1999 Site Characterization Report
Red Top Retort Site
Aleknagik, Alaska

Prepared for

U.S. Department of the Interior
Bureau of Land Management
Alaska State Office
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HLA Project 41475

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DISTRIBUTION

1.0 INTRODUCTION

Harding Lawson Associates/Wilder Construction Company Joint Venture (HLA/Wilder) prepared this report for the U.S. Bureau of Land Management (BLM) to present additional site investigation results from 1999 work completed at the Red Top Retort site. The BLM assigned this project to HLA/Wilder under Modification 03 to Delivery Order 11 of Contract 1422-N660-C97-3025.

1.1 Site Background

The Red Top Retort site is on the north bank of the Wood River in Section 32, Township 10 south, Range 55 west, Seward Meridian. The site is approximately 1/8 acre in size and is approximately 18 miles north of Dillingham, Alaska, and 2 miles east-southeast of Aleknagik, Alaska (Figure 1).

The Red Top Retort site processed mercury ore (cinnabar) derived at the Red Top Mine from approximately 1952 to 1955. Mercury was extracted by heating crushed ore in a retort chamber (steel cylinder 8.5 feet long and 2 feet in diameter). The chamber was housed in a small wood structure, approximately 10 feet wide and 15 feet long. Heat for the process was produced by burning wood and bunker C fuel.

1.2 Previous Investigation and Remedial Action

In June1994, Quest Environmental (Quest) performed a site assessment at the Red Top Retort site. Laboratory analytical results indicated that soils in the vicinity of the retort structure contained mercury and diesel-range organics (DRO) at concentrations exceeding state and federal regulatory levels. In September 1994, the retort building and associated equipment and supplies (including asbestos heat panels and gaskets) were decommissioned and placed in 1-cubic yard (yd^3) plastic storage boxes (totes) and stored on site. Soil suspected of exceeding state and federal regulatory levels for mercury contamination near the former retort building was excavated, placed in 1-yd^3 totes, and stored on site. The approximate dimensions of the resulting excavation were 55 feet wide, 75 feet long, and 2 to 3 feet deep (Quest, 1995). Samples collected from the limits of the excavation contained total mercury at concentrations ranging from 0.1 milligrams per kilogram (mg/kg) to 97 mg/kg, and DRO at concentrations up to 5,800 mg/kg. A liner was placed in the excavation before backfilling. Approximately 30 yd^3 of DRO-contaminated soil was temporarily stockpiled east of the excavation and covered (Quest, 1995).

In 1996, the U.S. Geological Survey (USGS) collected soil samples from the Red Top Mine site and analyzed them for mercury speciation. Soil samples from the Red Top area had methylmercury concentrations of 1.149 and 1.271 micrograms per kilogram (µg/kg) and soil samples collected in the vicinity of the retort shack had methylmercury concentrations of 0.080 to 6.855 µg/kg (USGS, 1996).

In August and September 1998, HLA/Wilder sampled, labeled, transported, and disposed of the totes, and stockpiled soil and debris stored onsite from the 1994 Quest activities. HLA/Wilder also excavated additional mercury-contaminated soil and collected additional characterization samples in the area excavated by Quest in 1994 (Figure 2). Four of the HLA/Wilder characterization samples exceeded the Alaska Department of Environmental Conservation (ADEC) mercury cleanup level of 1 mg/kg established in Title 18, Alaska Administrative Code, Chapter 75 (18 AAC 75) - Table B1, Migration to Groundwater (ADEC, 1999). HLA/Wilder's December 31, 1998, report titled *Remedial Action Report, Red Top Retort Site, Aleknagik, Alaska,* summarizes 1998 field activities and site characterization results.

HLA/Wilder also collected samples for speciation analysis during 1998 activities, but in an effort to analyze samples with the highest total mercury concentrations, samples were not submitted to the laboratory until preliminary results for total mercury were received. Because of the delay in sending samples, the holding time for methylmercury analysis was exceeded. The 1998 results include inorganic and elemental fractions for samples collected at IS6, IS18 and IS24 shown on Figure 2.

In June 1999, the ADEC, BLM, and HLA/Wilder met to discuss results of 1998 activities and any further action necessary at the site. The ADEC suggested the mercury concentrations from the

1998 sampling activities (high of 40.6 mg/kg) were acceptable for site closure if institutional controls would be placed on the property title, and some additional site characterization was completed. For additional site characterization, the ADEC requested samples be collected for total mercury analysis from below the 1998 sample location depths, and from selected locations outside the 1998 sample grid.

The ADEC also requested samples be collected for DRO, and benzene, toluene, ethylbenzene, and xylenes (BTEX) analysis from the former drum storage area where a 1994 sample had a DRO concentration of 5,800 mg/kg.

2.0 FIELD ACTIVITIES

HLA/Wilder conducted site characterization activities from September 20 through 22, 1999. The site investigation activities consisted of the following activities:

- Collected 30 soil samples to further define the mercury concentrations for in situ soil at the former retort area.
- Established a soil sampling grid for petroleum hydrocarbon field screening near the former drum storage area. Selected three samples with the highest field screening results for laboratory analysis of DRO, BTEX, and polynuclear aromatic hydrocarbons.
- Collected six soil samples from areas considered unaffected by the former mine activities to further evaluate background mercury concentrations.
- Selected soil samples with suspected elevated mercury concentrations for mercury speciation analysis.

Field activities were conducted in accordance with HLA/Wilder's *1999 Site Characterization Work Plan/Sampling and Analysis Plan* and the *Quality Assurance Program Plan, Hazardous Materials Removal Actions, Various Locations, Alaska.*

Photographs from the 1999 field activities are in Appendix A.

2.1 Field Screening

Field screening was conducted using a photoionization detector (PID) on a sampling grid in the former drum-storage area. Five soil screening samples were collected and placed into quart-sized, resealable bags. After a minimum of 15 minutes, the probe of the PID was inserted into the bag for approximately 30 seconds and the maximum organic vapor headspace reading was recorded. Results were recorded in the project field book. Sample locations and screening results are shown on Figure 2.

2.2 Site Characterization Sampling

Thirty characterization soil samples were collected from the former retort area sampling grid established in 1998. Samples were collected between 1 and 3.5 feet below ground surface (bgs). Shovels, a sample auger, a breaker bar, and a power auger were used to dig the sample holes. Once the desired sample depth was reached, samples were collected with the sample auger or by hand with clean nitrile gloves. Tools were scrubbed in a detergent solution and rinsed in river water between sample locations. Soil was immediately placed into a laboratory-provided container, which was labeled with a unique sample number, the date and time of sample collection, and the requested analysis. Samples were then placed in a cooler with frozen ice-substitute and submitted to the laboratory for analysis.

2.3 Background Sampling

HLA/Wilder collected six background soil samples from three locations north of the retort site (Figure 3). The locations were in areas that appeared unaffected by mercury retort activities. Two samples were collected from each location: one shallow (0.5 feet bgs) and one deep (1 to 3 feet bgs). A shovel was used to reach the desired depth, and samples were collected with a decontaminated stainless steel trowel or by hand with clean nitrile gloves.

3.0 ANALYTICAL PROGRAM

Commercial Testing and Engineering Environmental Laboratory Services (CT&E), in Anchorage, Alaska, was used for the following analyses:

- Total Mercury by U.S. Environmental Protection Agency (EPA) Method 7040A,
- DRO by State of Alaska Method AK102,
- BTEX by EPA Method 8021,
- Carcinogenic polynuclear aromatic hydrocarbons (cPAHs) by selective ion monitoring.

Frontier Geosciences Inc. (Frontier) in Seattle, Washington, was used for mercury speciation analysis. Speciation analysis evaluated concentrations of the following mercury types:

- Cold 12 normal nitric acid (12N HNO_3) which recovers all mercury fractions (elemental, salts, amalgams and organic forms), except cinnabar (HgS) or mercury tightly bound in mineral lattices.
- Aqua regia which recovers the fraction not recovered with 12N HNO_3, including HgS and mercury bound in mineral lattices.
- Methylmercury fractions.
- Total mercury by adding 12N HNO_3 and aqua regia results.

4.0 DATA QUALITY REVIEW

The data quality review included a review of sample holding times, temperatures, custody records, and reported results for samples and extraction quality control (QC). Analytical data was reviewed according to the *Chemical Quality Assurance for Hazardous, Toxic, and Radioactive Waste Projects, U.S. Army Corps of Engineers* (USACE) EM-200-1-6, October 10, 1997.

Samples were not relinquished at CT&E. The sample custody was not compromised. Samples were received at 1.3 to 1.9 degrees Centigrade (°C), below the suggested temperature range of 2.0 to 6.0°C, but the samples were not frozen upon receipt, and therefore results were not affected.

There were no analytical abnormalities associated with BTEX, DRO, or mercury analyses. Some cPAH laboratory control sample (LCS) duplicate analytes failed to meet QC criteria, but the associated LCS met QC criteria and results are not affected.

Field duplicates were sampled at a rate of 10 percent of the project samples. Field duplicate relative percent differences (RPDs) were less than 50 percent for all samples except as noted. Total mercury field duplicates for samples 99RT14SL and 99RT16SL analyzed by CT&E have an RPD of 84 percent, possibly due to non-homogeneity of the samples or error inherent with the small sample mass used for the analysis. Results for these samples should be considered estimated.

Field sample duplicates (99RT14SL and 99RT15SL, and 99RT19SL and 99RT21SL) which compare total mercury analyzed by CT&E digested by EPA Method 3050 (99RT14SL and 99RT19SL), and total mercury analyzed by Frontier (99RT15SL and 99RT21SL), have RPDs greater than 50 percent. EPA Method 3050 is a hot leach method and tends to provide poor recoveries in samples with high concentrations of HgS. In this case, EPA Method 5030 may more accurately be compared to the cold leach method using 12N HNO_3 digestion. When total mercury digested by EPA Method 3050 is compared to 12N HNO_3, the sample RPDs are less than 50 percent for all field sample duplicates. Data is considered acceptable without qualification.

5.0 ANALYTICAL RESULTS

5.1 Background

Six background soil samples (99RTB1 through 99RTB6) were collected north of the former retort site from an area considered unaffected by retort activity. Two samples were collected at different depths at each of the three locations and analyzed for total mercury. Analytical results are on Table 1. Background sample locations and results are shown on Figure 3.

The total mercury concentrations for the background samples ranged from 0.0342 to 0.156 mg/kg.

5.2 In Situ Site Characterization

5.2.1 Mercury Samples

Twenty project soil samples and two QC samples were collected from the retort area sample grid and analyzed for total mercury. Analytical results are on Table 1. The 1998 and 1999 site characterization locations and results are shown on Figure 2.

Six samples were collected at the 1998 sample grid nodes at locations deeper (approximately 3 to 3.5 feet bgs) than the 1998 sample points. Samples were also collected from six new sample grid locations. One from just below the bottom of the 1994 excavation (1 to 2 feet bgs) and one from a deeper interval (3 to 3.5 feet bgs).

The mercury concentration in one sample (99RT10SL at 108 mg/kg) exceeded the highest concentration found in 1998 (40 mg/kg). A statistical analysis of the data set indicates the upper 95 percent confidence level is 10.81 mg/kg and the lower 95 percent confidence level is 0.126 mg/kg (Appendix C). The data set includes 44 sample results (does not include QC sample results) and covers approximately 3,800 square feet.

5.2.2 Mercury Speciation

Organic mercury compounds, especially methylmercury, are considered the most toxic forms of mercury. Organic forms of mercury have been found to be at least an order of magnitude less concentrated in terrestrial environments than inorganic forms of mercury. Conversely, organic forms of mercury like methylmercury have been found to make up 70 to 100 percent of the total mercury concentration found in biological tissues (USGS, 1995). USGS findings from studies in southwestern Alaska have also found the ratio of total mercury to methylmercury in background areas is much lower than areas with elevated mercury concentrations. Specifically, the methylmercury fraction does not increase proportionately to an increase in total mercury concentration, and therefore, elevated total mercury concentrations may only suggest slightly elevated methylmercury concentrations.

The 1998 speciation data is not considered significant for this discussion because methylmercury is not included in the analysis. However, the 1998 data is included for reference in Appendix B.

The 1999 mercury speciation results are lower than 1998 data because of the lower total mercury concentrations. The 1999 speciation data does, however, include methylmercury analysis. The 1999 methylmercury results ranged from 0.086 to 0.633 µg/kg. USGS background data from 1996 ranged from 1.149 to 1.271 µg/kg. The 1999 speciation data is shown in Table 2, and speciation sample locations are shown on Figure 2.

5.2.3 Petroleum Hydrocarbons Samples

Three samples collected from the former drum storage area with the highest field screening results were submitted to the laboratory for DRO, BTEX, and cPAH analysis. Sample locations are shown on Figure 2. Results are on Table 3.

DRO and BTEX were not detected at or above the method detection limit. Phenanthrene and fluoranthene were detected in sample 99RT27SL, but the fluoranthene concentration (1.69 µg/kg) is below the ADEC cleanup levels established in 18 AAC 75. A cleanup level for phenanthrene is not listed in the 18 AAC 75 regulations.

6.0 CONCLUSIONS AND RECOMMENDATIONS

During a June 1999 meeting with the ADEC, BLM, and HLA/Wilder, the ADEC indicated closure for the Red Top Retort site could be obtained with total mercury concentrations found during the 1998 sampling activities (maximum concentration of 40.6 mg/kg), if the site was more adequately characterized, and institutional controls attached to the property title. Data collected from HLA/Wilder's 1998 and 1999 sampling activities adequately define the extent and concentrations of mercury at the site. One sample collected in 1999 had a total mercury concentration of 108 mg/kg,

exceeding the highest detection in 1998. A statistical analysis of the 1998 and 1999 data set indicates that the upper 95 percent confidence level for total mercury is 10.81 mg/kg. Mercury speciation results indicate the methylmercury concentration of the selected samples was less than the background samples collected by the USGS near the site. Results for DRO, BTEX, and cPAHs were below established cleanup levels.

HLA/Wilder recommends site closure with ADEC directed institutional controls on the property title.

7.0 BIBLIOGRAPHY

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TABLES

Table 1. Analytical Results for Total Mercury

Sample Number	Sample Type	Sample Location	Date	Sample Depth (feet bgs)	Concentration of Total Mercury[a] (mg/kg)
99RT01SL	PR	IS8	9/20/99	3.0	1.15
99RT02SL	PR	IS17	9/21/99	3.0	0.100
99RT03SL	PR	IS34	9/21/99	1.5	0.129
99RT04SL	PR	IS34	9/21/99	3.0	0.154
99RT05SL	PR	IS11	9/21/99	3.0	0.090
99RT08SL	PR	IS32	9/21/99	1.8	14.9
99RT09SL	PR	IS32	9/21/99	3.5	0.068
99RT10SL	PR	IS33	9/21/99	2.0	108
99RT11SL	PR	IS33	9/21/99	3.0	2.38
99RT12SL	PR	IS31	9/21/99	1.5	29.0
99RT13SL	PR	IS31	9/21/99	3.2	0.195
99RT14SL	PR	IS24	9/21/99	3.2	0.0836
99RT16SL	QC	IS24	9/21/99	3.2	0.205
99RT17SL	PR	IS30	9/21/99	1.5	12.0
99RT18SL	PR	IS30	9/21/99	3.5	0.353
99RT19SL	PR	IS6	9/21/99	3.0	0.098
99RT20SL	QC	IS6	9/21/99	3.0	0.143
99RT22SL	PR	IS7	9/21/99	3.0	0.129
99RT23SL	PR	IS29	9/21/99	1.0	0.0558
99RT24SL	PR	IS29	9/21/99	3.0	0.0819
99RTEI1SL	PR	EI1	9/22/99	3.7	0.636
99RTEI2SL	PR	EI2	9/22/99	3.5	0.778
99RTB1	PR	Background 1	9/22/99	0.5	0.0568
99RTB2	PR	Background 1	9/22/99	1.8	0.0845
99RTB3	PR	Background 2	9/22/99	0.5	0.0342
99RTB4	PR	Background 2	9/22/99	3.0	0.0789
99RTB5	PR	Background 3	9/22/99	0.5	0.0842
99RTB6	PR	Background 3	9/22/99	1.0	0.156

a. Total mercury determined by U.S. Environmental Protection Agency Method 7470A

bgs Below ground surface
mg/kg Milligrams per kilogram (parts per million)
PR Project sample
QC Quality control sample

Table 2. Analytical Results For Mercury Speciation

	Sample Number	99RT06SL	99RT07SL	99RT15SL	99RT21SL
	Sample Location	IS11	IS8	IS24	IS6
	Date Collected	9/21/99	9/21/99	9/21/99	9/21/99
	Depth of Sample (feet bgs)	3.0	3.2	3.2	3.0
Mercury Speciation	Units				
Wet basis					
Aqua regia - Cinnabar (HgS)	µg/kg	21.7	22.1	1395	55.7
12N HNO_3 - (elemental, salts, amalgams, and organic forms)	µg/kg	67.5	64.3	101.6	135.4
Methylmercury	µg/kg	0.113	0.074	0.174	0.54
Dry					
Aqua regia - Cinnabar (HgS)	µg/kg	23.4	25.8	1550.0	65.3
12N HNO_3 - (elemental, salts, amalgams, and organic forms)	µg/kg	72.8	74.9	112.9	158.7
Methylmercury	µg/kg	0.122	0.086	0.193	0.633

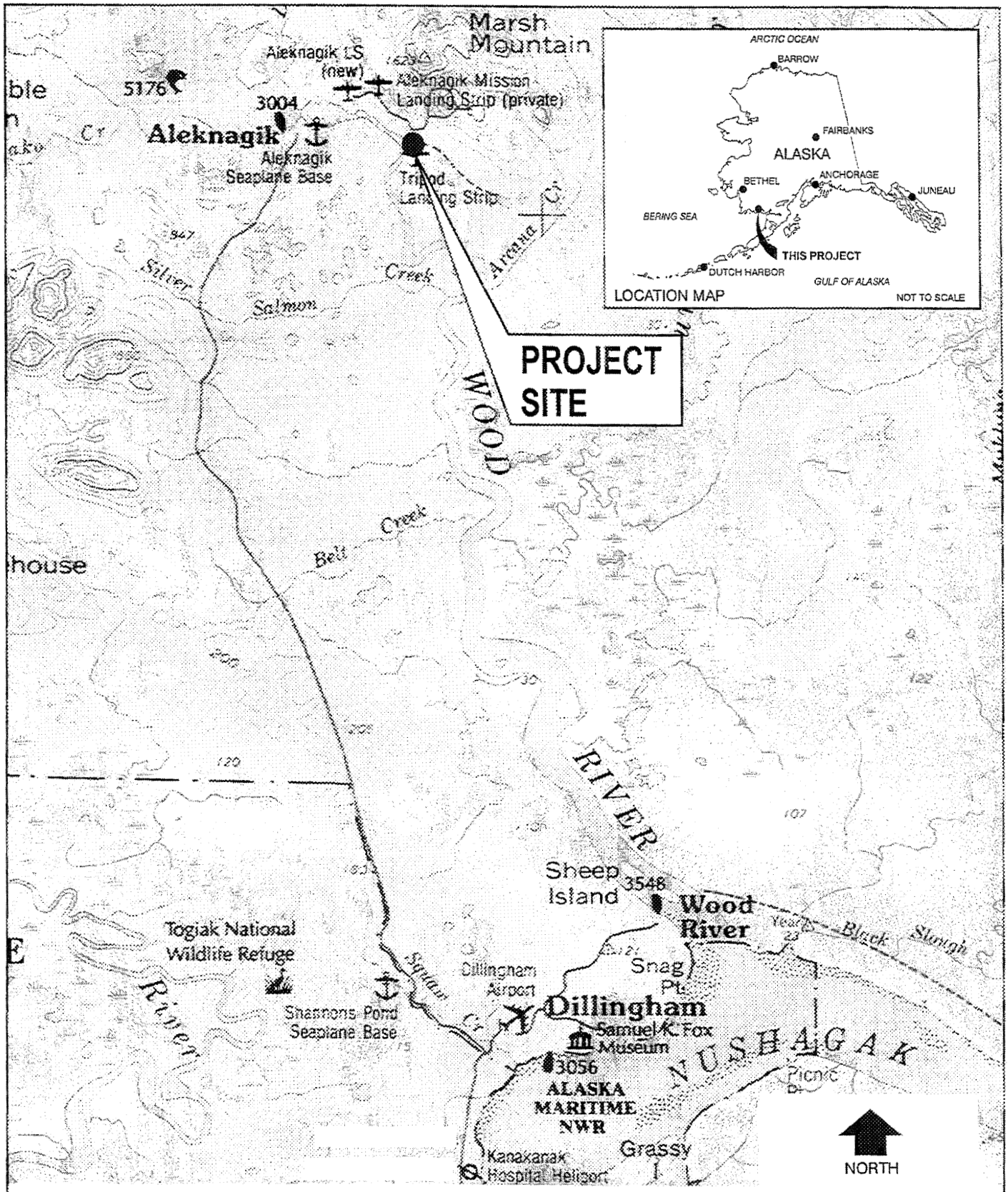
bgs Below ground surface
µg/kg Micrograms per kilogram (parts per billion)
12N HNO_3 Cold 12 normal nitric acid

