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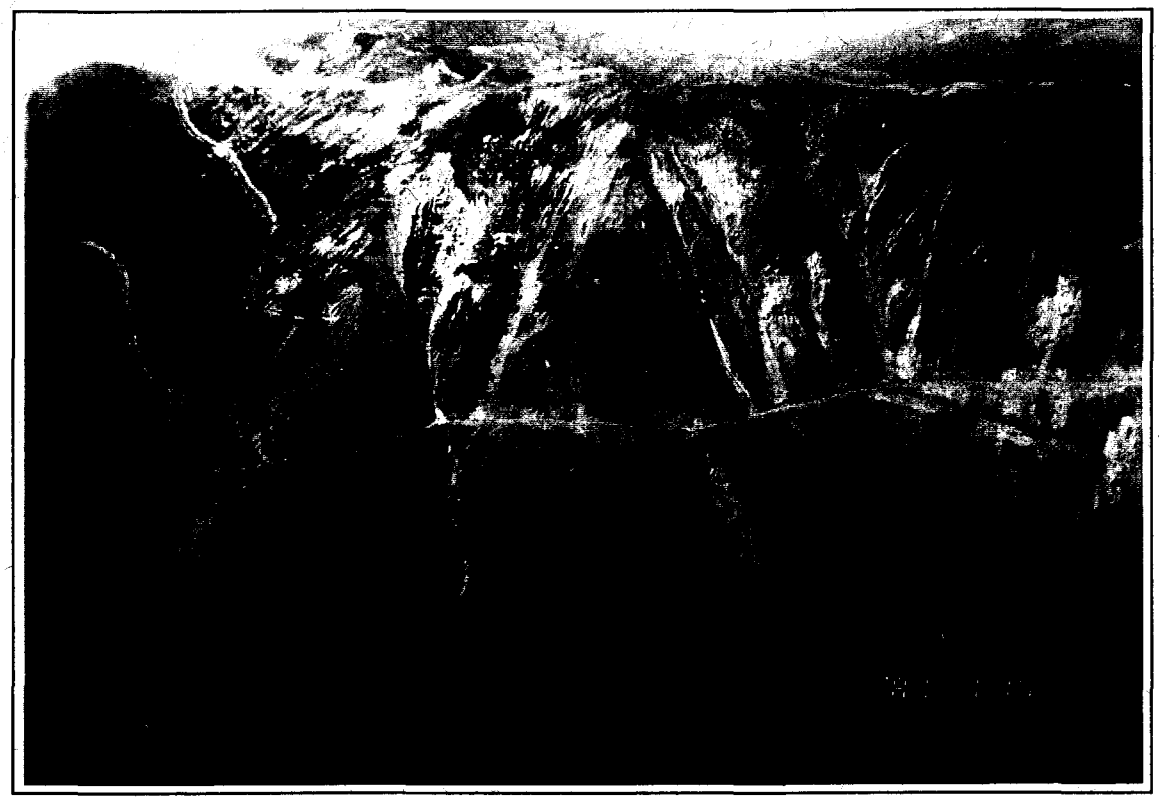
PWGSC

Quality in Environmental Services

PHASE II ENVIRONMENTAL ASSESSMENT OF THE SLATE MOUNTAIN ABANDONED MINE SITE



prepared for:

Action on Waste Program
Indian and Northern Affairs Canada

prepared by:

Environmental Services
Public Works and Government Services Canada

March 1997

Public Works and Government Services Canada
Travaux publics et Services gouvernementaux Canada

Canada

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EXECUTIVE SUMMARY

A phase II environmental assessment was conducted at the Slate Mountain abandoned mine site (60^0 59'28" N, 133^0 43'49" W) in July, 1996 by Environmental Services, Public Works and Government Services Canada for the Action on Waste Program, Indian and Northern Affairs Canada. Based on the findings of the Phase I investigation performed in 1993 by DIAND Technical Services, a phase II assessment was conducted to a) identify potential environmental and human health risks associated with the present condition of the mine site, and b) provide recommendations for remediation of those risks.

