
Total Number	3	5

APPENDIX F.iii.
WHITE MOUNTAIN MICROBIAL FIGURES AND TABLES

White Mountain

Figure 1: *E.coli* (A) and *Enterococcus sp.* (B) microbial indicator organism load detected in impacted dump and control surface water samples

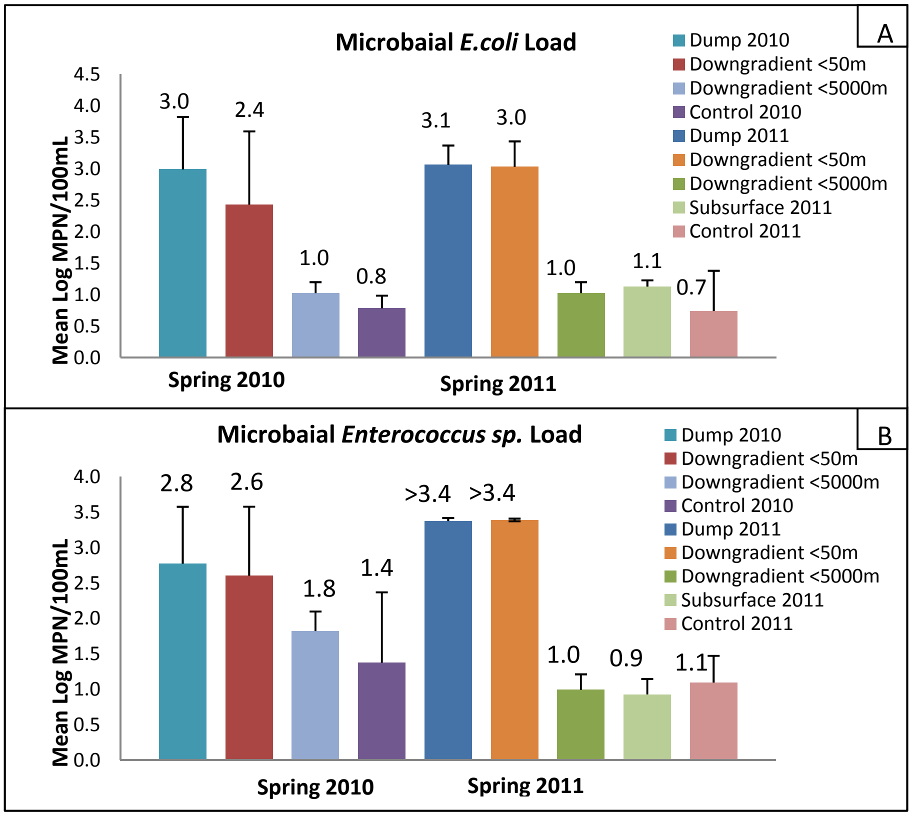

Table1: List of White Mountain tested microbial samples, which are exceeded the EPA recommended bacteria geometric mean for water quality criteria.

	Indicator	
Location	***E. coli*** **Recommended geometric mean 126/100 ml**	**Enterococci Recommended geometric mean 33/100 ml**
Dump Impacted Water Spring 2010	1000/100mL	631/100mL
<50m downgradient Spring 2010	251/100mL	398/100mL
Dump Impacted Water Spring 2011	1259/100mL	2512/100mL
<50m downgradient Spring 2011	1000/100mL	2512/100mL
Total Number	4	4

APPENDIX F.iv.
FORT YUKON MICROBIAL FIGURES AND TABLES

Fort Yukon

Figure 1: *E.coli* (A) and *Enterococcus sp.* (B) microbial indicator organism load detected in impacted dump and control surface water samples on June 22, 2010, May 23, 2011, and August 19, 2011.