Table 3. Analytical Results for Petroleum Hydrocarbons

	Sample Number	99RT25SL	99RT26SL	99RT27SL	99RT28SL
	Sample Location	H1	H1 (QC)	H3	H4
	Date Collected	9/21/99	9/21/99	9/21/99	9/21/99
	Depth of Sample (feet bgs)	2.5	2.5	2.5	2.5
Petroleum Hydrocarbons	Units				
DRO					
Diesel-range organics	mg/kg	ND(9.80)	ND(9.67)	ND(10.1)	ND(10.0)
BTEX					
Benzene	mg/kg	ND(0.011)	ND(0.012)	ND(0.013)	ND(0.0099)
Toluene	mg/kg	ND(0.042)	ND(0.047)	ND(0.053)	ND(0.040)
Ethylbenzene	mg/kg	ND(0.042)	ND(0.047)	ND(0.053)	ND(0.040)
Total Xylenes	mg/kg	ND(0.042)	ND(0.047)	ND(0.053)	ND(0.040)
cPAHs					
Naphthalene	µg/kg	ND(1.6)	ND(1.6)	ND(1.5)	ND(1.7)
Acenaphthylene	µg/kg	ND(1.6)	ND(1.6)	ND(1.5)	ND(1.7)
Acenaphthene	µg/kg	ND(1.6)	ND(1.6)	ND(1.5)	ND(1.7)
Fluorene	µg/kg	ND(1.6)	ND(1.6)	ND(1.5)	ND(1.7)
Phenathrene	µg/kg	ND(1.6)	ND(1.6)	1.82	ND(1.7)
Anthracene	µg/kg	ND(1.6)	ND(1.6)	ND(1.5)	ND(1.7)
Fluoranthene	µg/kg	ND(1.6)	ND(1.6)	1.69	ND(1.7)
Pyrene	µg/kg	ND(1.6)	ND(1.6)	ND(1.5)	ND(1.7)
Benzo(a)Anthracene	µg/kg	ND(1.6)	ND(1.6)	ND(1.5)	ND(1.7)
Chrysene	µg/kg	ND(1.6)	ND(1.6)	ND(1.5)	ND(1.7)
Benzo[b]Fluoranthene	µg/kg	ND(1.6)	ND(1.6)	ND(1.5)	ND(1.7)
Benzo[k]fluoranthene	µg/kg	ND(1.6)	ND(1.6)	ND(1.5)	ND(1.7)
Benzo[a]pyrene	µg/kg	ND(1.6)	ND(1.6)	ND(1.5)	ND(1.7)
Indeno[1,2,3-c,d] pyrene	µg/kg	ND(1.6)	ND(1.6)	ND(1.5)	ND(1.7)
Dibenzo[a,h]anthracene	µg/kg	ND(1.6)	ND(1.6)	ND(1.5)	ND(1.7)
Benzo[g,h,I]perylene	µg/kg	ND(1.6)	ND(1.6)	ND(1.5)	ND(1.7)

BTEX Benzene, toluene, ethylbenzene, and total xylenes
cPAHs Carcinogenic polynuclear aromatic hydrocarbons
DRO Diesel-range organics
mg/kg Milligrams per kilogram (parts per million)
µg/kg Micrograms per kilogram (parts per billion)

FIGURES



SOURCE: ALASKA GAZETEER, DELORME MAPPING, 1992.

HLA WILDER

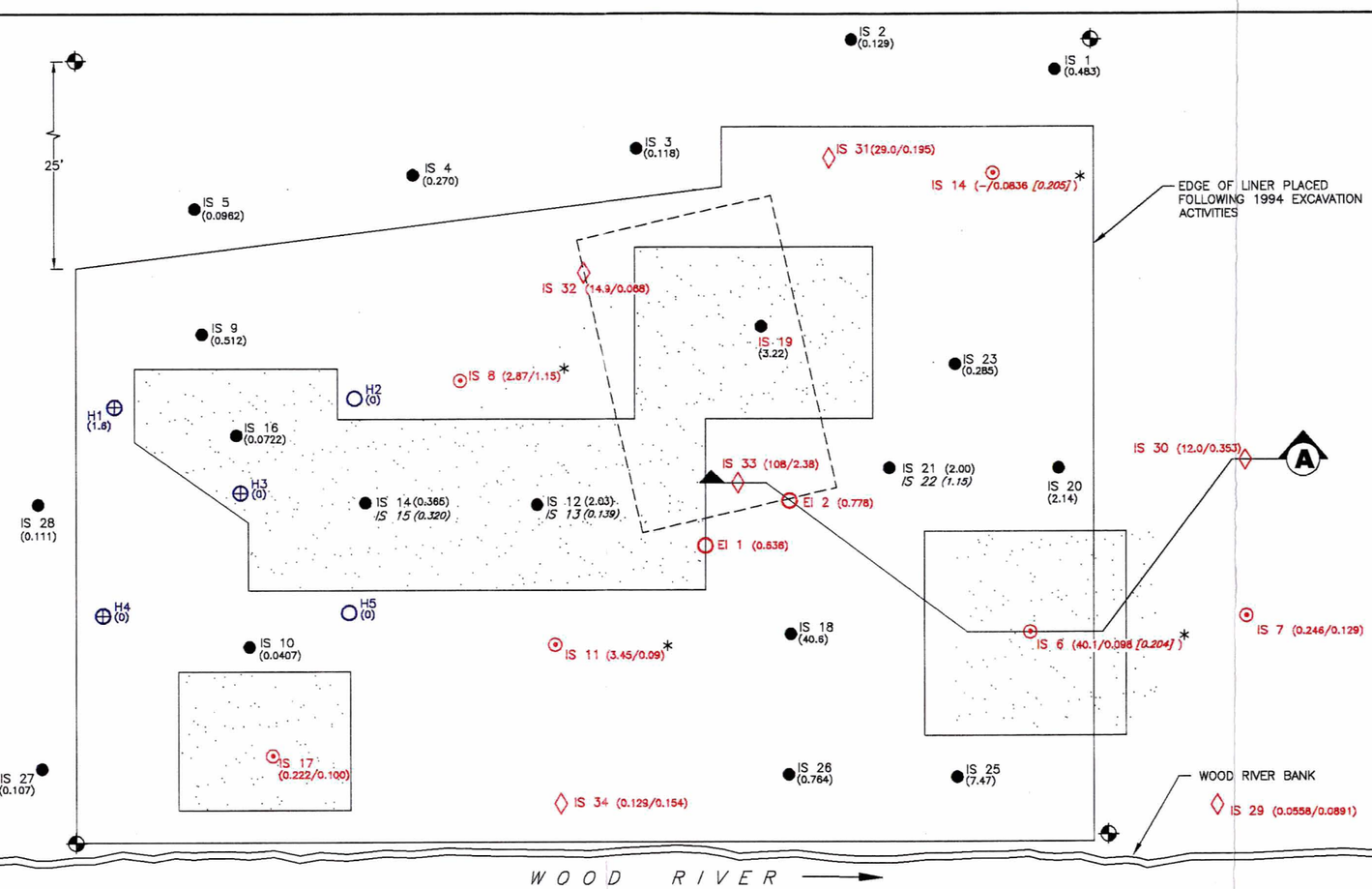
Harding Lawson Associates/
Wilder Construction Company
Joint Venture

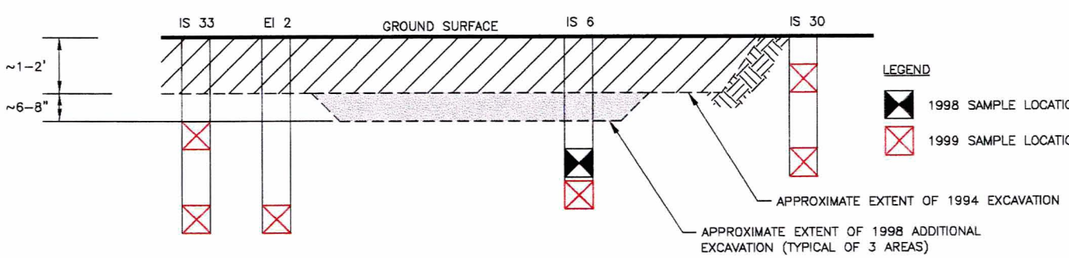
Site Vicinity and Project Location Map

Red Top Retort Site
Aleknagik, Alaska

FIGURE **1**

DRAWN	PROJECT NUMBER	APPROVED	DATE	FILE NAME
JP	41475	JWM	12/99	357c1.cdr





LEGEND

1998 SAMPLE LOCATION

1999 SAMPLE LOCATION

CROSS SECTION (typical)
NOT TO SCALE
A

LEGEND

LOCATION OF REFERENCE REBAR PLACED IN 1998

IS 8 (3.45/0.09) — 1998 SAMPLE LOCATION AND NUMBER. RESAMPLED IN 1999 AT A GREATER DEPTH, APPROXIMATELY 1.5' TO 2.0' BELOW 1998 LOCATIONS. (TOTAL MERCURY RESULTS SHOWN IN PARENTHESES, SHALLOW RESULTS/DEEP RESULTS) [DUPLICATE SAMPLE SHOWN IN ITALICS]

IS 5 (0.0982) — 1998 HLA/WILDER SAMPLE LOCATION AND NUMBER (TOTAL MERCURY RESULT SHOWN IN PARENTHESES)

IS 34 (0.129/0.1454) — 1999 MERCURY SAMPLE LOCATIONS AND ASSOCIATED NUMBER (TOTAL MERCURY RESULTS IN PARENTHESES, SHALLOW RESULTS/DEEP RESULTS) [DUPLICATE SAMPLE SHOWN IN ITALICS]

H5 (0) — 1999 PETROLEUM HYDROCARBON FIELD SCREENING SAMPLE LOCATION AND NUMBER (PID RESULTS SHOWN IN PARENTHESES)

H1 (1.8) — 1999 PETROLEUM HYDROCARBON FIELD SCREENING SAMPLE LOCATION AND NUMBER SELECTED FOR ANALYTICAL CONFIRMATION SAMPLING

EI 1 (0.636) — 1999 HLA/WILDER SAMPLE LOCATION AND NUMBER (TOTAL MERCURY RESULTS IN PARENTHESES) REQUESTED BY THE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

PID — PHOTOIONIZATION DETECTOR

* — INDICATES SAMPLE SUBMITTED TO LABORATORY FOR MERCURY SPECIATION ANALYSIS

ESTIMATED LOCATION OF FORMER RETORT SHACK BASED ON INTERPOLATED QUEST ENVIRONMENTAL SITE MAPS AND HLA/WILDER FIELD NOTES

AREA OF 1998 EXCAVATIONS COMPLETED BY HLA/WILDER (BACKFILL WAS REMOVED TO EXPOSE LINER, LINER WAS CUT AND AN ADDITIONAL 6-8 INCHES OF MATERIAL WAS REMOVED)

NORTH

0 4 8 16

APPROXIMATE SCALE IN FEET

NOTES:

1) PLASTIC LINER LOCATED AT EXCAVATION LIMITS.
2) ALL RESULTS SHOWN IN PARTS PER MILLION.
3) LOCATIONS SHOWN IN RED AND BLUE SAMPLED DURING 1999 ACTIVITIES.

HLA WILDER

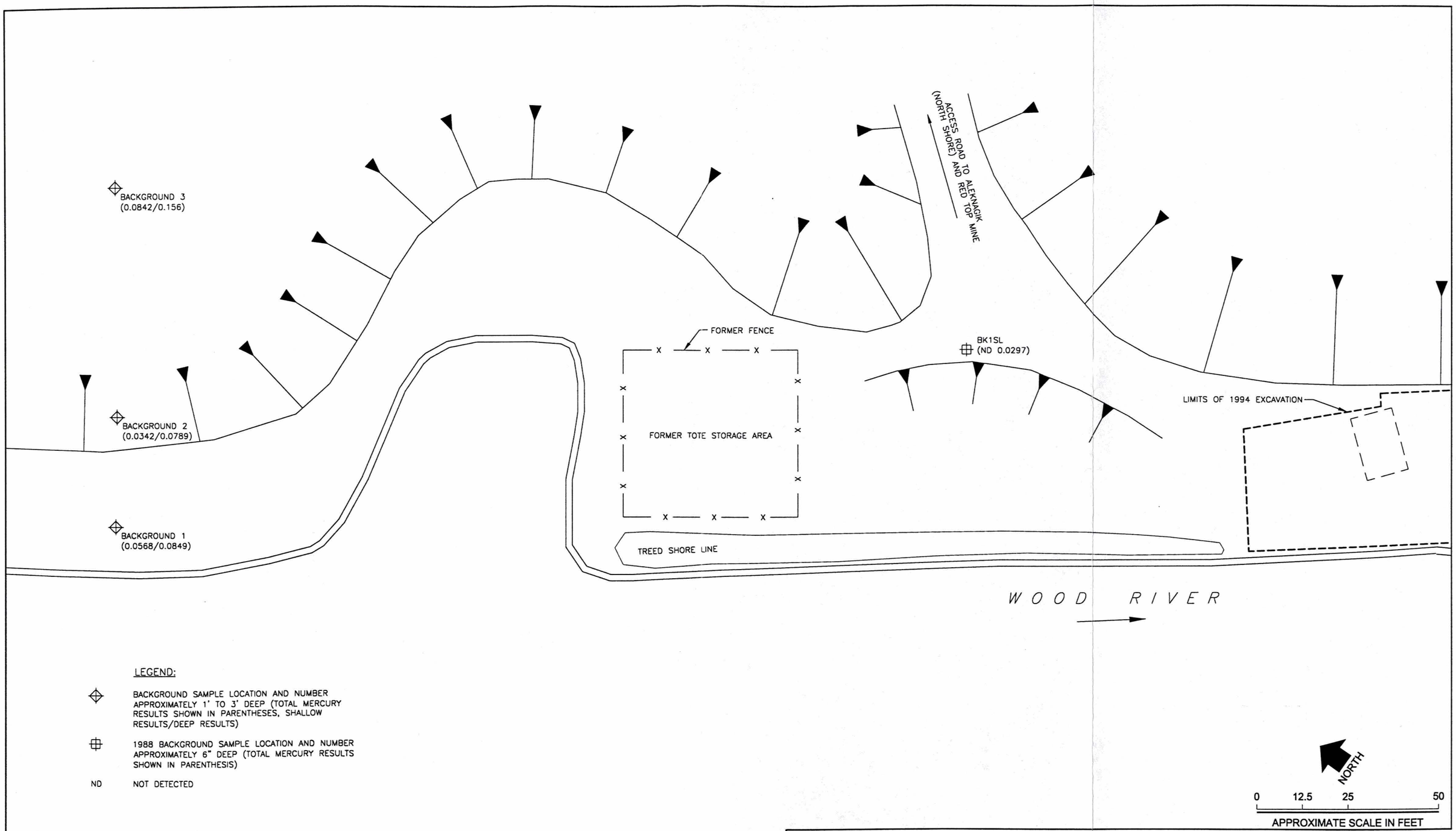
Harding Lawson Associates/ Wilder Construction Company
Joint Venture

Excavation Area and In Situ Characterization Sample Locations

Red Top Retort Site
Aleknagik, Alaska

FIGURE **2**

DRAWN	PROJECT NUMBER	APPROVED	DATE	FILE NAME
CEH	41475	BDL	12/99	41475a1.dwg



LEGEND:

BACKGROUND SAMPLE LOCATION AND NUMBER APPROXIMATELY 1' TO 3' DEEP (TOTAL MERCURY RESULTS SHOWN IN PARENTHESES, SHALLOW RESULTS/DEEP RESULTS)

1988 BACKGROUND SAMPLE LOCATION AND NUMBER APPROXIMATELY 6" DEEP (TOTAL MERCURY RESULTS SHOWN IN PARENTHESIS)

ND NOT DETECTED

NOTE:

1) ALL RESULTS SHOWN IN MILLIGRAMS PER KILOGRAM.

WILDER

Harding Lawson Associates/
Wilder Construction Company
Joint Venture

Background Sample Loctions and Results

Red Top Retort Site
Aleknagik, Alaska

FIGURE
3

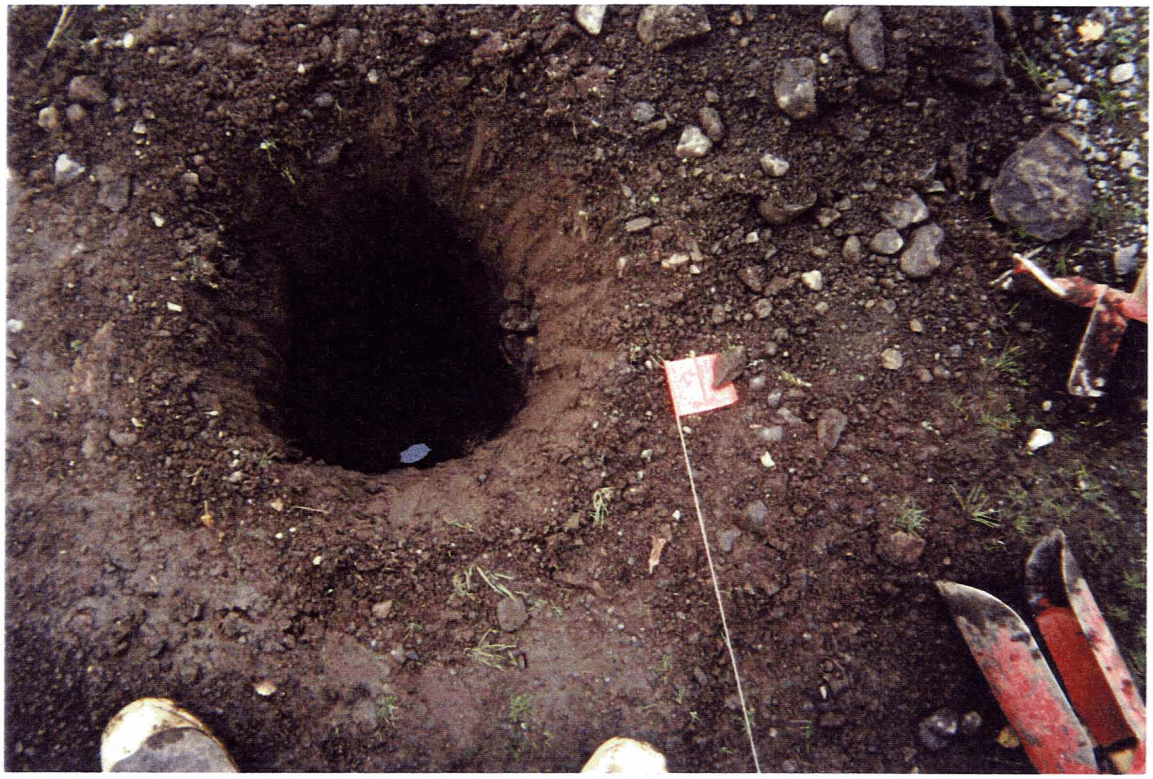
DRAWN	PROJECT NUMBER	APPROVED	DATE	FILE NAME
CEH	41475		12/99	41475a2.dwg

APPENDIX A

PHOTOGRAPHS

Collecting site characterization sample at former retort area. Pink flags denote sample locations.
View: south. Date: September 20, 1999.

Typical sample excavation, note liner at approximately 1-foot below ground surface.
View: NA. Date: September 21, 1999.



Location of Samples 99RT08SL and 99RT09SL. Encountered groundwater at approximately 3.5-below ground surface. View: NA. Date: September 21, 1999.

Former retort area after sample collection completed.
View: south. Date: September 22, 1999.