A field investigation of the mine site was conducted to evaluate environmental and human safety concerns with respect to: mine openings and workings; buildings and infrastructure; waste disposal areas; waste rock disposal areas; surface water (including adit and waste rock seepage, and receiving waters); and hazardous and non-hazardous materials on the site.

The results of the investigation concluded that there is currently a valid claim on the site, however, it does not appear that there has been any development in the past few years and some concerns were noted. Large volumes of petroleum hydrocarbons were contained in two storage tanks and a number of barrels. An assessment of the acid rock drainage potential for the waste rock shows that the rock is currently acid generating, however, the rock is naturally acid generating and there has been little impact on the adjacent stream's water quality. Aesthetic concerns were present in the form of large volumes of materials including buildings, equipment and storage tanks in a number of areas of the site. As well, drill site access roads have caused extensive scarring of much of the mountain side.

The site is not abandoned and, therefore, there is no requirement to dispose of any of the site equipment. Three soil stains, including one off site, were investigated. With the exception of total extractable hydrocarbons, no hazardous compounds were noted in samples at any of the sites. There were no sensitive environmental receptors in the immediate area of either of the two stains located on site. The off site stained area is located in a bog inaccessible to heavy equipment. Attempts to remediate this site would likely cause more damage to the site then benefits. As such, the contaminated soils at all three sites should be left as is and allowed to remediate by natural attenuation.

Using applicable federal and territorial criteria, the recommendations are to incinerate residual product in the storage tanks and barrels at the site.

No further test work is recommended on the waste rock or downstream water quality.

Table 1: Summary of Potential Hazards at Slate Mountain Mine Site

ASSESSMENT COMPONENT	RISK	RECOMMENDATION
1. Building, Infrastructure, Equipment		
9 buildings	Aesthetic concern	None
5 storage tanks	Aesthetic concern	None
2. Non-Hazardous Waste Material		
Core sample boxes	Aesthetic concern	None
80 empty 205 L barrels	Aesthetic concern	None
2 large piles of material (much of material remains useable)	Aesthetic concern	None
3. Hazardous Materials		
3 locations with stained soils	Minor environmental risk at site; Environmental risk off site	Leave as is
Residual fuel in 45 barrels	Environmental risk	Incinerate wastes
4 L container antifreeze	Minor environmental risk	Incinerate wastes
3 - 23 L pails of gear lubricant	Minor environmental risk	Incinerate wastes
Residual fuel (~2000 L) in 2 storage tanks	Environmental risk	Incinerate wastes
4. Water Quality		
Mine Seepage - None		
Site Drainage - Yes	Minor environmental risk	None
Receiving Waters - downstream of Silco Cr. tributary	Minor environmental risk	None
5. Waste Rock Disposal Areas		
Waste Rock - ARD potential	Minor environmental risk	None
6. Mine Openings		
None		
7. Tailings		
None		

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1.0 INTRODUCTION AND BACKGROUND

In 1993, assessments of 49 abandoned Yukon mine exploration and development sites were completed under the Arctic Environmental Strategy - Action on Waste program by DIAND Technical Services. These assessments were intended to: provide a general overview of historical activities; describe site infrastructure, mine workings and wastes; identify existing environmental and/or safety concerns on each site; and provide general recommendations for remediation and/or mitigation work, as appropriate.

At the Slate Mountain abandoned mine site, the 1993 report recommended further investigation into possible environmental impacts resulting from the previous mining activities. According to this report, the potential areas of concern included a concern with large volumes of materials remaining at the three areas of the camp site. The report recommends incinerating the fuel remaining at the site. Following this activity, recommendations are to burn wood materials and remove metal materials from the site. It was recommended that temporary metal culverts be removed, the roads regraded and the core samples catalogued and removed from the site. No rock, tailings, soil or water samples were collected in this assessment.

In light of these preliminary findings, Indian and Northern Affairs Canada has determined that further investigation is warranted. Environmental Services, Public Works and Government Services Canada was retained to conduct an environmental assessment of the Slate Mountain abandoned mine site to a) identify specific environmental and human safety risks and b) provide clean-up recommendations.