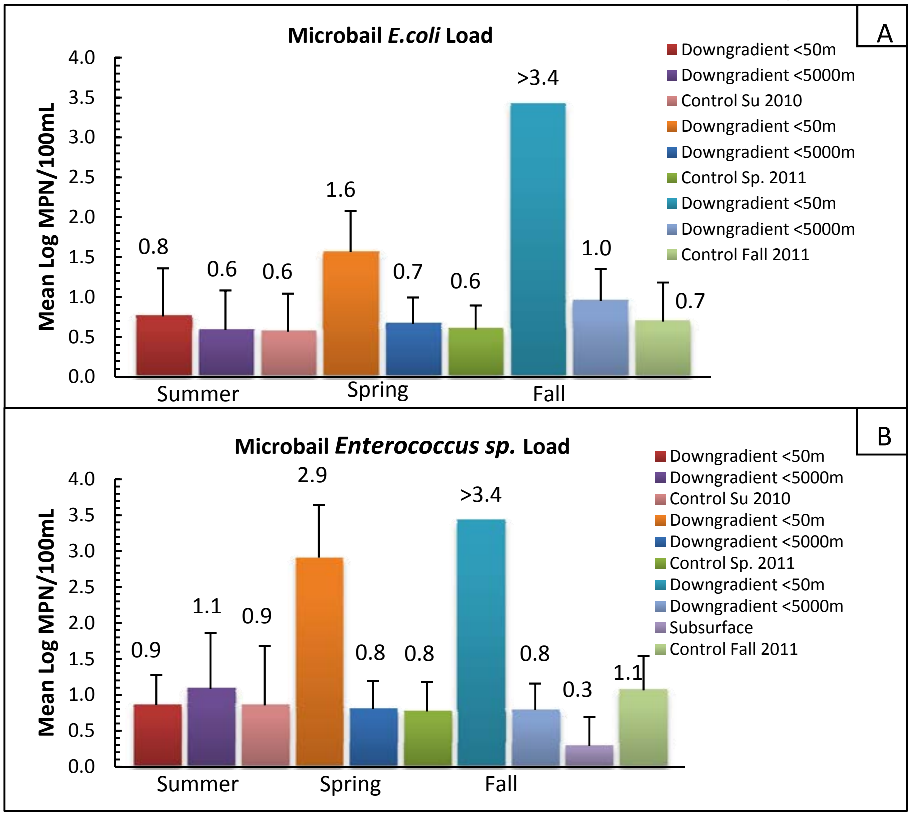

Table1: List of Fort Yukon tested microbial samples, which exceeded EPA recommended geometric mean for water quality criteria.

	Indicator	
Location	***E. coli*** **Recommended geometric mean 126/100 ml**	***Enterococci*** **Recommended geometric mean 33/100 ml**
<50m downgradient Spring 2011		794/100mL
<50m downgradient Fall 2011	2512/100mL	2512/100mL
Total Number	1	2

APPENDIX F.v.
ALLAKAKET MICROBIAL FIGURES AND TABLES

Allakaket

Figure 1: *E.coli* (A) and *Enterococcus* (B) microbial indicators detected in impacted dump and control surface water samples on July 7, 2010 and August 17, 2011.

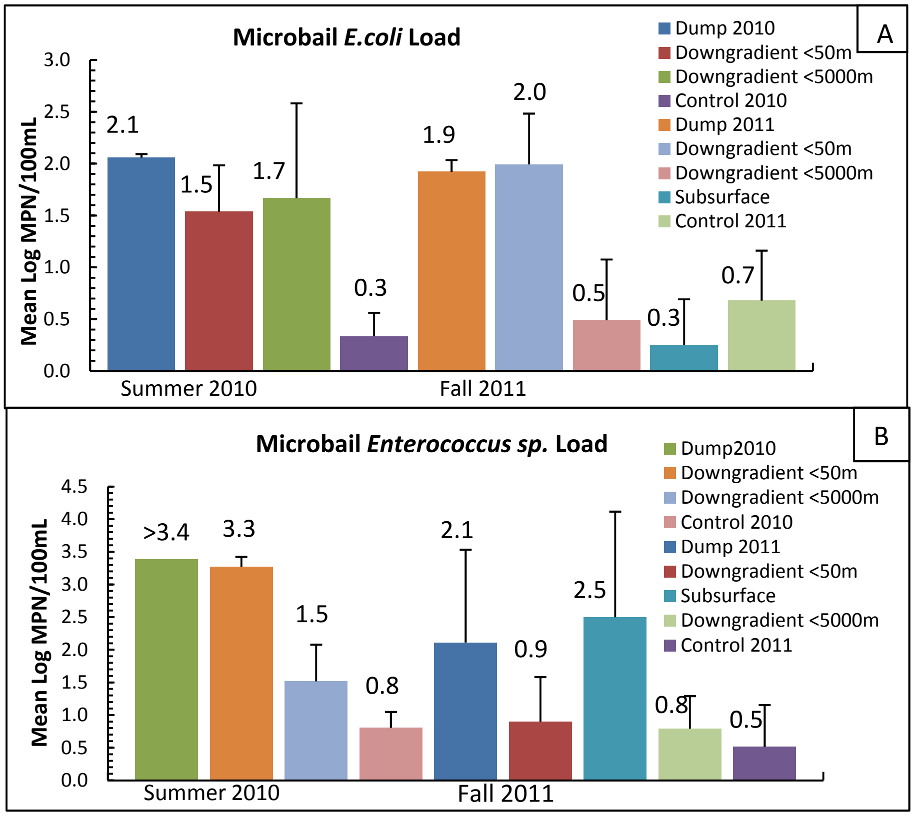

Table1: List of Allakaket tested microbial samples exceeding EPA recommended bacterial geometric mean for water quality criteria 1986.

	Indicator	
Location	***E. coli*** **Recommended geometric mean 126/100 ml**	***Enterococci*** **Recommended geometric mean 33/100 ml**
Dump Impacted Water 2010	126/10mL	2512/100mL
<50m Downgradient 2010		1995/100mL
Dump Impacted Water 2011		125/100mL
Subsurface Water 2011		316/100mL
Total Number	1	4