APPENDIX B

SAMPLING RECORDS AND ANALYTICAL RESULTS

- TABLE B1 - SAMPLE RECORD LOG
- ANALYTICAL DATA PACKAGES – CT&E
- ANALYTICAL DATA PACKAGES -- FRONTIER GEOSCIENCES
- DATA QUALITY ASSESSMENT SHEETS

RED TOP RETORT

1999 Sample Record Log

SAMPLE NUMBER	LOCATION	DATE	TIME	SAMPLER	DEPTH (ft)	PR	QC	MERCURY 7470	MERCURY SPECIATION	DRO AK102	BTEX 602	PAH 610	COMMENTS
99RT01SL	IS8	9/20/99	1600	H^3/LJJ	3.0	X		X					16" below liner
99RT02SL	IS17	9/21/99	930	H^3/LJJ	3.0	X		X					2.0' below liner
99RT03SL	IS34	9/21/99	940	H^3/LJJ	1.5	X		X					0.5' below liner
99RT04SL	IS34	9/21/99	955	H^3/LJJ	3.0	X		X					2.0' below liner
99RT05SL	IS11	9/21/99	1020	H^3/LJJ	3.0	X		X					2.0' below liner
99RT06SL	IS11	9/21/99	1025	H^3/LJJ	3.0		X		X				2.0' below liner
99RT07SL	IS8	9/21/99	1035	H^3/LJJ	3.2	X			X				1.5' below liner
99RT08SL	IS32	9/21/99	1050	H^3/LJJ	1.8	X		X					0.4' below liner
99RT09SL	IS32	9/21/99	1100	H^3/LJJ	3.5	X		X					2.1' below liner/water at the bottom
99RT10SL	IS33	9/21/99	1145	H^3/LJJ	2.0	X		X					0.5' below liner
99RT11SL	IS33	9/21/99	1155	H^3/LJJ	3.0	X		X					1.5' below liner
99RT12SL	IS31	9/21/99	1220	H^3/LJJ	1.5	X		X					0.5' below liner
99RT13SL	IS31	9/21/99	1240	H^3/LJJ	3.2	X		X					2.2' below liner/soil very wet
99RT14SL	IS24	9/21/99	1300	H^3/LJJ	3.2	X		X					1.9' below liner
99RT15SL	IS24	9/21/99	1305	H^3/LJJ	3.2	X			X				1.9' below liner
99RT16SL	IS24	9/21/99	1320	H^3/LJJ	3.2		X	X					duplicate of -14SL
99RT17SL	IS30	9/21/99	1340	H^3/LJJ	1.5	X		X					no liner
99RT18SL	IS30	9/21/99	1345	H^3/LJJ	3.5	X		X					water at the bottom
99RT19SL	IS6	9/21/99	1405	H^3/LJJ	3.0	X		X					0.5' below liner/water at 3.0'
99RT20SL	IS6	9/21/99	1410	H^3/LJJ	3.0		X	X					duplicate of -20SL
99RT21SL	IS6	9/21/99	1415	H^3/LJJ	3.0	X			X				duplicate of -20SL
99RT22SL	IS7	9/21/99	1420	H^3/LJJ	3.0	X		X					white plastic at 0.5' bgs
99RT23SL	IS29	9/21/99	1455	H^3/LJJ	1.0	X		X					outside liner area
99RT24SL	IS29	9/21/99	1500	H^3/LJJ	3.0	X		X					outside liner area
99RT25SL	H1	9/21/99	1715	H^3/LJJ	2.5	X				X	X	X	OVM=1.6ppm
99RT26SL	H1	9/21/99	1725	H^3/LJJ	2.5		X			X	X	X	duplicate of -25SL
99RT27SL	H3	9/21/99	1735	H^3/LJJ	2.5	X				X	X	X	OVM=0ppm
99RT28SL	H4	9/21/99	1740	H^3/LJJ	2.5	X				X	X	X	OVM=0ppm
99RTEI1SL	EI1	9/22/99	1000	H^3/LJJ	3.7	X		X					2.2' below liner
99RTEI2SL	EI2	9/22/99	1015	H^3/LJJ	3.5	X		X					1.7' below liner
99RTB1SL	Background 1	9/22/99	1100	H^3/LJJ	0.5	X		X					75 paces N of tote area, 20' from river

RED TOP RETORT

1999 Sample Record Log

SAMPLE NUMBER	LOCATION	DATE	TIME	SAMPLER	DEPTH (ft)	PR	QC	MERCURY 7470	MERCURY SPECIATION	DRO AK102	BTEX 602	PAH 610	COMMENTS
99RTB2SL	Background 1	9/22/99	1105	H^3/LJJ	1.8	X		X					75 paces N of tote area, 20' from river
99RTB3SL	Background 2	9/22/99	1115	H^3/LJJ	0.5	X		X					E of B1 50 paces
99RTB4SL	Background 2	9/22/99	1120	H^3/LJJ	3.0	X		X					E of B1 50 paces
99RTB5SL	Background 3	9/22/99	1130	H^3/LJJ	0.5	X		X					top of hill above B3
99RTB6SL	Background 3	9/22/99	1140	H^3/LJJ	1.0	X		X					top of hill above B3

ft	feet
PR	project sample
QC	quality control duplicate sample
DRO	diesel-range organics
BTEX	benzene, toluene, ethylbenzene, and total xylenes
PAH	polynuclear aeromatic hydrocarbons

RECEIVED

OCT 22 1999

HARDING LAWSON
ASSOCIATES

CTE Environmental Services
Alaska Division
Laboratory Data Report

Project: Red Top Site Char. Aleknagik

Client: Harding Lawson & Assoc

CTE Work Order: 995203

Contents:

Chain of Custody
Quality Control Summary Forms

Note:

Unless otherwise noted, all quality assurance/quality control criteria is in compliance with the proper regulatory authority and/or CTE's Quality Assurance Program Plan.

Case Narrative

Customer: HARLAWP **Harding Lawson & Assoc**

Project: 995203 **Red Top Site Char. Aleknagik**

There were no analytical anomalies associated with your data.

Harding Lawson Associates
601 East 57th Place, Anchorage, Alaska, 99518
(907) 563-8102 / FAX (907)561-4574

CHAIN OF CUSTODY 995203

99RT 01

1/4

Laboratory CT&E

Project Name: Red Top Site Characterization

Project Location: Aleknagik, Alaska

Project Manager: Joe McElroy

Samplers: H. Hoen / L. Johnson

Recorder: [signature]

Subcontract / Work Authorization Nos.: GSC99021.08 / 007

Turnaround Time: Standard

	MATRIX		# Containers & Preservative: Unpreserved	Methanol			IDENTIFIER: Sample Number	DATE AND TIME: YR	MO	DY	TIME	ANALYSIS REQUESTED: AK 102 - DRO				EPA 8021 - BTEX		Total Hg - EPA 7040A	Mercury Speciation					
1	S	L		1			99RT 01 SL	99	09	20	1600							X						
2	S	L		1			99RT 02 SL	99	09	21	0930							X						
3	S	L		1			99RT 03 SL	99	09	21	0940							X						
4	S	L		1			99RT 04 SL	99	09	21	0955							X						
5	S	L		1			99RT 05 SL	99	09	21	1020							X						
6	S	L		1			99RT 08 SL	99	09	21	1050							X						
7	S	L		1			99RT 09 SL	99	09	21	1100							X						
8	S	L		1			99RT 10 SL	99	09	21	1145							X						
9	S	L		1			99RT 11 SL	99	09	21	1155							X						
10	S	L		1			99RT 12 SL	99	09	21	1220							X						

NOTES:

Use work authorization number for invoicing

CHAIN OF CUSTODY RECORD

RELINQUISHED BY:(Signature)	DATE	TIME	RECEIVED BY:(Signature)	DATE	TIME
[signature]	9/23/99	3:30			
RELINQUISHED BY:(Signature)	DATE	TIME	RECEIVED BY:(Signature)	DATE	TIME
RELINQUISHED BY:(Signature)	DATE	TIME	RECEIVED BY:(Signature)	DATE	TIME
DISPATCHED BY:(Signature)	DATE	TIME	RECEIVED FOR LAB BY:(Signature)	DATE	TIME
			[signature]	9-23-99	1530
METHOD OF SHIPMENT					

1.9°C

Harding Lawson Associates
601 East 57th Place, Anchorage, Alaska, 99518
(907) 563-8102 / FAX (907)561-4574

CHAIN OF CUSTODY

99RT 01

995203

2/4

Laboratory CT&E

Project Name: Red Top Site Characterization

Subcontract / Work Authorization Nos.: GSC99021.08 / 007

Project Location: Aleknagik, Alaska

Samplers: H. Hoen / L. Johnson

Project Manager: Joe McElroy

Recorder: Lori [illegible]

Turnaround Time: Standard

	MATRIX		# Containers & Preservative					IDENTIFIER	DATE AND TIME							ANALYSIS REQUESTED												
			unpreserved	methanol				Sample Number	YR		MO		DY		TIME	AK 102 - DRO				EPA 8021 - BTEX		Totoal Hg - EPA 7040A	Mercury Speciation					
11	S	L		1				99RT 13 SL	9	9	0	9	2	1	1240							X						
12	S	L		1				99RT 14 SL	9	9	0	9	2	1	1300							X						
13	S	L		1				99RT 16 SL	9	9	0	9	2	1	1320							X						
14	S	L		1				99RT 17 SL	9	9	0	9	2	1	1340							X						
15	S	L		1				99RT 18 SL	9	9	0	9	2	1	1345							X						
16	S	L		1				99RT 19 SL	9	9	0	9	2	1	1405							X						
17	S	L		1				99RT 20 SL	9	9	0	9	2	1	1410							X						
18	S	L		1				99RT 22 SL	9	9	0	9	2	1	1420							X						
19	S	L		1				99RT 23 SL	9	9	0	9	2	1	1455							X						
20	S	L		1				99RT 24 SL	9	9	0	9	2	1	1500							X						

NOTES:

Use work authorization number for invoicing

CHAIN OF CUSTODY RECORD

RELENQUISHED BY:(Signature)	DATE	TIME	RECEIVED BY:(Signature)	DATE	TIME
RELENQUISHED BY:(Signature)	DATE	TIME	RECEIVED BY:(Signature)	DATE	TIME
RELENQUISHED BY:(Signature)	DATE	TIME	RECEIVED BY:(Signature)	DATE	TIME
DISPATCHED BY:(Signature)	DATE	TIME	RECEIVED FOR LAB BY:(Signature) Sara Howell	DATE 9-23-99	TIME 1720
METHOD OF SHIPMENT					

CT&E Environmental Services Inc.

SAMPLE RECEIPT FORM

995203

CT&E WO#:

Yes	No	
	X	Are samples **RUSH**, priority, or *within 72 hrs* of **hold time**?
		If yes, have you done *e-mail notification*?
	X	Are samples *within 24 hrs* of **hold time** or **due date**?
		If yes, have you *spoken with* Supervisor?
	X	Are there any **problems** (e.g., ids, analyses)?
X		Were samples preserved correctly and pH verified?
		Has Project Manager been notified of problems?
		Is this an ACOE/AFCEE/ADEC project?
		Will a **data package** be required?
	X	If this is for PWS, provide **PWSID**.
		Is there a **quote** for this project?
	X	Will **courier** charges apply?

Due Date: 10-4-99
Received Date/Time: 9-23-99 1530
Cooler Temperature: 1.9°C
Sample Condition: (Good) / Poor
Matrix of each Sample:
2 " " -1 → -20
" "
" "
" "
Trip Blank
MS/MSD

Additional Sample Remarks:
AK101s/_____ 8260s field pres'd?
Field-filtered for dissolved_____?
Lab-filter for dissolved_____?
Ref Lab required?

Notes:

Completed by (sign): Tara Howell (print): Tara Howell

*** The following *must* be completed for *all* ACOE & AFCEE projects: ***

Yes	No		Notes:
	X	Is cooler temperature 4 ± C?	1.9°C
		thermometer used:	CTE3
	X	Was there an airbill, etc? note #:	hand carry
	X	Was cooler sealed with custody seals?	
		#/where?	hand carry
NA		Were seals intact upon arrival?	
X		Was there a COC with cooler?	
X	X	Was the COC filled out properly? – page 2 of COC was not relinquished	
	X	Did the COC indicate ACOE/AFCEE project?	
X		Did the COC and samples correspond?	
	X	Were samples screened with Geiger counter?	
X		Were all samples packed to prevent breakage?	
		packing material:	bubble wrap
X		Were all samples unbroken and clearly labelled?	
X		Were all samples sealed in separate plastic bags?	
NA		Were all bottles for volatiles free of headspace?	
X		Were correct container/sample sizes submitted?	
		Was client notified of problems? (specify below)	

Individual contacted:
Date & Time: _____ Phone/Fax #: _____

# of each Container Received:

	950 ml amber	unpres'd
	950 ml amber	w/ HCl
	500 ml amber	w/ H2SO4
	1L cubies	unpres'd
	1L cubies	w/ HNO3
	1L cubies	w/ H2SO4
	1L cubies	w/ NaOH + ZnAc
	120 ml coli	bottles
	60 ml	Nalg
20	8 oz amber	unpres'd
	4 oz amber	unpres'd
	4 oz w/ septa	w/ MeOH
	40 ml vials	w/ HCl
	Other (specify)	
	Other (specify)	

#/Log In Proofed by: _____

Form Number: F004r2
Printed: 7/12/99

CT&E Environmental Services Inc.
Laboratory Division

Laboratory Analysis Report

October 05, 1999

Joe McElroy
Harding Lawson & Assoc
601 East 57th Place
Anchorage, AK 99518

Client Name	Harding Lawson & Assoc
Project ID	Red Top Site Char. Aleknagik [995203]
Printed	October 05, 1999

Enclosed are the analytical results associated with the above project.

As required by the state of Alaska and the USEPA, a formal Quality Assurance/Quality Control Program is maintained by CT&E. A copy of our Quality Control Manual that outlines this program is available at your request.

Except as specifically noted, all statements and data in this report are in conformance to the provisions set forth in our Quality Assurance Program Plan.

If you have any questions regarding this report or if we can be of any other assistance, please call your CT&E Project Manager at (907) 562-2343.

The following descriptors may be found on your report which will serve to further qualify the data.

U - Indicates the compound was analyzed for but not detected.
J - Indicates an estimated value that falls below PQL, but is greater than the MDL.
B - Indicates the analyte is found in the blank associated with the sample.
* - The analyte has exceeded allowable limits.
GT - Greater Than
D - Secondary Dilution
LT - Less Than
! - Surrogate out of range

CT&E Environmental Services Inc.

CT&E Ref.#	995203001	**Client PO#**	
Client Name	Harding Lawson & Assoc	**Printed Date/Time**	10/05/99 09:53
Project Name/#	Red Top Site Char. Aleknagik	**Collected Date/Time**	09/20/99 16:00
Client Sample ID	99RT01SL	**Received Date/Time**	09/23/99 15:30
Matrix	Soil/Solid	**Technical Director: Stephen C. Ede**	
Ordered By			
PWSID		**Released By**	J Wundlebank

Sample Remarks:

Parameter	Results	PQL	Units	Method	Allowable Limits	Prep Date	Analysis Date	Init
^								
Total Solids	93.9		%	SM18 2540G			09/24/99	SEC
Mercury by Cold Vapor	1.15	0.0412	mg/Kg	SW846-7471		10/01/99	10/01/99	RMV

F-701

CT&E Environmental Services Inc.

CT&E Ref.#	995203002	**Client PO#**	
Client Name	Harding Lawson & Assoc	**Printed Date/Time**	10/05/99 09:53
Project Name/#	Red Top Site Char. Aleknagik	**Collected Date/Time**	09/21/99 09:30
Client Sample ID	99RT02SL	**Received Date/Time**	09/23/99 15:30
Matrix	Soil/Solid	**Technical Director: Stephen C. Ede**	
Ordered By			
PWSID		**Released By**	J Windebank

Sample Remarks:

Parameter	Results	PQL	Units	Method	Allowable Limits	Prep Date	Analysis Date	Init
^								
Total Solids	94.6		%	SM18 2540G			09/24/99	SEC
Mercury by Cold Vapor	0.100	0.0162	mg/Kg	SW846-7471		10/01/99	10/01/99	RMV

CT&E Environmental Services Inc.

CT&E Ref.#	995203003	**Client PO#**	
Client Name	Harding Lawson & Assoc	**Printed Date/Time**	10/05/99 09:53
Project Name/#	Red Top Site Char. Aleknagik	**Collected Date/Time**	09/21/99 09:40
Client Sample ID	99RT03SL	**Received Date/Time**	09/23/99 15:30
Matrix	Soil/Solid	**Technical Director: Stephen C. Ede**	
Ordered By			
PWSID		**Released By**	J Windebank

Sample Remarks:

Parameter	Results	PQL	Units	Method	Allowable Limits	Prep Date	Analysis Date	Init
^								
Total Solids	92.9		%	SM18 2540G			09/24/99	SEC
Mercury by Cold Vapor	0.129	0.0184	mg/Kg	SW846-7471		10/01/99	10/01/99	RMV

CT&E Environmental Services Inc.

CT&E Ref.#	995203004	**Client PO#**	
Client Name	Harding Lawson & Assoc	**Printed Date/Time**	10/05/99 09:53
Project Name/#	Red Top Site Char. Aleknagik	**Collected Date/Time**	09/21/99 09:55
Client Sample ID	99RT04SL	**Received Date/Time**	09/23/99 15:30
Matrix	Soil/Solid	**Technical Director: Stephen C. Ede**	
Ordered By			
PWSID		**Released By**	J Windebank

Sample Remarks:

Parameter	Results	PQL	Units	Method	Allowable Limits	Prep Date	Analysis Date	Init
^								
Total Solids	94.2		%	SM18 2540G			09/24/99	SEC
Mercury by Cold Vapor	0.154	0.0197	mg/Kg	SW846-7471		10/01/99	10/01/99	RMV

E-701

CT&E Environmental Services Inc.

CT&E Ref.#	995203005	**Client PO#**	
Client Name	Harding Lawson & Assoc	**Printed Date/Time**	10/05/99 09:53
Project Name/#	Red Top Site Char. Aleknagik	**Collected Date/Time**	09/21/99 10:20
Client Sample ID	99RT05SL	**Received Date/Time**	09/23/99 15:30
Matrix	Soil/Solid	**Technical Director: Stephen C. Ede**	
Ordered By			
PWSID		**Released By**	J Windebank

Sample Remarks:

Parameter	Results	PQL	Units	Method	Allowable Limits	Prep Date	Analysis Date	Init
^								
Total Solids	96.1		%	SM18 2540G			09/24/99	SEC
Mercury by Cold Vapor	0.0900	0.0189	mg/Kg	SW846-7471		10/01/99	10/01/99	RMV

F-701

CT&E Environmental Services Inc.

CT&E Ref.#	995203006	**Client PO#**	
Client Name	Harding Lawson & Assoc	**Printed Date/Time**	10/05/99 09:53
Project Name/#	Red Top Site Char. Aleknagik	**Collected Date/Time**	09/21/99 10:50
Client Sample ID	99RT08SL	**Received Date/Time**	09/23/99 15:30
Matrix	Soil/Solid	**Technical Director: Stephen C. Ede**	
Ordered By			
PWSID		**Released By**	J Windebank

Sample Remarks:

Parameter	Results	PQL	Units	Method	Allowable Limits	Prep Date	Analysis Date	Init
^								
Total Solids	88.2		%	SM18 2540G			09/24/99	SEC
Mercury by Cold Vapor	14.9	1.89	mg/Kg	SW846-7471		10/01/99	10/01/99	RMV

CT&E Environmental Services Inc.

CT&E Ref.#	995203007	**Client PO#**	
Client Name	Harding Lawson & Assoc	**Printed Date/Time**	10/05/99 09:53
Project Name/#	Red Top Site Char. Aleknagik	**Collected Date/Time**	09/21/99 11:00
Client Sample ID	99RT09SL	**Received Date/Time**	09/23/99 15:30
Matrix	Soil/Solid	**Technical Director: Stephen C. Ede**	
Ordered By			
PWSID		**Released By**	J Windebank

Sample Remarks:

Parameter	Results	PQL	Units	Method	Allowable Limits	Prep Date	Analysis Date	Init
^								
Total Solids	92.8		%	SM18 2540G			09/24/99	SEC
Mercury by Cold Vapor	0.0684	0.0200	mg/Kg	SW846-7471		10/01/99	10/01/99	RMV

E-701

CT&E Environmental Services Inc.