1.1 LOCATION

The Slate Mountain abandoned mine site is located at 60° 59'28"N latitude and 133° 43'49"W longitude. It is located approximately 75 km north east of Whitehorse. The site is between 1300 and 1400 m above sea level on Red Mountain, not Slate Mountain as the name implies, in the Sawtooth Range of the Pelly Mountains (Figure 1).

1.2 OVERVIEW OF SITE DEVELOPMENT

The following work history of the site has been summarized in *Geology and mineralization of the Red Mountain porphyry molybdenum deposit, south-central Yukon*, by P. Brown and B. Kalhert, formerly of Amoco Canada Petroleum.

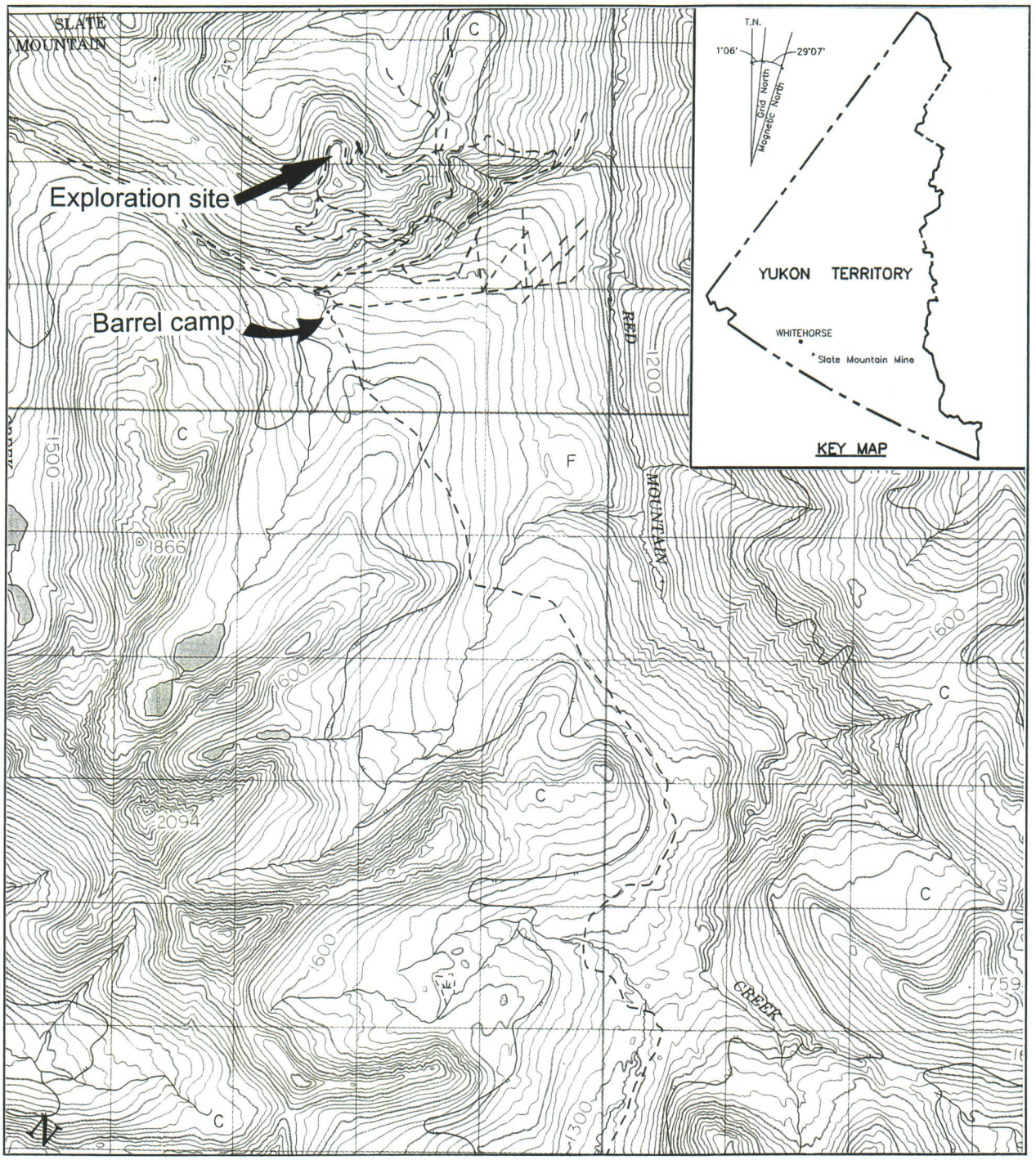

Figure 1. **Location of Slate Mountain Mine - 1:50,000, NTS- 105 C/13 [Energy Mines and Resources Canada: 1986]**

Initial exploration within the area dates back to 1915 and concentrated on lead-silver showings. In 1936, E.J. Lees of the Geological Survey of Canada noted that a 40 m (120 ft) long adit and several open cuts had been driven on the north side of Boswell River. The adit was driven in biotite schist and cut 4 m of quartz containing silver bearing galena and a little molybdenite. This site was not located during the aerial reconnaissance of the area.

In 1966 - 1967, Boswell River Mines followed up reported occurrences of lead-silver veins near Red Mountain and staked the Fox and Star claims. In 1968, a winter road from the Canol Road to the property was constructed along with trenching and access road construction on the property.

Amoco Canada Petroleum Company Ltd. optioned the property from Tintina Silver Mines Ltd. in October 1977. During the following five years, Amoco conducted a comprehensive property evaluation consisting of geological mapping, geochemical and geophysical survey and 21,391 m of diamond drilling in 32 holes.

1.3 SITE ACCESS

The site can be accessed in two ways. The first way is to fly from Whitehorse to an airstrip at the confluence of Boswell River and Wiley Creeks. From this airstrip, the site is approximately 10 km to the south east on Red Mountain. A road from the airstrip is in place. Alternatively, the site is accessible from a road intersecting the South Canol Road at Sidney Creek south of Quiet Lake approximately 40 km east of the site. This road is overgrown with willows in some sections, is currently eroding in some areas and has several creek crossings. Depending on the time of year, the creeks may be deep. It is possible to access the site most of the summer using four wheel drive all-terrain vehicles, however, this trip is expected to be difficult.

2.0 PURPOSE AND SCOPE OF WORK

The following assessment activities were completed:

- Inspection of mine openings and workings, buildings and infrastructure, and waste disposal areas;
- Photo documentation and mapping of relevant site features;

- Sampling of waste rock disposal areas, stained soils, surface water (including adit and waste rock seepage, and receiving waters) and barrel contents;
- Identification and inventory of hazardous and non-hazardous materials on the site;
- Identification of potential or actual environmental pathways and receptors for site contaminants; and
- Assessment of human safety hazards and potential for accidental or deliberate access to hazardous areas.

Upon completion of these activities, recommendations were generated to meet the following remediation/mitigation requirements:

- Physical stabilization of waste rock disposal areas;
- Chemical stabilization of the waste rock disposal areas as appropriate to local and background conditions, taking into account impact, on-site resources, and accessibility;
- Sealing of all mine openings;
- Consolidation and landfill of all non-hazardous, non-combustible solid wastes;
- Remediation or removal and disposal of contaminated soils as required to meet the more stringent of: Yukon Government's Contaminated Sites Regulations (1996) Schedule 1; and Canadian Council of Ministers of the Environment's Interim Canadian Environmental Quality Criteria for Contaminated Sites (1991) Commercial/Industrial criteria for soils;
- Removal and disposal of hazardous solid wastes;
- Draining, cleaning and disposal of drums or other containers containing petroleum products or other liquid hazardous wastes;
- Onsite flaring or removal and off-site disposal of petroleum products and other liquid hazardous wastes; and
- Demolition of buildings and infrastructure to foundation level and burning of combustible non-hazardous materials in approved location.

3.0 SITE ASSESSMENT METHODOLOGY

3.1 ASSUMPTIONS

The assessment was limited to the area specifically developed or occupied for exploration or mining purposes, and adjacent areas and resources believed to be

affected by these activities. Water samples were taken off-site to determine potential impact to surface water bodies due to mining activities. Access roadways to mine sites were not included in the assessments.