CT&E Ref.#	995203008	**Client PO#**	
Client Name	Harding Lawson & Assoc	**Printed Date/Time**	10/05/99 09:53
Project Name/#	Red Top Site Char. Aleknagik	**Collected Date/Time**	09/21/99 11:45
Client Sample ID	99RT10SL	**Received Date/Time**	09/23/99 15:30
Matrix	Soil/Solid	**Technical Director: Stephen C. Ede**	
Ordered By			
PWSID		**Released By**	J Windebank

Sample Remarks:

Parameter	Results	PQL	Units	Method	Allowable Limits	Prep Date	Analysis Date	Init
^								
Total Solids	90.5		%	SM18 2540G			09/24/99	SEC
Mercury by Cold Vapor	108	3.34	mg/Kg	SW846-7471		10/01/99	10/01/99	RMV

F-701

CT&E Environmental Services Inc.

CT&E Ref.#	995203009	**Client PO#**	
Client Name	Harding Lawson & Assoc	**Printed Date/Time**	10/05/99 09:53
Project Name/#	Red Top Site Char. Aleknagik	**Collected Date/Time**	09/21/99 11:55
Client Sample ID	99RT11SL	**Received Date/Time**	09/23/99 15:30
Matrix	Soil/Solid	**Technical Director: Stephen C. Ede**	
Ordered By			
PWSID		**Released By**	J Windebank

Sample Remarks:

Parameter	Results	PQL	Units	Method	Allowable Limits	Prep Date	Analysis Date	Init
^								
Total Solids	94.6		%	SM18 2540G			09/24/99	SEC
Mercury by Cold Vapor	2.38	0.102	mg/Kg	SW846-7471		10/01/99	10/01/99	RMV

F-701

CT&E Environmental Services Inc.

CT&E Ref.#	995203010	**Client PO#**	
Client Name	Harding Lawson & Assoc	**Printed Date/Time**	10/05/99 09:53
Project Name/#	Red Top Site Char. Aleknagik	**Collected Date/Time**	09/21/99 12:20
Client Sample ID	99RT12SL	**Received Date/Time**	09/23/99 15:30
Matrix	Soil/Solid	**Technical Director: Stephen C. Ede**	
Ordered By			
PWSID		**Released By**	J Windebank

Sample Remarks:

Parameter	Results	PQL	Units	Method	Allowable Limits	Prep Date	Analysis Date	Init
^								
Total Solids	92.7		%	SM18 2540G			09/24/99	SEC
Mercury by Cold Vapor	29.0	1.83	mg/Kg	SW846-7471		10/01/99	10/01/99	RMV

F-701

CT&E Environmental Services Inc.

CT&E Ref.#	995203011	**Client PO#**	
Client Name	Harding Lawson & Assoc	**Printed Date/Time**	10/05/99 09:53
Project Name/#	Red Top Site Char. Aleknagik	**Collected Date/Time**	09/21/99 12:40
Client Sample ID	99RT13SL	**Received Date/Time**	09/23/99 15:30
Matrix	Soil/Solid	**Technical Director: Stephen C. Ede**	
Ordered By			
PWSID		**Released By**	J Windebank

Sample Remarks:

Parameter	Results	PQL	Units	Method	Allowable Limits	Prep Date	Analysis Date	Init
^								
Total Solids	92.3		%	SM18 2540G			09/24/99	SEC
Mercury by Cold Vapor	0.195	0.0182	mg/Kg	SW846-7471		10/01/99	10/01/99	RMV

F-701

CT&E Environmental Services Inc.

CT&E Ref.#	995203012	**Client PO#**	
Client Name	Harding Lawson & Assoc	**Printed Date/Time**	10/05/99 09:53
Project Name/#	Red Top Site Char. Aleknagik	**Collected Date/Time**	09/21/99 13:00
Client Sample ID	99RT14SL	**Received Date/Time**	09/23/99 15:30
Matrix	Soil/Solid	**Technical Director: Stephen C. Ede**	
Ordered By			
PWSID		**Released By**	J Windebank

Sample Remarks:

Parameter	Results	PQL	Units	Method	Allowable Limits	Prep Date	Analysis Date	Init
^								
Total Solids	93.9		%	SM18 2540G			09/24/99	SEC
Mercury by Cold Vapor	0.0836	0.0159	mg/Kg	SW846-7471		10/01/99	10/01/99	RMV

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CT&E Environmental Services Inc.

CT&E Ref.#	995203013	**Client PO#**	
Client Name	Harding Lawson & Assoc	**Printed Date/Time**	10/05/99 09:53
Project Name/#	Red Top Site Char. Aleknagik	**Collected Date/Time**	09/21/99 13:20
Client Sample ID	99RT16SL	**Received Date/Time**	09/23/99 15:30
Matrix	Soil/Solid	**Technical Director: Stephen C. Ede**	
Ordered By			
PWSID		**Released By**	J Windebank

Sample Remarks:

Parameter	Results	PQL	Units	Method	Allowable Limits	Prep Date	Analysis Date	Init
^								
Total Solids	94.9		%	SM18 2540G			09/24/99	SEC
Mercury by Cold Vapor	0.205	0.0154	mg/Kg	SW846-7471		10/01/99	10/01/99	RMV

CT&E Environmental Services Inc.

CT&E Ref.#	995203014	**Client PO#**	
Client Name	Harding Lawson & Assoc	**Printed Date/Time**	10/05/99 09:53
Project Name/#	Red Top Site Char. Aleknagik	**Collected Date/Time**	09/21/99 13:40
Client Sample ID	99RT17SL	**Received Date/Time**	09/23/99 15:30
Matrix	Soil/Solid	**Technical Director: Stephen C. Ede**	
Ordered By			
PWSID		**Released By**	J Windebank

Sample Remarks:

Parameter	Results	PQL	Units	Method	Allowable Limits	Prep Date	Analysis Date	Init
^								
Total Solids	86.4		%	SM18 2540G			09/24/99	SEC
Mercury by Cold Vapor	12.0	2.04	mg/Kg	SW846-7471		10/01/99	10/01/99	RMV

CT&E Environmental Services Inc.

CT&E Ref.#	995203015	**Client PO#**	
Client Name	Harding Lawson & Assoc	**Printed Date/Time**	10/05/99 09:53
Project Name/#	Red Top Site Char. Aleknagik	**Collected Date/Time**	09/21/99 13:45
Client Sample ID	99RT18SL	**Received Date/Time**	09/23/99 15:30
Matrix	Soil/Solid	**Technical Director: Stephen C. Ede**	
Ordered By			
PWSID		**Released By**	J Wundebank

Sample Remarks:

Parameter	Results	PQL	Units	Method	Allowable Limits	Prep Date	Analysis Date	Init
^								
Total Solids	93.4		%	SM18 2540G			09/24/99	SEC
Mercury by Cold Vapor	0.353	0.0188	mg/Kg	SW846-7471		10/01/99	10/01/99	RMV

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CT&E Environmental Services Inc.

CT&E Ref.#	995203016	**Client PO#**	
Client Name	Harding Lawson & Assoc	**Printed Date/Time**	10/05/99 09:53
Project Name/#	Red Top Site Char. Aleknagik	**Collected Date/Time**	09/21/99 14:05
Client Sample ID	99RT19SL	**Received Date/Time**	09/23/99 15:30
Matrix	Soil/Solid	**Technical Director: Stephen C. Ede**	
Ordered By			
PWSID		**Released By**	J Windebank

Sample Remarks:

Parameter	Results	PQL	Units	Method	Allowable Limits	Prep Date	Analysis Date	Init
^								
Total Solids	88.4		%	SM18 2540G			09/24/99	SEC
Mercury by Cold Vapor	0.0982	0.0200	mg/Kg	SW846-7471		10/01/99	10/01/99	RMV

CT&E Environmental Services Inc.

CT&E Ref.#	995203017	**Client PO#**	
Client Name	Harding Lawson & Assoc	**Printed Date/Time**	10/05/99 09:53
Project Name/#	Red Top Site Char. Aleknagik	**Collected Date/Time**	09/21/99 14:10
Client Sample ID	99RT20SL	**Received Date/Time**	09/23/99 15:30
Matrix	Soil/Solid	**Technical Director: Stephen C. Ede**	
Ordered By			
PWSID		**Released By**	J Windebank

Sample Remarks:

Parameter	Results	PQL	Units	Method	Allowable Limits	Prep Date	Analysis Date	Init
^								
Total Solids	93.8		%	SM18 2540G			09/24/99	SEC
Mercury by Cold Vapor	0.143	0.0190	mg/Kg	SW846-7471		10/01/99	10/01/99	RMV

CT&E Environmental Services Inc.

CT&E Ref.#	995203018	**Client PO#**	
Client Name	Harding Lawson & Assoc	**Printed Date/Time**	10/05/99 09:53
Project Name/#	Red Top Site Char. Aleknagik	**Collected Date/Time**	09/21/99 14:20
Client Sample ID	99RT22SL	**Received Date/Time**	09/23/99 15:30
Matrix	Soil/Solid	**Technical Director: Stephen C. Ede**	
Ordered By			
PWSID		**Released By**	J Windebank

Sample Remarks:

Parameter	Results	PQL	Units	Method	Allowable Limits	Prep Date	Analysis Date	Init
^								
Total Solids	95.9		%	SM18 2540G			09/24/99	SEC
Mercury by Cold Vapor	0.129	0.0150	mg/Kg	SW846-7471		10/01/99	10/01/99	RMV

CT&E Environmental Services Inc.

CT&E Ref.#	995203019	**Client PO#**	
Client Name	Harding Lawson & Assoc	**Printed Date/Time**	10/05/99 09:53
Project Name/#	Red Top Site Char. Aleknagik	**Collected Date/Time**	09/21/99 14:55
Client Sample ID	99RT23SL	**Received Date/Time**	09/23/99 15:30
Matrix	Soil/Solid	**Technical Director: Stephen C. Ede**	
Ordered By			
PWSID		**Released By**	J Windebank

Sample Remarks:

Parameter	Results	PQL	Units	Method	Allowable Limits	Prep Date	Analysis Date	Init
^								
Total Solids	71.3		%	SM18 2540G			09/24/99	SEC
Mercury by Cold Vapor	0.0558	0.0271	mg/Kg	SW846-7471		10/01/99	10/01/99	RMV

CT&E Environmental Services Inc.

CT&E Ref.#	995203020	**Client PO#**	
Client Name	Harding Lawson & Assoc	**Printed Date/Time**	10/05/99 09:53
Project Name/#	Red Top Site Char. Aleknagik	**Collected Date/Time**	09/21/99 15:00
Client Sample ID	99RT24SL	**Received Date/Time**	09/23/99 15:30
Matrix	Soil/Solid	**Technical Director: Stephen C. Ede**	
Ordered By			
PWSID		**Released By**	J Windebank

Sample Remarks:

Parameter	Results	PQL	Units	Method	Allowable Limits	Prep Date	Analysis Date	Init
^								
Total Solids	95.1		%	SM18 2540G			09/24/99	SEC
Mercury by Cold Vapor	0.0819	0.0191	mg/Kg	SW846-7471		10/01/99	10/01/99	RMV

CT&E Environmental Services Inc.

Client	Harding Lawson & Assoc		
Workorder	Red Top Site Char. Aleknagik		
QC Batch	SPT 2994 (66687)		
Original Matrix	Soil/Solid	**Analysis Method**	SM18 2540G

QC results affect the following production samples:

995203001	995203002	995203003	995203004	995203005
995203006	995203007	995203008	995203009	995203010
995203011	995203012	995203013	995203014	995203015
995203016	995203017	995203018	995203019	995203020

QC results for Method Blank [265343]

Run Instrument:

Parameter	Analyzed	Result	PQL	Units
Total Solids	09/24/99	100		%

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CT&E Environmental Services Inc.

Client Harding Lawson & Assoc
Workorder Red Top Site Char. Aleknagik

QC Batch SPT 2994 (66687)
Original 995203001
Matrix Soil/Solid

Analysis Method SM18 2540G

QC results affect the following production samples:

995203001	995203002	995203003	995203004	995203005
995203006	995203007	995203008	995203009	995203010
995203011	995203012	995203013	995203014	995203015
995203016	995203017	995203018	995203019	995203020

QC results for Duplicate [265344]

Parameter	Original Result	QC Result	RPD	RPD Limits	Analyzed	Instru ID
Total Solids	93.9	93.8	.14		09/24/99	

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CT&E Environmental Services Inc.

Client	Harding Lawson & Assoc		
Workorder	Red Top Site Char. Aleknagik		
QC Batch	MXX 6382 (67079)		
Original		**Prep Date**	10/01/99 12:30
Matrix	Water (Surface, Eff., Ground)	**Analysis Method**	SW846-7471

QC results affect the following production samples:

995203001	995203002	995203003	995203004	995203005
995203006	995203007	995203008	995203009	995203010
995203011	995203012	995203013	995203014	995203015
995203016	995203017	995203018	995203019	995203020

QC results for Method Blank [267126]

Run Instrument: HgAA Leeman AutoAnalyzer PS200

Parameter	Analyzed	Result	PQL	Units
Mercury by Cold Vapor	10/01/99	0.000200 U	0.000200	mg/L

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CT&E Environmental Services Inc.

Client Harding Lawson & Assoc
Workorder Red Top Site Char. Aleknagik

QC Batch MXX 6382 (67079)
Original
Matrix Water (Surface, Eff., Ground)

Prep Date 10/01/99 12:30
Analysis Method SW846-7471

QC results affect the following production samples:

995203001	995203002	995203003	995203004	995203005
995203006	995203007	995203008	995203009	995203010
995203011	995203012	995203013	995203014	995203015
995203016	995203017	995203018	995203019	995203020

QC results for Lab Check Standard [267127]

Parameter		QC Result	Pct Recov	LCS/LCSD Limits	RPD	RPD Limits	Spiked Amount	Analyzed	Instru ID
Mercury by Cold Vapor	LCS	0.00192	96	85-115			.002mg/L	10/01/99	F3

F-701

RECEIVED

OCT 21 1999

HARDING LAWSON
ASSOCIATES

CTE Environmental Services
Alaska Division
Laboratory Data Report

Project: Red Top Site Char. Aleknagik

Client: Harding Lawson & Assoc

CTE Work Order: 995204

Contents:

Chain of Custody
Quality Control Summary Forms

Note:

Unless otherwise noted, all quality assurance/quality control criteria is in compliance with the proper regulatory authority and/or CTE's Quality Assurance Program Plan.

CTE Environmental Services
Alaska Division
Laboratory Data Report

Project: Red Top Site Char. Aleknagik

Client: Harding Lawson & Assoc

CTE Work Order: 995204

Contents:

Chain of Custody
Quality Control Summary Forms

Note:

Unless otherwise noted, all quality assurance/quality control criteria is in compliance with the proper regulatory authority and/or CTE's Quality Assurance Program Plan.

Case Narrative

Customer: HARLAWP **Harding Lawson & Assoc**

Project: 995204 **Red Top Site Char. Aleknagik**

266781 LCSD

PAHSIM - LCSD recovery for Acenaphthene(114%) and Fluorene(115%) are biased high. The LCS recovery and RPD met all recovery goals. The data is not significantly affected.

267313 LCSD

PAHSIM - LCSD recovery for Benzo[g,h,i]perylene(121%) is biased high. The LCS recovery and RPD met all criteria. The results are not significantly affected.

267515 IB

PAHSIM - Recovery for surrogate #1(121%) and #2(121%) are biased high. The data is not significantly affected.

Harding Lawson Associates
601 East 57th Place, Anchorage, Alaska, 99518
(907) 563-8102 / FAX (907)561-4574

CHAIN OF CUSTODY

99RT 01

995204

3/4

Laboratory CT&E

Subcontract / Work Authorization Nos.: GSC99021.08 / 007

Turnaround Time: Standard

Project Name: Red Top Site Characterization

Project Location: Aleknagik, Alaska

Project Manager: Joe McElroy

Samplers: H. Hoen / L. Johnson

Recorder: [illegible]

	MATRIX		# Containers & Preservative				IDENTIFIER	DATE AND TIME							ANALYSIS REQUESTED												
			Unpreserved	Methanol			Sample Number	YR		MO		DY		TIME	AK 102 - DRO	cPAH 610			EPA 8021 - BTEX		Total Hg - EPA 7040A	Mercury Speciation					
1	S	L	2	1			99RT 25 SL	9	9	0	9	2	1	1715	X	X			X								
2	S	L	2	1			99RT 26 SL	9	9	0	9	2	1	1725	X	X			X								
3	S	L	2	1			99RT 27 SL	9	9	0	9	2	1	1735	X	X			X								
4	S	L	2	1			99RT 28 SL	9	9	0	9	2	1	1740	X	X			X								
5	S	L	2				99RT EI1 SL	9	9	0	9	2	2	10:00							X						
6	S	L	2				99RT EI2 SL	9	9	0	9	2	2	10:15							X						
7	S	L	2				99RT B1 SL	9	9	0	9	2	2	1100							X						
8	S	L	2				99RT B2 SL	9	9	0	9	2	2	1105							X						
9	S	L	2				99RT B3 SL	9	9	0	9	2	2	1115							X						
10	S	L	2				99RT B4 SL	9	9	0	9	2	2	1120							X						

NOTES:

Use work authorization number for invoicing

CHAIN OF CUSTODY RECORD

RELENQUISHED BY:(Signature)	DATE	TIME	RECEIVED BY:(Signature)	DATE	TIME
RELENQUISHED BY:(Signature)	DATE	TIME	RECEIVED BY:(Signature)	DATE	TIME
RELENQUISHED BY:(Signature)	DATE	TIME	RECEIVED BY:(Signature)	DATE	TIME
DISPATCHED BY:(Signature)	DATE	TIME	RECEIVED FOR LAB BY:(Signature) Sara Howell	DATE 9-23-99	TIME 1530
METHOD OF SHIPMENT					

rding Lawson Associates
601 East 57th Place, Anchorage, Alaska, 99518
(907) 563-8102 / FAX (907)561-4574

CHAIN OF CUSTODY 995204

99RT 01

4/4

Laboratory CT&E

Project Name: Red Top Site Characterization

Subcontract / Work Authorization Nos.: GSC99021.08 / 007

Project Location: Aleknagik, Alaska

Samplers: H. Hoen / L. Johnson

Project Manager: Joe McElroy

Recorder:

Turnaround Time: Standard

	MATRIX		# Containers & Preservative				IDENTIFIER	DATE AND TIME							ANALYSIS REQUESTED												
			unpreserved	methanol			Sample Number	YR		MO		DY		TIME	AK 102 - DRO				EPA 8021 - BTEX		Totoal Hg - EPA 7040A	Mercury Speciation					
11	S	L		2			99RT B5 SL	9	9	0	9	2	2	1130							X						
12	S	L		2			99RT B6 SL	9	9	0	9	2	2	1140							X						
13	S	L			1		99RT TB SL	9	9	0	9								X								
	S	L					99RT SL	9	9	0	9																
	S	L					99RT SL	9	9	0	9																
	S	L					99RT SL	9	9	0	9																
	S	L					99RT SL	9	9	0	9																
	S	L					99RT SL	9	9	0	9																
	S	L					99RT SL	9	9	0	9																
	S	L					99RT SL	9	9	0	9																

NOTES:

Use work authorization number for invoicing

CHAIN OF CUSTODY RECORD

RELINQUISHED BY:(Signature)	DATE	TIME	RECEIVED BY:(Signature)	DATE	TIME
RELINQUISHED BY:(Signature)	DATE	TIME	RECEIVED BY:(Signature)	DATE	TIME
RELINQUISHED BY:(Signature)	DATE	TIME	RECEIVED BY:(Signature)	DATE	TIME
DISPATCHED BY:(Signature)	DATE	TIME	RECEIVED FOR LAB BY:(Signature) Sara Howell	DATE 9-23-99	TIME 1530
METHOD OF SHIPMENT Hand Deliver					

995204

CT&E Environmental Services Inc.

SAMPLE RECEIPT FORM

CT&E WO#:

Yes	No	
	X	Are samples **RUSH**, priority, or *within 72 hrs* of **hold time**?
		If yes, have you done *e-mail notification*?
	X	Are samples *within 24 hrs* of **hold time** or **due date**?
		If yes, have you *spoken with* Supervisor?
	X	Are there any **problems** (e.g., ids, analyses)?
X		Were samples preserved correctly and pH verified?

	X	Has Project Manager been notified of problems?
	X	Is this an ACOE/AFCEE/ADEC project?
	X	Will a **data package** be required?
	X	If this is for PWS, provide **PWSID**.
	X	Is there a **quote** for this project?
	X	Will **courier** charges apply?

Completed by (sign): Tara Howell (print): Tara Howell

Due Date:	10-4-99
Received Date/Time:	9-23-99 1530
Cooler Temperature:	1.9°C
Sample Condition:	(Good) Poor

Matrix of each Sample:

2	" "	-1 → -13
	" "	
	" "	
	" "	
2	Trip Blank	-13
	MS/MSD	

Additional Sample Remarks:

yes	AK101s/_____ 8260s field pres'd?
	Field-filtered for dissolved_____?
	Lab-filter for dissolved_____?
	Ref Lab required?

Notes:

*** The following *must* be completed for *all* ACOE & AFCEE projects: ***

Yes	No		Notes:
	X	Is cooler temperature 4 ± C?	1.9°C
		thermometer used:	CT3
	X	Was there an airbill, etc? note #:	hand carry
	X	Was cooler sealed with custody seals?	
		#/where?	hand carry
	N/A	Were seals intact upon arrival?	
X		Was there a COC with cooler?	
	X	Was the COC filled out properly?	pgs. 3 & 4 were not relinquished
	X	Did the COC indicate ACOE/AFCEE project?	
X		Did the COC and samples correspond?	
	X	Were samples screened with Geiger counter?	
X		Were all samples packed to prevent breakage?	
		packing material:	bubble wrap
X		Were all samples unbroken and clearly labelled?	
X		Were all samples sealed in separate plastic bags?	
N/A		Were all bottles for volatiles free of headspace?	
X		Were correct container/sample sizes submitted?	
		Was client notified of problems? (specify below)	

Individual contacted: _____

Date & Time: _____ Phone/Fax #: _____

# of each Container Received:

	950 ml amber	unpres'd
	950 ml amber	w/ HCl
	500 ml amber	w/ H2SO4
	1L cubies	unpres'd
	1L cubies	w/ HNO3
	1L cubies	w/ H2SO4
	1L cubies	w/ NaOH + ZnAc
	120 ml coli	bottles
	60 ml	Nalg
4	8 oz amber	unpres'd
20	4 oz amber	unpres'd
5	4 oz w/ septa	w/ MeOH
	40 ml vials	w/ HCl
	Other (specify)	
	Other (specify)	

#/Log In Proofed by: _____

Form Number: F004r2
Printed: 7/12/99

CT&E Environmental Services Inc.

Laboratory Division

Laboratory Analysis Report

October 08, 1999

Joe McElroy
Harding Lawson & Assoc
601 East 57th Place
Anchorage, AK 99518

Client Name	Harding Lawson & Assoc
Project ID	Red Top Site Char. Aleknagik [995204]
Printed	October 08, 1999

Enclosed are the analytical results associated with the above project.

As required by the state of Alaska and the USEPA, a formal Quality Assurance/Quality Control Program is maintained by CT&E. A copy of our Quality Control Manual that outlines this program is available at your request.

Except as specifically noted, all statements and data in this report are in conformance to the provisions set forth in our Quality Assurance Program Plan.

If you have any questions regarding this report or if we can be of any other assistance, please call your CT&E Project Manager at (907) 562-2343.

The following descriptors may be found on your report which will serve to further qualify the data.

U - Indicates the compound was analyzed for but not detected.
J - Indicates an estimated value that falls below PQL, but is greater than the MDL.
B - Indicates the analyte is found in the blank associated with the sample.
* - The analyte has exceeded allowable limits.
GT - Greater Than
D - Secondary Dilution
LT - Less Than
! - Surrogate out of range

CT&E Environmental Services Inc.

CT&E Ref.#	995204001	**Client PO#**	GSC99021.08/007
Client Name	Harding Lawson & Assoc	**Printed Date/Time**	10/08/99 12:35
Project Name/#	Red Top Site Char. Aleknagik	**Collected Date/Time**	09/21/99 17:15
Client Sample ID	99RT25SL	**Received Date/Time**	09/23/99 15:30
Matrix	Soil/Solid	**Technical Director: Stephen C. Ede**	
Ordered By			
PWSID		**Released By**	

Sample Remarks:

Parameter	Results	PQL	Units	Method	Allowable Limits	Prep Date	Analysis Date	Init
^								
Total Solids	96.3		%	SM18 2540G			09/24/99	MPA
BTEX								
Benzene	0.011 U	0.011	mg/Kg	BTX SW846-8021B		09/21/99	09/30/99	ELB
Toluene	0.042 U	0.042	mg/Kg	BTX SW846-8021B		09/21/99	09/30/99	ELB
Ethylbenzene	0.042 U	0.042	mg/Kg	BTX SW846-8021B		09/21/99	09/30/99	ELB
P & M -Xylene	0.042 U	0.042	mg/Kg	BTX SW846-8021B		09/21/99	09/30/99	ELB
o-Xylene	0.042 U	0.042	mg/Kg	BTX SW846-8021B		09/21/99	09/30/99	ELB
Surrogates								
4-Bromofluorobenzene <Surr>	90.8		%	BTX SW846-8021B	(50-150)	09/21/99	09/30/99	
1,4-Difluorobenzene <Surr>	83.3		%	BTX SW846-8021B	(60-120)	09/21/99	09/30/99	
AK102								
Diesel Range Organics	9.80 U	9.80	mg/Kg	AK102 DRO		09/25/99	09/30/99	MMP
Surrogates								
5a Androstane <surr>	67.6		%	AK102 DRO	(50-150)	09/25/99	09/30/99	

CT&E Environmental Services Inc.

CT&E Ref.#	995204001	**Client PO#**	GSC99021.08/007
Client Name	Harding Lawson & Assoc	**Printed Date/Time**	10/08/99 12:35
Project Name/#	Red Top Site Char. Aleknagik	**Collected Date/Time**	09/21/99 17:15
Client Sample ID	99RT25SL	**Received Date/Time**	09/23/99 15:30
Matrix	Soil/Solid	**Technical Director: Stephen C. Ede**	
Ordered By			
PWSID			

Parameter	Results	PQL	Units	Method	Allowable Limits	Prep Date	Analysis Date	Init
PAH SIM								
Naphthalene	1.6 U	1.6	ug/Kg	PAH SIM		10/05/99	10/07/99	KWM
Acenaphthylene	1.6 U	1.6	ug/Kg	PAH SIM		10/05/99	10/07/99	KWM
Acenaphthene	1.6 U	1.6	ug/Kg	PAH SIM		10/05/99	10/07/99	KWM
Fluorene	1.6 U	1.6	ug/Kg	PAH SIM		10/05/99	10/07/99	KWM
Phenanthrene	1.6 U	1.6	ug/Kg	PAH SIM		10/05/99	10/07/99	KWM
Anthracene	1.6 U	1.6	ug/Kg	PAH SIM		10/05/99	10/07/99	KWM
Fluoranthene	1.6 U	1.6	ug/Kg	PAH SIM		10/05/99	10/07/99	KWM
Pyrene	1.6 U	1.6	ug/Kg	PAH SIM		10/05/99	10/07/99	KWM
Benzo(a)Anthracene	1.6 U	1.6	ug/Kg	PAH SIM		10/05/99	10/07/99	KWM
Chrysene	1.6 U	1.6	ug/Kg	PAH SIM		10/05/99	10/07/99	KWM
Benzo[b]Fluoranthene	1.6 U	1.6	ug/Kg	PAH SIM		10/05/99	10/07/99	KWM
Benzo[k]fluoranthene	1.6 U	1.6	ug/Kg	PAH SIM		10/05/99	10/07/99	KWM
Benzo[a]pyrene	1.6 U	1.6	ug/Kg	PAH SIM		10/05/99	10/07/99	KWM
Indeno[1,2,3-c,d] pyrene	1.6 U	1.6	ug/Kg	PAH SIM		10/05/99	10/07/99	KWM
Dibenzo[a,h]anthracene	1.6 U	1.6	ug/Kg	PAH SIM		10/05/99	10/07/99	KWM
Benzo[g,h,i]perylene	1.6 U	1.6	ug/Kg	PAH SIM		10/05/99	10/07/99	KWM
Surrogates								
Naphthalene-d8 <surr/IS>	48.1		%	PAH SIM	(9-187)	10/05/99	10/07/99	
Acenaphthene-d10 <surr/IS>	49.4		%	PAH SIM	(21-179)	10/05/99	10/07/99	
Chrysene-d12 <surr/IS>	60.3		%	PAH SIM	(46-154)	10/05/99	10/07/99	

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CT&E Environmental Services Inc.

CT&E Ref.#	995204002	**Client PO#**	GSC99021.08/007
Client Name	Harding Lawson & Assoc	**Printed Date/Time**	10/08/99 12:35
Project Name/#	Red Top Site Char. Aleknagik	**Collected Date/Time**	09/21/99 17:25
Client Sample ID	99RT26SL	**Received Date/Time**	09/23/99 15:30
Matrix	Soil/Solid	**Technical Director: Stephen C. Ede**	
Ordered By			
PWSID		**Released By**	J Windebank

Sample Remarks:

Parameter	Results	PQL	Units	Method	Allowable Limits	Prep Date	Analysis Date	Init
^								
Total Solids	95.5		%	SM18 2540G			09/24/99	MPA
BTEX								
Benzene	0.012 U	0.012	mg/Kg	BTX SW846-8021B		09/21/99	09/30/99	ELB
Toluene	0.047 U	0.047	mg/Kg	BTX SW846-8021B		09/21/99	09/30/99	ELB
Ethylbenzene	0.047 U	0.047	mg/Kg	BTX SW846-8021B		09/21/99	09/30/99	ELB
P & M -Xylene	0.047 U	0.047	mg/Kg	BTX SW846-8021B		09/21/99	09/30/99	ELB
o-Xylene	0.047 U	0.047	mg/Kg	BTX SW846-8021B		09/21/99	09/30/99	ELB
Surrogates								
4-Bromofluorobenzene <Surr>	86.8		%	BTX SW846-8021B	(50-150)	09/21/99	09/30/99	
1,4-Difluorobenzene <Surr>	83.6		%	BTX SW846-8021B	(60-120)	09/21/99	09/30/99	
AK102								
Diesel Range Organics	9.67 U	9.67	mg/Kg	AK102 DRO		09/25/99	09/30/99	MMP
Surrogates								
5a Androstane <surr>	59.2		%	AK102 DRO	(50-150)	09/25/99	09/30/99	

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CT&E Environmental Services Inc.

CT&E Ref.#	995204002	**Client PO#**	GSC99021.08/007
Client Name	Harding Lawson & Assoc	**Printed Date/Time**	10/08/99 12:35
Project Name/#	Red Top Site Char. Aleknagik	**Collected Date/Time**	09/21/99 17:25
Client Sample ID	99RT26SL	**Received Date/Time**	09/23/99 15:30
Matrix	Soil/Solid	**Technical Director: Stephen C. Ede**	
Ordered By			
PWSID			

Parameter	Results	PQL	Units	Method	Allowable Limits	Prep Date	Analysis Date	Init
PAH SIM								
Naphthalene	1.6 U	1.6	ug/Kg	PAH SIM		10/05/99	10/07/99	KWM
Acenaphthylene	1.6 U	1.6	ug/Kg	PAH SIM		10/05/99	10/07/99	KWM
Acenaphthene	1.6 U	1.6	ug/Kg	PAH SIM		10/05/99	10/07/99	KWM
Fluorene	1.6 U	1.6	ug/Kg	PAH SIM		10/05/99	10/07/99	KWM
Phenanthrene	1.6 U	1.6	ug/Kg	PAH SIM		10/05/99	10/07/99	KWM
Anthracene	1.6 U	1.6	ug/Kg	PAH SIM		10/05/99	10/07/99	KWM
Fluoranthene	1.6 U	1.6	ug/Kg	PAH SIM		10/05/99	10/07/99	KWM
Pyrene	1.6 U	1.6	ug/Kg	PAH SIM		10/05/99	10/07/99	KWM
Benzo(a)Anthracene	1.6 U	1.6	ug/Kg	PAH SIM		10/05/99	10/07/99	KWM
Chrysene	1.6 U	1.6	ug/Kg	PAH SIM		10/05/99	10/07/99	KWM
Benzo[b]Fluoranthene	1.6 U	1.6	ug/Kg	PAH SIM		10/05/99	10/07/99	KWM
Benzo[k]fluoranthene	1.6 U	1.6	ug/Kg	PAH SIM		10/05/99	10/07/99	KWM
Benzo[a]pyrene	1.6 U	1.6	ug/Kg	PAH SIM		10/05/99	10/07/99	KWM
Indeno[1,2,3-c,d] pyrene	1.6 U	1.6	ug/Kg	PAH SIM		10/05/99	10/07/99	KWM
Dibenzo[a,h]anthracene	1.6 U	1.6	ug/Kg	PAH SIM		10/05/99	10/07/99	KWM
Benzo[g,h,i]perylene	1.6 U	1.6	ug/Kg	PAH SIM		10/05/99	10/07/99	KWM
Surrogates								
Naphthalene-d8 <surr/IS>	54.8		%	PAH SIM	(9-187)	10/05/99	10/07/99	
Acenaphthene-d10 <surr/IS>	60.8		%	PAH SIM	(21-179)	10/05/99	10/07/99	
Chrysene-d12 <surr/IS>	64.5		%	PAH SIM	(46-154)	10/05/99	10/07/99	

CT&E Environmental Services Inc.

CT&E Ref.#	995204003	**Client PO#**	GSC99021.08/007
Client Name	Harding Lawson & Assoc	**Printed Date/Time**	10/08/99 12:35
Project Name/#	Red Top Site Char. Aleknagik	**Collected Date/Time**	09/21/99 17:35
Client Sample ID	99RT27SL	**Received Date/Time**	09/23/99 15:30
Matrix	Soil/Solid	**Technical Director: Stephen C. Ede**	
Ordered By			
PWSID		**Released By**	J Windebank

Sample Remarks:

Parameter	Results	PQL	Units	Method	Allowable Limits	Prep Date	Analysis Date	Init
^								
Total Solids	95.4		%	SM18 2540G			09/24/99	MPA
BTEX								
Benzene	0.013 U	0.013	mg/Kg	BTX SW846-8021B		09/21/99	09/30/99	ELB
Toluene	0.053 U	0.053	mg/Kg	BTX SW846-8021B		09/21/99	09/30/99	ELB
Ethylbenzene	0.053 U	0.053	mg/Kg	BTX SW846-8021B		09/21/99	09/30/99	ELB
P & M -Xylene	0.053 U	0.053	mg/Kg	BTX SW846-8021B		09/21/99	09/30/99	ELB
o-Xylene	0.053 U	0.053	mg/Kg	BTX SW846-8021B		09/21/99	09/30/99	ELB
Surrogates								
4-Bromofluorobenzene <Surr>	91.4		%	BTX SW846-8021B	(50-150)	09/21/99	09/30/99	
1,4-Difluorobenzene <Surr>	84.1		%	BTX SW846-8021B	(60-120)	09/21/99	09/30/99	
AK102								
Diesel Range Organics	10.1 U	10.1	mg/Kg	AK102 DRO		09/25/99	09/30/99	MMP
Surrogates								
5a Androstane <surr>	68.8		%	AK102 DRO	(50-150)	09/25/99	09/30/99	

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CT&E Environmental Services Inc.

CT&E Ref.#	995204003	**Client PO#**	GSC99021.08/007
Client Name	Harding Lawson & Assoc	**Printed Date/Time**	10/08/99 12:35
Project Name/#	Red Top Site Char. Aleknagik	**Collected Date/Time**	09/21/99 17:35
Client Sample ID	99RT27SL	**Received Date/Time**	09/23/99 15:30
Matrix	Soil/Solid	**Technical Director: Stephen C. Ede**	
Ordered By			
PWSID			

Parameter	Results	PQL	Units	Method	Allowable Limits	Prep Date	Analysis Date	Init
PAH SIM								
Naphthalene	1.5 U	1.5	ug/Kg	PAH SIM		10/01/99	10/06/99	KWM
Acenaphthylene	1.5 U	1.5	ug/Kg	PAH SIM		10/01/99	10/06/99	KWM
Acenaphthene	1.5 U	1.5	ug/Kg	PAH SIM		10/01/99	10/06/99	KWM
Fluorene	1.5 U	1.5	ug/Kg	PAH SIM		10/01/99	10/06/99	KWM
Phenanthrene	1.82	1.5	ug/Kg	PAH SIM		10/01/99	10/06/99	KWM
Anthracene	1.5 U	1.5	ug/Kg	PAH SIM		10/01/99	10/06/99	KWM
Fluoranthene	1.69	1.5	ug/Kg	PAH SIM		10/01/99	10/06/99	KWM
Pyrene	1.5 U	1.5	ug/Kg	PAH SIM		10/01/99	10/06/99	KWM
Benzo(a)Anthracene	1.5 U	1.5	ug/Kg	PAH SIM		10/01/99	10/06/99	KWM
Chrysene	1.5 U	1.5	ug/Kg	PAH SIM		10/01/99	10/06/99	KWM
Benzo[b]Fluoranthene	1.5 U	1.5	ug/Kg	PAH SIM		10/01/99	10/06/99	KWM
Benzo[k]fluoranthene	1.5 U	1.5	ug/Kg	PAH SIM		10/01/99	10/06/99	KWM
Benzo[a]pyrene	1.5 U	1.5	ug/Kg	PAH SIM		10/01/99	10/06/99	KWM
Indeno[1,2,3-c,d] pyrene	1.5 U	1.5	ug/Kg	PAH SIM		10/01/99	10/06/99	KWM
Dibenzo[a,h]anthracene	1.5 U	1.5	ug/Kg	PAH SIM		10/01/99	10/06/99	KWM
Benzo[g,h,i]perylene	1.5 U	1.5	ug/Kg	PAH SIM		10/01/99	10/06/99	KWM
Surrogates								
Naphthalene-d8 <surr/IS>	54		%	PAH SIM	(9-187)	10/01/99	10/06/99	
Acenaphthene-d10 <surr/IS>	62.7		%	PAH SIM	(21-179)	10/01/99	10/06/99	
Chrysene-d12 <surr/IS>	91.6		%	PAH SIM	(46-154)	10/01/99	10/06/99	

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CT&E Environmental Services Inc.

CT&E Ref.#	995204004	**Client PO#**	GSC99021.08/007
Client Name	Harding Lawson & Assoc	**Printed Date/Time**	10/08/99 12:35
Project Name/#	Red Top Site Char. Aleknagik	**Collected Date/Time**	09/21/99 17:40
Client Sample ID	99RT28SL	**Received Date/Time**	09/23/99 15:30
Matrix	Soil/Solid	**Technical Director: Stephen C. Ede**	
Ordered By			
PWSID		**Released By**	J Windebank

Sample Remarks:

Parameter	Results	PQL	Units	Method	Allowable Limits	Prep Date	Analysis Date	Init
^								
Total Solids	94.0		%	SM18 2540G			09/24/99	MPA
BTEX								
Benzene	0.0099 U	0.0099	mg/Kg	BTX SW846-8021B		09/21/99	10/02/99	ELB
Toluene	0.040 U	0.040	mg/Kg	BTX SW846-8021B		09/21/99	10/02/99	ELB
Ethylbenzene	0.040 U	0.040	mg/Kg	BTX SW846-8021B		09/21/99	10/02/99	ELB
P & M -Xylene	0.040 U	0.040	mg/Kg	BTX SW846-8021B		09/21/99	10/02/99	ELB
o-Xylene	0.040 U	0.040	mg/Kg	BTX SW846-8021B		09/21/99	10/02/99	ELB
Surrogates								
4-Bromofluorobenzene <Surr>	82.2		%	BTX SW846-8021B	(50-150)	09/21/99	10/02/99	
1,4-Difluorobenzene <Surr>	86.9		%	BTX SW846-8021B	(60-120)	09/21/99	10/02/99	
AK102								
Diesel Range Organics	10.0 U	10.0	mg/Kg	AK102 DRO		09/25/99	09/30/99	MMP
Surrogates								
5a Androstane <surr>	54.2		%	AK102 DRO	(50-150)	09/25/99	09/30/99	

CT&E Environmental Services Inc.