3.2 ASSESSMENT CRITERIA

3.2.1 Criteria and Guidelines

Contaminated Sites Regulations (Draft) (Yukon Government, 1996)

According to these draft regulations a site is contaminated if it is used for agricultural, commercial, industrial, parkland, or residential land use and contains a substance in concentration greater than or equal to:

(I) the generic numerical soil standard of Schedule 1, or
(ii) the matrix (pathway specific) numerical soil standards of Schedule 2

and, surface or groundwater used for aquatic life, irrigation, livestock, or drinking water which exceeds a concentration greater than or equal to:

(I) the generic numerical water standard of Schedule 3, or
(ii) the local background concentration of that substance in the soil, surface water, or groundwater.

Below 3 metres of the surface, commercial land use criteria is applicable.

Interim Canadian Environmental Quality Criteria for Contaminated Sites (Canadian Council of Ministers of the Environment, 1992)

The Canadian Council of Ministers of the Environment (CCME) Interim Canadian Environmental Quality Criteria for Contaminated Sites are numerical limits for contaminants in soil and water intended to protect, maintain or improve environmental quality and human health at contaminated sites in general.

CCME criteria include two types of benchmarks for soil and water quality - assessment criteria and remediation criteria. Assessment criteria are approximate background concentrations or approximate analytical detection limits for contaminants in soil and water, and remediation criteria are used as clean-up benchmarks based upon intended land use. Remediation criteria do not address site-specific conditions. They are considered generally protective of human and

environmental health for specified uses of soil and water at contaminated sites. The remediation criteria for soil are classified by three land uses:

1) Agricultural,
2) Residential/Parkland, and
3) Commercial/Industrial.

Remediation criteria for water are classified by four uses of water likely of concern at contaminated sites:

1) Freshwater aquatic life,
2) Irrigation,
3) Livestock watering, and
4) Drinking water.

Mine Reclamation in Northwest Territories and Yukon (INAC, 1992)

This report defines factors which are to be considered in reclamation of abandoned mine sites operating in northern climates. Factors include:

- open pit and underground mines;
- special mines such as uranium, sand and gravel, and coal;
- waste rock and tailings disposal;
- acid generation and leaching; and
- estimating cleanup costs.

Barrel Clean Up Protocol (INAC, 1992)

See Appendix E for protocol on testing and cleaning of barrels and contents.

3.2.2 Application of Criteria and Guidelines

For the Slate Mountain abandoned mine site assessment the following criteria were used:

A. Soils:

CCME:	Remediation Criteria for Soil - Commercial/Industrial standard

YUKON RENEWABLE RESOURCES:	Draft Contaminated Sites Regulations - used for hydrocarbon screening parameters

B. Water:

ENVIRONMENT CANADA:	Metal Mining Liquid Effluent Regulations and Guidelines - are compared to seepage from mine openings and river/stream quality
BACKGROUND:	Downstream water quality results of rivers and streams are compared to the results of upstream (background) water quality (where (available)
CCME:	Remediation Criteria for Water - Freshwater Aquatic Life standard

[Note: In this screening assessment of water quality, analytical results are primarily compared to background values which may more accurately characterize the local environment.]

C. Mine Clean-Up and Reclamation:

INAC:	Mine Reclamation in Northwest Territories and Yukon Territory

D. Barrel Clean-Up

INAC:	Barrel Clean-Up Protocol

3.3 METHODS

3.3.1 Background Information

Available background information was consolidated from the Yukon Chamber of Mines mine records, Whitehorse Public Library, Yukon Archives holdings, and records and reports from the Yukon Renewable Resources Library, Yukon Water Board, DIAND Lands Branch, DIAND Water Resources, and DIAND Library. INAC (1994) provided an overview assessment of the Slate Mountain abandoned mine site to that date. Other published information sources were examined for site or

regional information as applicable. On the basis of available information, knowledge gaps regarding existing or potential safety and environmental risks at the site were identified and a site assessment plan was developed.

3.3.2 Site Assessment Components

A site assessment was conducted to identify existing or potential safety and environmental risks on the site. The assessment included the following components:

Waste Rock disposal areas were inspected and sampled by a professional geologist to assess acid rock drainage potential by:

- Identifying waste rock mineralization with potential to release acidic and/or metal-contaminated drainage;
- Mapping and logging waste rock, tailings, pit walls and rock faces;
- Collecting and field testing representative samples of mine wastes.