CT&E Ref.#	995204004	**Client PO#**	GSC99021.08/007
Client Name	Harding Lawson & Assoc	**Printed Date/Time**	10/08/99 12:35
Project Name/#	Red Top Site Char. Aleknagik	**Collected Date/Time**	09/21/99 17:40
Client Sample ID	99RT28SL	**Received Date/Time**	09/23/99 15:30
Matrix	Soil/Solid	**Technical Director: Stephen C. Ede**	
Ordered By			
PWSID			

Parameter	Results	PQL	Units	Method	Allowable Limits	Prep Date	Analysis Date	Init
PAH SIM								
Naphthalene	1.7 U	1.7	ug/Kg	PAH SIM		10/01/99	10/06/99	KWM
Acenaphthylene	1.7 U	1.7	ug/Kg	PAH SIM		10/01/99	10/06/99	KWM
Acenaphthene	1.7 U	1.7	ug/Kg	PAH SIM		10/01/99	10/06/99	KWM
Fluorene	1.7 U	1.7	ug/Kg	PAH SIM		10/01/99	10/06/99	KWM
Phenanthrene	1.7 U	1.7	ug/Kg	PAH SIM		10/01/99	10/06/99	KWM
Anthracene	1.7 U	1.7	ug/Kg	PAH SIM		10/01/99	10/06/99	KWM
Fluoranthene	1.7 U	1.7	ug/Kg	PAH SIM		10/01/99	10/06/99	KWM
Pyrene	1.7 U	1.7	ug/Kg	PAH SIM		10/01/99	10/06/99	KWM
Benzo(a)Anthracene	1.7 U	1.7	ug/Kg	PAH SIM		10/01/99	10/06/99	KWM
Chrysene	1.7 U	1.7	ug/Kg	PAH SIM		10/01/99	10/06/99	KWM
Benzo[b]Fluoranthene	1.7 U	1.7	ug/Kg	PAH SIM		10/01/99	10/06/99	KWM
Benzo[k]fluoranthene	1.7 U	1.7	ug/Kg	PAH SIM		10/01/99	10/06/99	KWM
Benzo[a]pyrene	1.7 U	1.7	ug/Kg	PAH SIM		10/01/99	10/06/99	KWM
Indeno[1,2,3-c,d] pyrene	1.7 U	1.7	ug/Kg	PAH SIM		10/01/99	10/06/99	KWM
Dibenzo[a,h]anthracene	1.7 U	1.7	ug/Kg	PAH SIM		10/01/99	10/06/99	KWM
Benzo[g,h,i]perylene	1.7 U	1.7	ug/Kg	PAH SIM		10/01/99	10/06/99	KWM
Surrogates								
Naphthalene-d8 <surr/IS>	56.6		%	PAH SIM	(9-187)	10/01/99	10/06/99	
Acenaphthene-d10 <surr/IS>	66.3		%	PAH SIM	(21-179)	10/01/99	10/06/99	
Chrysene-d12 <surr/IS>	77.8		%	PAH SIM	(46-154)	10/01/99	10/06/99	

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CT&E Environmental Services Inc.

CT&E Ref.#	995204005	**Client PO#**	GSC99021.08/007
Client Name	Harding Lawson & Assoc	**Printed Date/Time**	10/08/99 12:35
Project Name/#	Red Top Site Char. Aleknagik	**Collected Date/Time**	09/22/99 10:00
Client Sample ID	99RTEI1	**Received Date/Time**	09/23/99 15:30
Matrix	Soil/Solid	**Technical Director: Stephen C. Ede**	
Ordered By			
PWSID		**Released By**	J Windebank

Sample Remarks:

Parameter	Results	PQL	Units	Method	Allowable Limits	Prep Date	Analysis Date	Init
^								
Total Solids	95.6		%	SM18 2540G			09/24/99	MPA
Mercury by Cold Vapor	0.636	0.0159	mg/Kg	SW846-7471		09/24/99	09/27/99	RMV

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CT&E Environmental Services Inc.

CT&E Ref.#	995204006	**Client PO#**	GSC99021.08/007
Client Name	Harding Lawson & Assoc	**Printed Date/Time**	10/08/99 12:35
Project Name/#	Red Top Site Char. Aleknagik	**Collected Date/Time**	09/22/99 10:15
Client Sample ID	99RTEI2	**Received Date/Time**	09/23/99 15:30
Matrix	Soil/Solid	**Technical Director: Stephen C. Ede**	
Ordered By			
PWSID		**Released By**	J Windebank

Sample Remarks:

Parameter	Results	PQL	Units	Method	Allowable Limits	Prep Date	Analysis Date	Init
^								
Total Solids	91.8		%	SM18 2540G			09/24/99	MPA
Mercury by Cold Vapor	0.778	0.0174	mg/Kg	SW846-7471		09/24/99	09/27/99	RMV

CT&E Environmental Services Inc.

CT&E Ref.#	995204007	**Client PO#**	GSC99021.08/007
Client Name	Harding Lawson & Assoc	**Printed Date/Time**	10/08/99 12:35
Project Name/#	Red Top Site Char. Aleknagik	**Collected Date/Time**	09/22/99 11:00
Client Sample ID	99RTB1	**Received Date/Time**	09/23/99 15:30
Matrix	Soil/Solid	**Technical Director: Stephen C. Ede**	
Ordered By			
PWSID		**Released By**	J Windebank

Sample Remarks:

Parameter	Results	PQL	Units	Method	Allowable Limits	Prep Date	Analysis Date	Init
^								
Total Solids	76.3		%	SM18 2540G			09/24/99	MPA
Mercury by Cold Vapor	0.0568	0.0216	mg/Kg	SW846-7471		09/24/99	09/27/99	RMV

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CT&E Environmental Services Inc.

CT&E Ref.#	995204008	**Client PO#**	GSC99021.08/007
Client Name	Harding Lawson & Assoc	**Printed Date/Time**	10/08/99 12:35
Project Name/#	Red Top Site Char. Aleknagik	**Collected Date/Time**	09/22/99 11:05
Client Sample ID	99RTB2	**Received Date/Time**	09/23/99 15:30
Matrix	Soil/Solid	**Technical Director: Stephen C. Ede**	
Ordered By			
PWSID		**Released By**	J Windebank

Sample Remarks:

Parameter	Results	PQL	Units	Method	Allowable Limits	Prep Date	Analysis Date	Init
^								
Total Solids	82.9		%	SM18 2540G			09/24/99	MPA
Mercury by Cold Vapor	0.0845	0.0200	mg/Kg	SW846-7471		09/24/99	09/27/99	RMV

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CT&E Environmental Services Inc.

CT&E Ref.#	995204009	**Client PO#**	GSC99021.08/007
Client Name	Harding Lawson & Assoc	**Printed Date/Time**	10/08/99 12:35
Project Name/#	Red Top Site Char. Aleknagik	**Collected Date/Time**	09/22/99 11:15
Client Sample ID	99RTB3	**Received Date/Time**	09/23/99 15:30
Matrix	Soil/Solid	**Technical Director: Stephen C. Ede**	
Ordered By			
PWSID		**Released By**	J Windebank

Sample Remarks:

Parameter	Results	PQL	Units	Method	Allowable Limits	Prep Date	Analysis Date	Init
^								
Total Solids	77.4		%	SM18 2540G			09/24/99	MPA
Mercury by Cold Vapor	0.0342	0.0203	mg/Kg	SW846-7471		09/24/99	09/27/99	RMV

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CT&E Environmental Services Inc.

CT&E Ref.#	995204010	**Client PO#**	GSC99021.08/007
Client Name	Harding Lawson & Assoc	**Printed Date/Time**	10/08/99 12:35
Project Name/#	Red Top Site Char. Aleknagik	**Collected Date/Time**	09/22/99 11:20
Client Sample ID	99RTB4	**Received Date/Time**	09/23/99 15:30
Matrix	Soil/Solid	**Technical Director: Stephen C. Ede**	
Ordered By			
PWSID		**Released By**	J Windebank

Sample Remarks:

Parameter	Results	PQL	Units	Method	Allowable Limits	Prep Date	Analysis Date	Init
^								
Total Solids	94.2		%	SM18 2540G			09/24/99	MPA
Mercury by Cold Vapor	0.0789	0.0161	mg/Kg	SW846-7471		09/24/99	09/27/99	RMV

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CT&E Environmental Services Inc.

CT&E Ref.#	995204011	**Client PO#**	GSC99021.08/007
Client Name	Harding Lawson & Assoc	**Printed Date/Time**	10/08/99 12:35
Project Name/#	Red Top Site Char. Aleknagik	**Collected Date/Time**	09/22/99 11:30
Client Sample ID	99RTB5	**Received Date/Time**	09/23/99 15:30
Matrix	Soil/Solid	**Technical Director: Stephen C. Ede**	
Ordered By			
PWSID		**Released By**	J Windebank

Sample Remarks:

Parameter	Results	PQL	Units	Method	Allowable Limits	Prep Date	Analysis Date	Init
^								
Total Solids	74.9		%	SM18 2540G			09/24/99	MPA
Mercury by Cold Vapor	0.0842	0.0219	mg/Kg	SW846-7471		09/24/99	09/27/99	RMV

CT&E Environmental Services Inc.

CT&E Ref.#	995204012	**Client PO#**	GSC99021.08/007
Client Name	Harding Lawson & Assoc	**Printed Date/Time**	10/08/99 12:35
Project Name/#	Red Top Site Char. Aleknagik	**Collected Date/Time**	09/22/99 11:40
Client Sample ID	99RTB6	**Received Date/Time**	09/23/99 15:30
Matrix	Soil/Solid	**Technical Director: Stephen C. Ede**	
Ordered By			
PWSID		**Released By**	J Windebank

Sample Remarks:

Parameter	Results	PQL	Units	Method	Allowable Limits	Prep Date	Analysis Date	Init
^								
Total Solids	86.9		%	SM18 2540G			09/24/99	MPA
Mercury by Cold Vapor	0.156	0.0186	mg/Kg	SW846-7471		09/24/99	09/27/99	RMV

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CT&E Environmental Services Inc.

CT&E Ref.#	995204013	**Client PO#**	GSC99021.08/007
Client Name	Harding Lawson & Assoc	**Printed Date/Time**	10/08/99 12:35
Project Name/#	Red Top Site Char. Aleknagik	**Collected Date/Time**	
Client Sample ID	99RTTB	**Received Date/Time**	09/23/99 15:30
Matrix	Soil/Solid	**Technical Director: Stephen C. Ede**	
Ordered By			
PWSID		**Released By**	J Windebank

Sample Remarks:

Parameter	Results	PQL	Units	Method	Allowable Limits	Prep Date	Analysis Date	Init
^								
Total Solids	100		%	SM18 2540G			09/24/99	MPA
BTEX								
Benzene	0.013 U	0.013	mg/Kg	BTX SW846-8021B		10/01/99	10/02/99	ELB
Toluene	0.050 U	0.050	mg/Kg	BTX SW846-8021B		10/01/99	10/02/99	ELB
Ethylbenzene	0.050 U	0.050	mg/Kg	BTX SW846-8021B		10/01/99	10/02/99	ELB
P & M -Xylene	0.050 U	0.050	mg/Kg	BTX SW846-8021B		10/01/99	10/02/99	ELB
o-Xylene	0.050 U	0.050	mg/Kg	BTX SW846-8021B		10/01/99	10/02/99	ELB
Surrogates								
4-Bromofluorobenzene <Surr>	87.6		%	BTX SW846-8021B		10/01/99	10/02/99	
1,4-Difluorobenzene <Surr>	87.6		%	BTX SW846-8021B	(50-150)	10/01/99	10/02/99	

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CT&E Environmental Services Inc.

Client Harding Lawson & Assoc
Workorder Red Top Site Char. Aleknagik

QC Batch SPT 2995 (66689)
Original
Matrix Soil/Solid **Analysis Method** SM18 2540G

QC results affect the following production samples:

995204001	995204002	995204003	995204004	995204005
995204006	995204007	995204008	995204009	995204010
995204011	995204012	995204013		

QC results for Method Blank [265349]

Run Instrument:

Parameter	Analyzed	Result	PQL	Units
Total Solids	09/24/99	100		%

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CT&E Environmental Services Inc.

Client Harding Lawson & Assoc
Workorder Red Top Site Char. Aleknagik

QC Batch SPT 2995 (66689)
Original 995204001
Matrix Soil/Solid **Analysis Method** SM18 2540G

QC results affect the following production samples:

995204001	995204002	995204003	995204004	995204005
995204006	995204007	995204008	995204009	995204010
995204011	995204012	995204013		

QC results for Duplicate [265350]

Parameter	Original Result	QC Result	RPD	RPD Limits	Analyzed	Instru ID
Total Solids	96.3	96.3	.067		09/24/99	

CT&E Environmental Services Inc.

Client	Harding Lawson & Assoc		
Workorder	Red Top Site Char. Aleknagik		
QC Batch	VXX 5686 (66995)		
Original		**Prep Date**	10/01/99 12:02
Matrix	Soil/Solid	**Analysis Method**	AK101/8021B

QC results affect the following production samples:

995204001 995204002 995204003

QC results for Method Blank [266815]

Run Instrument: HP 5890 Series II PID+FID VDA

Parameter	Analyzed	Result	PQL	Units
Benzene	09/30/99	0.0125 U	0.0125	mg/Kg
Toluene	09/30/99	0.0500 U	0.0500	mg/Kg
Ethylbenzene	09/30/99	0.0500 U	0.0500	mg/Kg
P & M -Xylene	09/30/99	0.0500 U	0.0500	mg/Kg
o-Xylene	09/30/99	0.0500 U	0.0500	mg/Kg

CT&E Environmental Services Inc.

Client	Harding Lawson & Assoc		
Workorder	Red Top Site Char. Aleknagik		
QC Batch	VXX 5686 (66995)		
Original		**Prep Date**	10/01/99 12:02
Matrix	Soil/Solid	**Analysis Method**	AK101/8021B

QC results affect the following production samples:

995204001 995204002 995204003

QC results for Lab Check Standard [266816] - Lab Check Standard Duplicate [266817]

Parameter		QC Result	Pct Recov	LCS/LCSD Limits	RPD	RPD Limits	Spiked Amount	Analyzed	Instru ID
Benzene	LCS	0.75	90.4	80-120			.83mg/Kg	09/30/99	VDA
	LCSD	0.747	90		.44	0-20	.83mg/Kg	09/30/99	VDA
Toluene	LCS	3.2	95.6	80-120			3.35mg/Kg	09/30/99	VDA
	LCSD	3.22	96.2		.63	0-20	3.35mg/Kg	09/30/99	VDA
Ethylbenzene	LCS	0.539	85.8	80-120			.628mg/Kg	09/30/99	VDA
	LCSD	0.542	86.3		.58	0-20	.628mg/Kg	09/30/99	VDA
P & M -Xylene	LCS	1.93	86.1	80-120			2.24mg/Kg	09/30/99	VDA
	LCSD	1.94	86.5		.46	0-20	2.24mg/Kg	09/30/99	VDA
o-Xylene	LCS	0.732	85.2	80-120			.859mg/Kg	09/30/99	VDA
	LCSD	0.735	85.5		.35	0-20	.859mg/Kg	09/30/99	VDA

F-701

CT&E Environmental Services Inc.

Client	Harding Lawson & Assoc		
Workorder	Red Top Site Char. Aleknagik		
QC Batch	VXX 5689 (66999)		
Original		**Prep Date**	10/01/99 15:12
Matrix	Soil/Solid	**Analysis Method**	AK101/8021B

QC results affect the following production samples:

995204004 995204013

QC results for Method Blank [266824]

Run Instrument: HP 5890 Series II PID+FID VCA

Parameter	Analyzed	Result	PQL	Units
Benzene	10/01/99	0.0125 U	0.0125	mg/Kg
Toluene	10/01/99	0.0500 U	0.0500	mg/Kg
Ethylbenzene	10/01/99	0.0500 U	0.0500	mg/Kg
P & M -Xylene	10/01/99	0.0500 U	0.0500	mg/Kg
o-Xylene	10/01/99	0.0500 U	0.0500	mg/Kg

F-701

CT&E Environmental Services Inc.

Client	Harding Lawson & Assoc		
Workorder	Red Top Site Char. Aleknagik		
QC Batch	VXX 5689 (66999)		
Original		**Prep Date**	10/01/99 15:12
Matrix	Soil/Solid	**Analysis Method**	AK101/8021B

QC results affect the following production samples:

995204004 995204013

QC results for Lab Check Standard [266825] - Lab Check Standard Duplicate [266826]

Parameter		QC Result	Pct Recov	LCS/LCSD Limits	RPD	RPD Limits	Spiked Amount	Analyzed	Instru ID
Benzene	LCS	0.845	102	80-120			.83mg/Kg	10/01/99	VCA
	LCSD	0.837	101		.99	0-20	.83mg/Kg	10/01/99	VCA
Toluene	LCS	3.52	105	80-120			3.35mg/Kg	10/01/99	VCA
	LCSD	3.5	104		.96	0-20	3.35mg/Kg	10/01/99	VCA
Ethylbenzene	LCS	0.613	97.6	80-120			.628mg/Kg	10/01/99	VCA
	LCSD	0.611	97.4		.21	0-20	.628mg/Kg	10/01/99	VCA
P & M -Xylene	LCS	2.23	99.8	80-120			2.24mg/Kg	10/01/99	VCA
	LCSD	2.23	99.7		.1	0-20	2.24mg/Kg	10/01/99	VCA
o-Xylene	LCS	0.834	97.1	80-120			.859mg/Kg	10/01/99	VCA
	LCSD	0.832	96.8		.31	0-20	.859mg/Kg	10/01/99	VCA

F-701

CT&E Environmental Services Inc.

Client	Harding Lawson & Assoc		
Workorder	Red Top Site Char. Aleknagik		
QC Batch	XXX 6081 (66698)		
Original		**Prep Date**	09/25/99 11:00
Matrix	Soil/Solid	**Analysis Method**	AK102/103

QC results affect the following production samples:

995204001 995204002 995204003 995204004

QC results for Method Blank [265386]

Run Instrument: HP 5890 Series II FID SV C F

Parameter	Analyzed	Result	PQL	Units
Diesel Range Organics	09/27/99	4.73 J	9.68	mg/Kg

F-701

CT&E Environmental Services Inc.

Client	Harding Lawson & Assoc		
Workorder	Red Top Site Char. Aleknagik		
QC Batch	XXX 6081 (66698)		
Original		**Prep Date**	09/25/99 11:00
Matrix	Soil/Solid	**Analysis Method**	AK102/103

QC results affect the following production samples:

995204001 995204002 995204003 995204004

QC results for Lab Check Standard [265387] - Lab Check Standard Duplicate [265388]

Parameter		QC Result	Pct Recov	LCS/LCSD Limits	RPD	RPD Limits	Spiked Amount	Analyzed	Instru ID
Diesel Range Organics	LCS	169	103	60-120			165mg/Kg	09/27/99	SCF
	LCSD	151	101		2	0-20	165mg/Kg	09/27/99	SCF

F-701

CT&E Environmental Services Inc.

Client	Harding Lawson & Assoc		
Workorder	Red Top Site Char. Aleknagik		
QC Batch	XXX 6122 (67120)		
Original		**Prep Date**	10/05/99 10:00
Matrix	Soil/Solid	**Analysis Method**	PAH SIM

QC results affect the following production samples:

995204001 995204002

QC results for Method Blank [267311]

Run Instrument: HP 5890 Series II MS2 SVOA

Parameter	Analyzed	Result	PQL	Units
Naphthalene	10/06/99	1.20 J	1.6	ug/Kg
Acenaphthylene	10/06/99	1.6 U	1.6	ug/Kg
Acenaphthene	10/06/99	1.6 U	1.6	ug/Kg
Fluorene	10/06/99	1.6 U	1.6	ug/Kg
Phenanthrene	10/06/99	1.6 U	1.6	ug/Kg
Anthracene	10/06/99	1.6 U	1.6	ug/Kg
Fluoranthene	10/06/99	1.6 U	1.6	ug/Kg
Pyrene	10/06/99	1.6 U	1.6	ug/Kg
Benzo(a)Anthracene	10/06/99	1.6 U	1.6	ug/Kg
Chrysene	10/06/99	1.6 U	1.6	ug/Kg
Benzo[b]Fluoranthene	10/06/99	1.6 U	1.6	ug/Kg
Benzo[k]fluoranthene	10/06/99	1.6 U	1.6	ug/Kg
Benzo[a]pyrene	10/06/99	1.6 U	1.6	ug/Kg
Indeno[1,2,3-c,d] pyrene	10/06/99	1.6 U	1.6	ug/Kg
Dibenzo[a,h]anthracene	10/06/99	1.6 U	1.6	ug/Kg
Benzo[g,h,i]perylene	10/06/99	1.6 U	1.6	ug/Kg

F-701

CT&E Environmental Services Inc.

Client	Harding Lawson & Assoc		
Workorder	Red Top Site Char. Aleknagik		
QC Batch	XXX 6122 (67120)		
Original		**Prep Date**	10/05/99 10:00
Matrix	Soil/Solid	**Analysis Method**	PAH SIM

QC results affect the following production samples:

995204001 995204002

QC results for Lab Check Standard [267312] - Lab Check Standard Duplicate [267313]

Parameter		QC Result	Pct Recov	LCS/LCSD Limits	RPD	RPD Limits	Spiked Amount	Analyzed	Instru ID
Naphthalene	LCS	18.3	118	58-140			15.5ug/Kg	10/06/99	SOA
	LCSD	19.1	118		0	0-40	15.5ug/Kg	10/06/99	SOA
Acenaphthylene	LCS	15.7	101	52-120			15.5ug/Kg	10/06/99	SOA
	LCSD	16.1	99		2	0-40	15.5ug/Kg	10/06/99	SOA
Acenaphthene	LCS	16.9	109	50-112			15.5ug/Kg	10/06/99	SOA
	LCSD	18.2	112		2.7	0-40	15.5ug/Kg	10/06/99	SOA
Fluorene	LCS	15.9	103	56-114			15.5ug/Kg	10/06/99	SOA
	LCSD	16.4	101		2	0-40	15.5ug/Kg	10/06/99	SOA
Phenanthrene	LCS	12.1	78.1	38-124			15.5ug/Kg	10/06/99	SOA
	LCSD	13.5	83.2		6.3	0-40	15.5ug/Kg	10/06/99	SOA
Anthracene	LCS	12.6	81.4	44-149			15.5ug/Kg	10/06/99	SOA
	LCSD	14.9	91.5		11.7	0-40	15.5ug/Kg	10/06/99	SOA
Fluoranthene	LCS	13.9	89.9	42-139			15.5ug/Kg	10/06/99	SOA
	LCSD	14.4	88.2		1.9	0-40	15.5ug/Kg	10/06/99	SOA
Pyrene	LCS	13.7	88.5	45-137			15.5ug/Kg	10/06/99	SOA
	LCSD	14.1	86.4		2.4	0-40	15.5ug/Kg	10/06/99	SOA
Benzo(a)Anthracene	LCS	15.9	103	51-135			15.5ug/Kg	10/06/99	SOA
	LCSD	16.5	101		2	0-40	15.5ug/Kg	10/06/99	SOA

F-701

CT&E Environmental Services Inc.

Client	Harding Lawson & Assoc		
Workorder	Red Top Site Char. Aleknagik		
QC Batch	XXX 6122 (67120)		
Original		**Prep Date**	10/05/99 10:00
Matrix	Soil/Solid	**Analysis Method**	PAH SIM

QC results for Lab Check Standard [267312] - Lab Check Standard Duplicate [267313] (continued)

Parameter		QC Result	Pct Recov	LCS/LCSD Limits	RPD	RPD Limits	Spiked Amount	Analyzed	Instru ID
Chrysene	LCS	16.9	109	49-124			15.5ug/Kg	10/06/99	SOA
	LCSD	18.2	112		2.7	0-40	15.5ug/Kg	10/06/99	SOA
Benzo[b]Fluoranthene	LCS	16.8	109	40-125			15.5ug/Kg	10/06/99	SOA
	LCSD	20.2	124		12.9	0-40	15.5ug/Kg	10/06/99	SOA
Benzo[k]fluoranthene	LCS	15.2	97.9	45-137			15.5ug/Kg	10/06/99	SOA
	LCSD	14.5	89		9.5	0-40	15.5ug/Kg	10/06/99	SOA
Benzo[a]pyrene	LCS	11.6	74.7	49-130			15.5ug/Kg	10/06/99	SOA
	LCSD	13.4	82.4		9.8	0-40	15.5ug/Kg	10/06/99	SOA
Indeno[1,2,3-c,d] pyrene	LCS	15.2	98.3	42-128			15.5ug/Kg	10/06/99	SOA
	LCSD	17.1	105		6.6	0-40	15.5ug/Kg	10/06/99	SOA
Dibenzo[a,h]anthracene	LCS	14.7	95	69-150			15.5ug/Kg	10/06/99	SOA
	LCSD	16.5	101		6.1	0-40	15.5ug/Kg	10/06/99	SOA
Benzo[g,h,i]perylene	LCS	16.9	109	67-120			15.5ug/Kg	10/06/99	SOA
	LCSD	19.6	121		10.4	0-40	15.5ug/Kg	10/06/99	SOA

F-701

CT&E Environmental Services Inc.

Client	Harding Lawson & Assoc		
Workorder	Red Top Site Char. Aleknagik		
QC Batch	XXX 6110 (66986)		
Original		**Prep Date**	10/01/99 09:30
Matrix	Soil/Solid	**Analysis Method**	PAH SIM

QC results affect the following production samples:

995204003 995204004

QC results for Method Blank [266779]

Run Instrument: HP 5890 Series II MS2 SVOA

Parameter	Analyzed	Result	PQL	Units
Naphthalene	10/05/99	0.723 J	1.6	ug/Kg
Acenaphthylene	10/05/99	1.6 U	1.6	ug/Kg
Acenaphthene	10/05/99	1.6 U	1.6	ug/Kg
Fluorene	10/05/99	1.6 U	1.6	ug/Kg
Phenanthrene	10/05/99	1.6 U	1.6	ug/Kg
Anthracene	10/05/99	1.6 U	1.6	ug/Kg
Fluoranthene	10/05/99	1.6 U	1.6	ug/Kg
Pyrene	10/05/99	1.6 U	1.6	ug/Kg
Benzo(a)Anthracene	10/05/99	1.6 U	1.6	ug/Kg
Chrysene	10/05/99	1.6 U	1.6	ug/Kg
Benzo[b]Fluoranthene	10/05/99	1.6 U	1.6	ug/Kg
Benzo[k]fluoranthene	10/05/99	1.6 U	1.6	ug/Kg
Benzo[a]pyrene	10/05/99	1.6 U	1.6	ug/Kg
Indeno[1,2,3-c,d] pyrene	10/05/99	1.6 U	1.6	ug/Kg
Dibenzo[a,h]anthracene	10/05/99	1.6 U	1.6	ug/Kg
Benzo[g,h,i]perylene	10/05/99	1.6 U	1.6	ug/Kg

F-201

CT&E Environmental Services Inc.

Client Harding Lawson & Assoc
Workorder Red Top Site Char. Aleknagik

QC Batch XXX 6110 (66986)
Original
Matrix Soil/Solid

Prep Date 10/01/99 09:30
Analysis Method PAH SIM

QC results affect the following production samples:

995204003 995204004

QC results for Lab Check Standard [266780] - Lab Check Standard Duplicate [266781]

Parameter		QC Result	Pct Recov	LCS/LCSD Limits	RPD	RPD Limits	Spiked Amount	Analyzed	Instru ID
Naphthalene	LCS	18.7	115	58-140			16.3ug/Kg	10/05/99	SOA
	LCSD	19.2	118		2.6	0-40	16.3ug/Kg	10/05/99	SOA
Acenaphthylene	LCS	16.9	104	52-120			16.3ug/Kg	10/05/99	SOA
	LCSD	18.1	112		7.4	0-40	16.3ug/Kg	10/05/99	SOA
Acenaphthene	LCS	17.9	110	50-112			16.3ug/Kg	10/05/99	SOA
	LCSD	18.6	114		3.6	0-40	16.3ug/Kg	10/05/99	SOA
Fluorene	LCS	16.8	103	56-114			16.3ug/Kg	10/05/99	SOA
	LCSD	18.7	115		11	0-40	16.3ug/Kg	10/05/99	SOA
Phenanthrene	LCS	14.3	88	38-124			16.3ug/Kg	10/05/99	SOA
	LCSD	14	86		2.3	0-40	16.3ug/Kg	10/05/99	SOA
Anthracene	LCS	12.7	78.1	44-149			16.3ug/Kg	10/05/99	SOA
	LCSD	12.3	75.5		3.4	0-40	16.3ug/Kg	10/05/99	SOA
Fluoranthene	LCS	14.4	88.7	42-139			16.3ug/Kg	10/05/99	SOA
	LCSD	15.3	94.1		5.9	0-40	16.3ug/Kg	10/05/99	SOA
Pyrene	LCS	16.5	101	45-137			16.3ug/Kg	10/05/99	SOA
	LCSD	17	105		3.9	0-40	16.3ug/Kg	10/05/99	SOA
Benzo(a)Anthracene	LCS	16.7	102	51-135			16.3ug/Kg	10/05/99	SOA
	LCSD	16.9	104		1.9	0-40	16.3ug/Kg	10/05/99	SOA

CT&E Environmental Services Inc.

Client	Harding Lawson & Assoc		
Workorder	Red Top Site Char. Aleknagik		
QC Batch	XXX 6110 (66986)		
Original		**Prep Date**	10/01/99 09:30
Matrix	Soil/Solid	**Analysis Method**	PAH SIM

QC results for Lab Check Standard [266780] - Lab Check Standard Duplicate [266781] (continued)

Parameter		QC Result	Pct Recov	LCS/LCSD Limits	RPD	RPD Limits	Spiked Amount	Analyzed	Instru ID
Chrysene	LCS	16.5	101	49-124			16.3ug/Kg	10/05/99	SOA
	LCSD	18.5	114		12.1	0-40	16.3ug/Kg	10/05/99	SOA
Benzo[b]fluoranthene	LCS	17.4	107	40-125			16.3ug/Kg	10/05/99	SOA
	LCSD	18.1	112		4.6	0-40	16.3ug/Kg	10/05/99	SOA
Benzo[k]fluoranthene	LCS	20	123	45-137			16.3ug/Kg	10/05/99	SOA
	LCSD	18.8	116		5.9	0-40	16.3ug/Kg	10/05/99	SOA
Benzo[a]pyrene	LCS	12.8	78.7	49-130			16.3ug/Kg	10/05/99	SOA
	LCSD	13.1	80.8		2.6	0-40	16.3ug/Kg	10/05/99	SOA
Indeno[1,2,3-c,d] pyrene	LCS	17.4	107	42-128			16.3ug/Kg	10/05/99	SOA
	LCSD	19	117		8.9	0-40	16.3ug/Kg	10/05/99	SOA
Dibenzo[a,h]anthracene	LCS	17.1	105	69-150			16.3ug/Kg	10/05/99	SOA
	LCSD	17.5	108		2.8	0-40	16.3ug/Kg	10/05/99	SOA
Benzo[g,h,i]perylene	LCS	16.9	104	67-120			16.3ug/Kg	10/05/99	SOA
	LCSD	17.4	107		2.8	0-40	16.3ug/Kg	10/05/99	SOA

F-701

CT&E Environmental Services Inc.

Client	Harding Lawson & Assoc		
Workorder	Red Top Site Char. Aleknagik		
QC Batch	MXX 6371 (66903)		
Original		**Prep Date**	09/24/99 15:30
Matrix	Water (Surface, Eff., Ground)	**Analysis Method**	SW846-7471

QC results affect the following production samples:

995204005	995204006	995204007	995204008	995204009
995204010	995204011	995204012		

QC results for Method Blank [266360]

Run Instrument: HgAA Leeman AutoAnalyzer PS200

Parameter	Analyzed	Result	PQL	Units
Mercury by Cold Vapor	09/27/99	0.000200 U	0.000200	mg/L

CT&E Environmental Services Inc.

Client	Harding Lawson & Assoc		
Workorder	Red Top Site Char. Aleknagik		
QC Batch	MXX 6371 (66903)		
Original		**Prep Date**	09/24/99 15:30
Matrix	Water (Surface, Eff., Ground)	**Analysis Method**	SW846-7471

QC results affect the following production samples:

995204005	995204006	995204007	995204008	995204009
995204010	995204011	995204012		

QC results for Lab Check Standard [266361]

Parameter		QC Result	Pct Recov	LCS/LCSD Limits	RPD	RPD Limits	Spiked Amount	Analyzed	Instru ID
Mercury by Cold Vapor	LCS	0.002	100	85-115			.002mg/L	09/27/99	F3

FRONTIER GEOSCIENCES INC.
ENVIRONMENTAL RESEARCH & SPECIALTY ANALYTICAL LABORATORY
(206) 622-6960 • FAX: (206) 622-6870
E-MAIL: INFO@FRONTIER.WA.COM
414 PONTIUS NORTH • SEATTLE, WA 98109

RECEIVED
NOV 30 1998
HARDING LAWSON ASSOCIATES

November 25, 1998

Joe McElroy
CT&E Environmental Services, Inc.
Laboratory Division
601 E. 57th Place
Anchorage, AK 99518

RE: Auth 48 Job 39551 (Red Top Retort)

Dear Joe,

Attached please find a table summarizing analytical results, including QA results, for three soil samples received from you on October 20, 1998.

Inorganic and elemental Hg were requested to be run on these samples. Inorganic mercury was determined using a dilute acid extraction (1.0 N HCl) at a solution/solid ratio of about 10 (3 g wet wgt/40 mL) and a contact time of 1 hour. The aqueous portion of these extractions was separated by filtration through a 0.45 micron pore size filter. The extract was then oxidized with bromine monochloride and analyzed by EPA Method 1631. This extraction is thought to recover most inorganic mercury compounds (e.g., chlorides, oxides, sulfates) but would not recover inorganic mercury incorporated in natural organic matter or mercuric sulfide. Dilute HCl does seem to slowly dissolve elemental mercury in soils so there is some potential overlap with "volatile" mercury. The extraction is thus not very specific but is a reasonable approximation of the maximum likely bioavailable fraction in soils and sediments.

Volatile mercury in these samples was determined using a modified version of the method described by Revis et al (1989) in which samples are heated for 5 days in an oven at 150 C to volatilize elemental mercury. We modified the method such that samples are contained in special glass purging vessels with iodated carbon traps on the exhaust to sorb the mercury. These traps are removed at the end of the purging period and analyzed for mercury content. This method is also not without its caveats as some oxidized mercury compounds may volatilize or decompose to volatile species during the 5-day heating and purging. Thus, results may be an overestimate of the content of elemental mercury in the samples.

We performed replicate analyses on sample 98-5928-1 for both assays. The reproducibility for volatile Hg was reasonably good, but not so for the HCl soluble Hg. This may be a sample inhomogeneity problem but with a 3-gram sample size it is hard to imagine this is the correct explanation. Absent other information, such as the total Hg concentration, it is difficult to interpret this variability. There are no reference materials which are certified for either of these Hg species. However, we have often extracted NIST-2709 (total Hg = 1400 ng/g) using the dilute HCl method and commonly recover about 400 to 500 ng/g. All other QA results for the analytical runs were within acceptable ranges.

If you have questions or concerns about the data or this report please call me.

Yours truly,

Ralph

Ralph Turner

CHAIN OF CUSTODY RECORD

CT&E Environmental Services Inc.
Laboratory Division

Locations Nationwide
- Alaska
- California
- Colorado
- Maryland
- Michigan
- New Jersey
- Ohio
- West Virginia

(1)

CLIENT: Harding Lawson + Assoc
CONTACT: Joe McElroy PHONE NO: 907 563 8102
PROJECT: Red Top Retort SITE:
REPORTS TO: 601 E. 57th Place FAX NO: 907 561 4574
INVOICE TO: Anchorage AK 99518 P.O. NUMBER: Auth 48 Job 39551

CT&E Reference: See Ralph Turner for instructions
PAGE ____ OF ____

(2)

LAB NO.	SAMPLE IDENTIFICATION	DATE	TIME	MATRIX	No. CONTAINERS	SAMPLE TYPE (C = COMP, G = GRAB)	Preservatives Used	Analysis Required (3): Inorg. Mercury	Elemental Mercury				% Solids			CT+E Ref # REMARKS
	98RTRIS6 SL	9/15/98	1008	SOIL	1			X	X				73.0			98.5928-1
	18		0945										82.2			98-5928-2
	24	9/16/98	1550										76.3			98.5928-3

(5)

Collected/Relinquished By: (1) CT&E	Date	Time	Received By:
Heather Stall	10/19/98	1100	Thomas Smith
Relinquished By: (2)	10/20/98	1200	Received By: Thomas Smith
Relinquished By: (3)	10/20/98	1200	Received By: Thomas Smith
Relinquished By: (4)	10/20/98	1200	Received For Laboratory By: Thomas Smith

(4)

Shipping Carrier:
Shipping Ticket No:
Samples Received Cold? (Circle) YES NO
Temperature °C:
Data Deliverables Required: Level I Level II Level III
Chain of Custody Seal: (Circle) INTACT BROKEN ABSENT
Requested Turnaround Time and Special Instructions:

200 W. Potter Drive **Anchorage, AK 99518-1605** Tel: (907) 562-2343 Fax: (907) 561-5301
3180 Peger Road **Fairbanks, AK 99701-5471** Tel: (907) 474-8656 Fax: (907) 474-9685

White - Retained by Lab (Project File) Yellow - Returned with Report Pink - Retained by Sampler

Summary of Volatile and Dilute-acid Soluble Hg in Soils (CT&E)

Analyzed 11/13/98 and 11/19/98

	sample	lab ID	Dry Fraction	Volatile Hg ng/g (WW)	1N HCl soluble Hg ng/g (WW)	Volatile Hg ng/g (DW)	1N HCl soluble Hg ng/g (DW)
IS6	98-5928-1	IC-A+B-1	0.689	3250	1844	4717	2676
IS6	98-5928-1 dup	IC-A+B-2	0.689	3010	1069	4369	1552
IS6	98-5928-1 dup	-	0.689	-	868		1260
IS18	98-5928-2	IC-A+B-3	0.879	1451	1002	1651	1140
IS24	98-5928-3	IC-A+B-4	0.7418	261	482	351.8	649.8
	Blank-1	PB-1		0.01	0.19		
	Blank-2	PB-2		0.69	0.09		
	Blank-3	PB-3		0.03	0.09		
	Blank-4	-		-	0.1		
	mean			0.24	0.12		
	SD			0.39	0.05		
	est MDL			1.16	0.15		
	A2SPEC-02 dup AS	IC-A+B-6 + 58,800 ng/g (equivalent spike)		111432	-		
				97.9% rec	-		
	DORM-2 LCS	(total Hg)		4238	4487		
				91.3% rec	96.7		
	NIST-2709 (R1)			-	426		
	NIST-2709 (R2)				412		
	Dataset			THG51.111998	THG21.111398		

elemental

inorganic

FRONTIER GEOSCIENCES INC.
ENVIRONMENTAL RESEARCH & SPECIALTY ANALYTICAL LABORATORY
(206) 622-6960 · fax: (206) 622-6870
E-MAIL: INFO@FRONTIER.WA.COM
414 PONTIUS NORTH · SEATTLE, WA 98109

RECEIVED
OCT 04 1999
HARDING LAWSON ASSOCIATES

Joe McElroy
Harding Lawson Associates
601 East 57th Place
Anchorage, AK 99518

October 1, 1999

Dear Joe,

Enclosed please find our results for selected mercury speciation in the four sediments/soils sent to us on September 21, 1999. I have also included a sheet that summarizes the analytical preparation for each of the species measured. Immediately upon arrival, the samples were sieved through a 2 mm screen, and the material passing the screen was put into a small bottle, while the coarser material was replaced in the original bottle, and archived pending inspection of the data. On the same day that the samples were sieved, an aliquot was taken for the determination of the dry fraction, be heating for 8 hours at 110°C, and measuring the loss in mass.

The selective extraction procedure was begun by careful weighing 1 gram (± 0.001 g) aliquots into 40 mL vials. Each sample was rinsed by shaking with 40 mL of deionized water, to remove chloride, centrifuged, and the aqueous layer decanted into a 125 mL bottle. The aqueous layer was preserved by the addition of 1% BrCl by volume. The vials were filled to the 40 mL mark with 12N HNO_3, and extracted with periodic agitation overnight at room temperature. The samples were centrifuged, decanted into the water fraction, and this process repeated, but with only 5 minutes extraction the second time. The fraction contained in the 125 mL bottles is thus the 12N extractable fraction, which is the "non-HgS" fraction.

The sediment remaining in the vials was digested overnight at room temperature using aqua regia (4:1 HCl + HNO_3), and then diluted to 40 mL with 0.01N BrCl solution. This fraction contains the HgS (cinnabar) content of the samples. All inorganic fractionation samples were analyzed using $SnCl_2$ reduction, purge and trap on gold, and CVAFS detection. Total mercury was determined as the sum of the 12N HNO_3 and the aqua regia leachable fractions.

QC was determined on these samples by matrix duplicate extractions, the use of the reference sediment NIST-2710, and two in house "pure substance" tracers of HgS in clay and $HgCl_2$ in clay. Matrix spikes are not appropriate for selective leaching procedures.

Methyl mercury was determined on a separate aliquot of the sieved sample using HBr extraction into CH_2Cl_2, back extraction into water, aqueous ethylation, purge and trap onto Carbotrap, isothermal GC separation, and CVAFS detection. QC was determined for this extraction by the use of matrix spikes and the reference sediment, IAEA-356.

Analytically, the data look very good, with most Hg recoveries, matrix spikes, blanks, and measures of precision being well within US EPA and Frontier control limits. The only exceptions were a 49% RPD for HgS in sample 99RT-21 (not uncommon for sediments and soils), and the odd finding of most of the $HgCl_2$ in the aqua regia, rather than the HNO_3 fraction. Previous tests with this lab-made material, shortly after preparation, showed all of the Hg in the HNO_3 fraction, as would be expected. This observation is odd, but cannot be explained from the data at hand. The fact that the total Hg in that sample was 109% of expected supports the notion that the measurements were accurate. It is possible that the solubility of the added Hg changed in the sample over the months of storing the solid. Given the long time required to go through a selective extraction/analysis sequence, we will not be able to investigate this issue until we have an opportunity to do additional internal research on the method.

The more pervasive oddity was that total Hg concentrations in the soils were considerably lower than was expected based upon our phone conversations. Given that the samples were sieved, which tends to increase the concentration of the finer material, the low values are particularly puzzling. If you want to, please feel free to call me to discuss the data, and try to develop reasons for the apparent discrepancy. Please note that we have invoiced for 4 samples, even though the purchase order is only written for three. This may require a PO amendment.

Best Wishes,

Nicolas Bloom

Nicolas Bloom

Mercury Speciation in Soils (Harding Lawson)

analyzed by

Frontier Geosciences Inc. 414 Pontius North Seattle, WA 98109
phone: 206-622-6960 fax: 206-622-6870 e-mail: nicolasb@frontier.wa.com

		mercury concentrations, ng/g (ppb) wet basis				mercury concentrations, ng/g (ppb) dry basis			
sample ID	**dry fract**	**12N HNO3**	**aqua regia**	**methyl**	**total**	**12N HNO3**	**aqua regia**	**methyl**	**total**
99RT-06	0.927	67.5	21.7	0.113	89.2	72.8	23.4	0.122	96.2
99RT-07	0.858	64.3	22.1	0.074	86.4	74.9	25.8	0.086	100.7
99RT-15	0.900	101.6	1395	0.174	1496.6	112.9	1550.0	0.193	1662.9
99RT-21	0.853	135.4	55.7	0.540	191.1	158.7	65.3	0.633	224.0
blank-1		-0.03	0.36	0.002					
blank-2		-0.06	0.33	0.002					
blank-3		-0.06	0.40	0.002					
estimated MDL		0.06	0.11	0.002					
99RT-21 rep 1		137.6	41.9		179.5				
99RT-21 rep 2		133.2	69.4		202.6				
mean		135.4	55.7		191.1				
RPD (%)		3.2	49.3		12.1				
spike level				22.80					
99RT-21 + MS				22.74					
% recovery				97.4					
spike level				22.54					
99RT-21 + MSD				22.67					
% recovery				98.2					
RPD (%)				0.8					
NIST-2710						22,818	7,589		30,407
% recovery						72.2	24.0		96.2
IAEA-356								6.00	
% recovery								109.0	
HgS in Kaolin						424	42,219		42,643
% recovery						0.9	93.4		93.5
HgCl2 in Kaolin						10,682	25,663		36,345
% recovery						32.0	76.9		109.0

Methods for Determining Speciation of Mercury in Soils

Frontier Geosciences Inc. 414 Pontius North, Seattle, WA 98109

1. **Methyl Hg.** Methyl Hg is first extracted by acidic KBr into CH_2Cl_2 and then back into water. The extract is reacted with $NaB(CH_2CH_3)_4$ to form volatile ethyl derivatives which are purged onto Carbotrap, and then thermally desorbed into an isothermal GC column for peak separation. The derivatives are passed through a pyrrolysis column to convert them to Hg^o and then cold vapor atomic fluorescence spectrometry (CVAFS) is employed for quantitation (EPA Method 1630). This determination is made on an independent sample aliquot.

2. **Elemental Hg.** Hg^o is volatilized from soils at 150 °C under air purge for 5 days (Revis, et. al, 1989, modified) and trapped on iodated carbon for analysis. One to two grams of soil are placed in a 125 mL glass vessel with a 2-hole glass closure fitted with an iodated carbon trap (exit) and tubing connected to an air cylinder, and the apparatus is placed in a thermostated oven at 150 ± 5 °C. The traps are acid digested and analysed by CVAFS (EPA Method 1631. This method likely overestimates the content of Hg^o in soils because other forms of mercury, e.g. $HgCl_2$, are also volatile or may degrade to Hg^o during heating. The amount of overestimation cannot be reliably established at this time, and is likely to vary among different samples. This determination is made on an independent sample aliquot.

3A. **Water Soluble Hg.** 2-3 grams of soil soil is leached with 40.0 mL distilled water for 1-2 hours. This procedure will solubilize highly soluble compounds like mercuric chloride (6.6 grams/liter) and some sparingly soluble compounds like mercuric oxide (53 mg/L) and elemental Hg (60 µg/L), although re-equilbration with the solid substrate may moderate the observed dissolved concentrations. Mercury in the leachate (centrifuged, then filtered through 0.4 µ) is analyzed in the same manner as water after oxidation with BrCl (EPA Method 1631). This determination is the first of a set of sequential extractions on a common sample aliquot.

3B. **HCl-Soluble Hg.** The soil pellet from 3A is leached for 18 hours in 40 mL of 1 N HCl on a shaker. The leachate is separated from the soil by centrifugation and filtration (0.4 µ) and then oxidized with BrCl prior to analysis following EPA Method 1631. This procedure recovers most inorganic mercury salts (oxides, chlorides, sulfates). Hg^o may also be slightly recovered due to slow oxidation during the extraction period, as well as the inherent solubility of Hg^o in water (60 µg/L equivalent to about 1 µg/g under these conditions).

3C. **KOH-Soluble Hg.** The soil pellet from 3B is leached for 4 hours in 40 mL of 1 N KOH on a shaker. The leachate is separated from the soil by centrifugation and filtration (0.4 µ), and then oxidized with BrCl prior to analysis following EPA Method 1631. This procedure recovers humic, fulvic, and organo-thiol complexed Hg(II). Hg^o may also be slightly recovered due to its inherent solubility in water (60 µg/L equivalent to about 1 µg/g under these conditions).

3D. **HNO_3 Soluble Hg.** Cold 12N HNO_3 (3:1 v/v) recovers all forms (elemental, salts, amalgams, organic) of mercury from soil except mercuric HgS and Hg tightly bound in mineral lattices. The residual solids (rinsed with distilled water to remove residual HCl) from one of the above fractions are treated with HNO_3 for 18 hours. The leachate is oxidized with BrCl and then analysed by CVAFS (EPA Method 1631). mercuric sulfide

3E. **Aqua Regia Soluble Hg.** The solid residue from the cold 12 N HNO_3 extraction (3D) will only contain HgS and perhaps a small quantity of Hg tightly bound in mineral lattices. The residual solids from extraction 3D is digested at room temperature in freshly prepared aqua regia (4:1 HCl + HNO_3) for 2 to 3 hours (similar digestion to EPA Method 7471 for total Hg). After dilution the digest is analyzed as a aqueous sample using CVAFS (EPA Method 1631).

Harding Lawson Associates
601 East 57th Place, Anchorage, Alaska, 99518
(907) 563-8102 / FAX (907)561-4574

CHAIN OF CUSTODY

99RT 02

Laboratory: Frontier Geosciences, Inc.

Project Name: Red Top Site Characterization PM- Nicolas

Project Location: Aleknagik, Alaska

Samplers: H. Hoen / L. Johnson

Subcontract / Work Authorization Nos.: GSC98005.08 / 001

Project Manager: Joe McElroy

Recorder: [signature]

Turnaround Time: Standard

MATRIX		# Containers & Preservative					IDENTIFIER		DATE AND TIME						ANALYSIS REQUESTED												
		unpreserved					Sample Number		YR		MO		DY		TIME	AK 102 - DRO				EPA 8021 - BTEX		Totoal Hg - EPA 7040A	Mercury Speciation				
S	L	1				✓	99RT 06	SL	9	9	0	9	2	1	1025								X				
S	L	1				✓	99RT 07	SL	9	9	0	9	2	1	1035								X				
S	L	1				✓	99RT 15	SL	9	9	0	9	2	1	1305								X				
S	L	1				✓	99RT 21	SL	9	9	0	9	2	1	1415								X				
S	L						99RT	SL	9	9	0	9															
S	L						99RT	SL	9	9	0	9															
S	L						99RT	SL	9	9	0	9															
S	L						99RT	SL	9	9	0	9															
S	L						99RT	SL	9	9	0	9															
S	L						99RT	SL	9	9	0	9															

NOTES:

Use work authorization number for invoicing

Temp: ≤1.3°C

Ice: FZN

COC Seal Broken by JG @ 0950 on 9-24-99

CHAIN OF CUSTODY RECORD

RELENQUISHED BY:(Signature)	DATE	TIME	RECEIVED BY:(Signature)	DATE	TIME
[signature]	9/23/99	2:14	Jason Gilliton Jason Gilliton	9-24-99	0950
RELENQUISHED BY:(Signature)	DATE	TIME	RECEIVED BY:(Signature)	DATE	TIME
RELENQUISHED BY:(Signature)	DATE	TIME	RECEIVED BY:(Signature)	DATE	TIME
DISPATCHED BY:(Signature)	DATE	TIME	RECEIVED FOR LAB BY:(Signature)	DATE	TIME
METHOD OF SHIPMENT					

DATA QUALITY ASSESSMENT (Note: Any "No" answer requires a comment)

Project: BLM Red Top

Laboratory Batch No.: CTE 995203

	Yes	No	Not Required
1. Were samples received in good condition?		X	
2. Were samples analyzed for requested parameters?	X		
3. Is the ADEC Data Deliverables package complete?	X		
4. Were samples extracted/analyzed within holding time acceptance criteria?	X		
5. For soils, were sample results reported on a "dry weight" basis?	X		
6. For volatiles, were trip blank analytes all reported as ND?			X
7. Were calibration and CCV/LS criteria met?			X
8. Were instrument blanks reported as ND?			X
9. Were method blanks reported as ND?	X		
10. Are the LCS/LCSDs within acceptance criteria?	X		
11. Are the MS/MSDs within acceptance criteria?			X
12. Are the LCS/LCSD relative percent differences within acceptance criteria?			X
13. Are the MS/MSD relative percent differences within acceptance criteria?			X
14. Are the sample duplicate relative percent differences within acceptance criteria?	X		
15. Are the surrogate percent recoveries within acceptance criteria?			X
16. Are the field duplicate relative percent differences less than 50 percent?		X	

Comments:

- Analytical data was reviewed according to the Chemical Quality Assurance for Hazardous, Toxic, and Radioactive Waste (HTRW) Projects, USACE EM-200-1-6, 10 October, 1997.
- All data may be accepted without qualification except as noted below.
- Samples were received at 1.9°C, outside the 4.0°C +/-2.0°C limits. Samples were not received frozen, therefore results should not be affected.
- Second page of the COC was not relinquished, however the samples were handcarried to the laboratory. Sample custody is not affected.
- Field duplicate samples 99RT14SL & 99RT16SL RPDs are greater than 50% for mercury (84%), possibly due to non-homogeneity of samples. Results for these samples should be considered estimated.
- Field duplicate samples 99RT19SL & 99RT20SL RPDs less than 50% for all compounds.

Reviewer: Michelle T. Turner Date: 11/17/99

DATA QUALITY ASSESSMENT (Note: Any "No" answer requires a comment)

Project: BLM Red Top
Laboratory Batch No.: CTE995204

	Yes	No	Not Required
1. Were samples received in good condition?		X	
2. Were samples analyzed for requested parameters?	X		
3. Is the ADEC Data Deliverables package complete?	X		
4. Were samples extracted/analyzed within holding time acceptance criteria?	X		
5. For soils, were sample results reported on a "dry weight" basis?	X		
6. For volatiles, were trip blank analytes all reported as ND?	X		
7. Were calibration and CCV/LS criteria met?			X
8. Were instrument blanks reported as ND?			X
9. Were method blanks reported as ND?	X		
10. Are the LCS/LCSDs within acceptance criteria?		X	
11. Are the MS/MSDs within acceptance criteria?			X
12. Are the LCS/LCSD relative percent differences within acceptance criteria?	X		
13. Are the MS/MSD relative percent differences within acceptance criteria?			X
14. Are the sample duplicate relative percent differences within acceptance criteria?	X		
15. Are the surrogate percent recoveries within acceptance criteria?	X		
16. Are the field duplicate relative percent differences less than 50 percent?	X		

Comments:

- Analytical data was reviewed according to the Chemical Quality Assurance for Hazardous, Toxic, and Radioactive Waste (HTRW) Projects, USACE EM-200-1-6, 10 October, 1997.
- All data may be accepted without qualification except as noted below.
- Samples were received at 1.9°C, outside the 4.0°C +/-2.0°C limits. Samples were not received frozen, therefore results should not be affected.
- Both pages of the COC were not relinquished, however the samples were handcarried to the laboratory. Sample custody is not affected.
- PAH extraction batch XXX6122 LCSD recovery for Benzo[g,h,I]perylene (121%) is outside of quality control limits. Since LCS and LCS/LCSD RPD meet QC criteria, results should not be affected.
- PAH extraction batch XXX6110 LCSD recovery for Acenaphthene (114%) and Fluorene (115%) are outside of quality control limits. Since LCS and LCS/LCSD RPD meet QC criteria, results should not be affected.
- Field duplicate samples 99RT25SL & 99RT26SL RPDs less than 50% for all compounds.

Reviewer: Michelle T. Turner Date: 11/17/99

DATA QUALITY ASSESSMENT (Note: Any "No" answer requires a comment)

Project: BLM Red Top

Laboratory Batch No.: Frontier 99RT02

	Yes	No	Not Required
1. Were samples received in good condition?		X	
2. Were samples analyzed for requested parameters?	X		
3. Is the ADEC Data Deliverables package complete?			X
4. Were samples extracted/analyzed within holding time acceptance criteria?	X		
5. For soils, were sample results reported on a "dry weight" basis?	X		
6. For volatiles, were trip blank analytes all reported as ND?			X
7. Were calibration and CCV/LS criteria met?			X
8. Were instrument blanks reported as ND?			X
9. Were method blanks reported as ND?	X		
10. Are the LCS/LCSDs within acceptance criteria?		X	
11. Are the MS/MSDs within acceptance criteria?	X		
12. Are the LCS/LCSD relative percent differences within acceptance criteria?		X	
13. Are the MS/MSD relative percent differences within acceptance criteria?	X		
14. Are the sample duplicate relative percent differences within acceptance criteria?	X		
15. Are the surrogate percent recoveries within acceptance criteria?			X
16. Are the field duplicate relative percent differences less than 50 percent?		X	

Comments:

- Analytical data was reviewed according to the Chemical Quality Assurance for Hazardous, Toxic, and Radioactive Waste (HTRW) Projects, USACE EM-200-1-6, 10 October, 1997.
- All data may be accepted without qualification except as noted below.
- Samples were received at 1.3°C, outside the 4.0°C +/-2.0°C limit. Sample were not frozen upon receipt, therefore results should not be affected.
- Field sample duplicates 99RT14SL & 99RT15SL RPDs were greater than 50% when comparing total mercury digested by EPA method 3050 (99RT14SL) and total speciated mercury (99RT15SL) at 180%. When total mercury digested by EPA method 3050 is compared to mercury digested by 12N HNO3 the RPD is 30%. EPA method 3050 digestion is a hot leach method and tends to provide poor recoveries for samples with high concentration of cinnabar (HgS). In such cases, EPA method 3050 may more accurately be compared to a cold leach method involving 12N HNO3 digestion.
- Field sample duplicates 99RT19SL & 99RT21SL RPDs were less than 50% when comparing total mercury digested by EPA method 3050 (99RT19SL) and total speciated mercury (99RT21SL) at 44%. When total mercury digested by EPA method 3050 is compared to mercury digested by 12N HNO3 the RPD is 10%. EPA method 3050 digestion is a hot leach method and tends to provide poor recoveries for samples with high concentration of cinnabar (HgS). In such cases, EPA method 3050 may more accurately be compared to a cold leach method involving 12N HNO3 digestion.

Reviewer: Michelle T. Turner Date: 11/17/99

APPENDIX C

STATISTICAL DATA

Table C-1

1998 and 1999 Site Assessment Data
Red Top Retort Site

sample number	*total mercury result*	*units*
98RTRIS1SL	**0.483**	mg/kg
98RTRIS2SL	**0.129**	mg/kg
98RTRIS3SL	**0.118**	mg/kg
98RTRIS4SL	**0.270**	mg/kg
98RTRIS5SL	**0.096**	mg/kg
98RTRIS6SL	**40.100**	mg/kg
98RTRIS7SL	**0.246**	mg/kg
98RTRIS8SL	**2.870**	mg/kg
98RTRIS9SL	**0.512**	mg/kg
98RTRIS10SL	**0.041**	mg/kg
98RTRIS11SL	**3.470**	mg/kg
98RTRIS12SL	**2.030**	mg/kg
98RTRIS14SL	**0.365**	mg/kg
98RTRIS16SL	**0.072**	mg/kg
98RTRIS17SL	**0.222**	mg/kg
98RTRIS19SL	**3.220**	mg/kg
98RTRIS20SL	**2.140**	mg/kg
98RTRIS21SL	**2.000**	mg/kg
98RTRIS23SL	**0.285**	mg/kg
98RTRIS24SL	**3.150**	mg/kg
98RTRIS25SL	**7.470**	mg/kg
98RTRIS26SL	**0.764**	mg/kg
98RTRIS27SL	**0.107**	mg/kg
98RTRIS28SL	**0.111**	mg/kg
99RT01SL	**1.150**	mg/kg
98RTRIS28SL	**0.111**	mg/kg
99RT03SL	**0.129**	mg/kg
99RT04SL	**0.154**	mg/kg
99RT05SL	**0.090**	mg/kg
99RT08SL	**14.900**	mg/kg
99RT09SL	**0.068**	mg/kg
99RT10SL	**108.000**	mg/kg
99RT11SL	**2.380**	mg/kg
99RT12SL	**29.000**	mg/kg
99RT13SL	**0.195**	mg/kg
99RT14SL	**0.084**	mg/kg
99RT17SL	**12.000**	mg/kg
99RT18SL	**0.353**	mg/kg
99RT19SL	**0.098**	mg/kg
99RT22SL	**0.129**	mg/kg
99RT23SL	**0.056**	mg/kg
99RT24SL	**0.082**	mg/kg
99RTEI1SL	**0.636**	mg/kg
99RTEI2SL	**0.778**	mg/kg

Table C-2

Microsoft Excel Descriptive Statictics Analysis	
Mean	5.469386364
Standard Error	2.649512116
Median	0.319
Mode	0.129
Standard Deviation	17.57487513
Sample Variance	308.8762359
Kurtosis	28.25178024
Skewness	5.0673778
Range	107.9593
Minimum	0.0407
Maximum	108
Sum	240.653
Count	44
Largest(1)	108
Smallest(1)	0.0407
Confidence Level(95.0%)	5.343246747
Upper 95% Confidence Level	**10.81263311**
Lower 95% Confidence Level	**0.126139617**

DISTRIBUTION

1999 Site Characterization Report
Red Top Retort Site
Aleknagik, Alaska

December 21, 1999

1 Copy:	Mr. Wayne Svejnoha U.S. Department of the Interior Bureau of Land Management Alaska State Office 222 West Seventh Avenue, #13 Anchorage, Alaska 99513-7599
10 Copies:	Mr. Mike Alcorn U.S. Department of the Interior Bureau of Land Management Anchorage Field Office 6881 Abbott Loop Road Anchorage, Alaska 99507

1 Copy:	Project File
1 Copy:	Bound Report File

Quality Control Reviewer

Bryan D. Lund
Senior Geologist

TE/jr/W0807R