Mine Openings were inspected and documented to identify closure requirements.

Non-Hazardous Site Debris was inventoried.

Contaminated Soil Areas were measured and sampled to determine the degree and type of contamination and estimate soil volumes for remediation.

Hazardous Materials were inventoried and sampled for analyses of contaminant constituents, as necessary.

Buildings and other Structures were inspected for hazardous materials and assessed for stability.

Borrow Sources were identified and assessed for accessibility and approximate quantity and type of granular material as applicable.

Scale site plans were prepared to identify the dimensions and locations of site structures, mine workings and adits, waste rock disposal areas, on-site sampling locations, and any other pertinent information.

3.3.3 Sampling Methods and Quality Assurance

Test Pit Sampling

Test pits were excavated to a depth of about 0.3 to 1.0 m. Horizons in the test pit walls were logged, noting colour/weathering, rock composition, primary and secondary mineralization, particle size distribution, paste pH and paste conductivity, and moisture content. The test pit was photographed and its location was marked on the field map.

Approximately 2 kg of rock was collected at each sample site. For test pits showing a homogeneous wall face, a plastic sheet was placed at the bottom of the test pit and the pit wall was cut vertically down with a cleaned shovel. All rock larger than 75 mm in size was discarded. The sample was coned and quartered, discarding opposite quarters, until a 2 kg sample was obtained.

For test pit walls showing clearly-distinguishable horizons (distinguishable by the sulphide and carbonate contents), the horizons were sampled individually.

Water Sampling

Samples were collected from surface streams upstream and downstream of mine related flows, and from representative seeps emanating from waste rock, tailings, pit walls, and/or adits.

250 ml water samples were collected by hand, facing upstream, ensuring that the sample was not contaminated by disturbed sediment, debris and other floating materials. Sample bottles were rinsed three times with water from the sample stream prior to collecting the sample.

2 ml of HNO_3 were immediately added to water samples destined for metals analyses. For analyses of non-metallic parameters, water samples were brim-filled to minimize head space, placed in a cooler, and maintained at 4° C until delivery to the laboratory.

Soil Sampling

Soil lithology was recorded from observations of the side walls of the test pit, and soil samples for both field and laboratory testing were collected. Observations were recorded for each soil sample site, including soil particle size, consistency, colour,

moisture, discoloration, stratification, odour, and any other observations of significance.

Samples were collected at depth intervals selected on the basis of stratigraphic observations and anticipated or apparent contamination. The lab samples were collected using disposable latex gloves and decontaminated stainless steel sampling utensils. All samples intended for organic analyses were stored in laboratory-cleaned 250 ml glass jars; samples intended for metals analyses were placed in new "Whirl-Pak" bags. All samples were placed in a cooler for shipment to the laboratory.

Barrel Sampling

Barrels containing hydrocarbons were sampled with 1.2 m clean hollow glass rods ("drum thieves"), capable of extracting up to 25 ml of product. The rods were inserted into the drum or pail, and the uppermost open tip was sealed to maintain the sample within the rod as it was extracted from the drum or pail. The sampled hydrocarbon was then drained into a 40-ml laboratory-cleaned vial. The extractions were repeated until at least 20-30 ml of product was obtained. The vial was then sealed and placed in a container for shipment to the laboratory. Each used drum thief rod was subsequently destroyed to prevent accidental re-use.

Since hydrocarbon samples were collected only for analyses of Total Halides and metals, no cooling or other preservative was required.

Quality Assurance

Quality Assurance (QA) is a set of procedures for ensuring that the results of chemical analyses are, and can be shown to be, accurately representative of field conditions. A complete QA program includes both a field component and a laboratory component.

In addition to the standard sample collection methods outlined above, the field QA measures that were implemented for this assessment study include:

- chain of custody procedures and forms;
- a sample labeling and sample location identification scheme;
- laboratory preparation of all sampling containers;
- laboratory defined sample preservation and shipping procedures; and

- regular maintenance (including re-calibration) and cleaning of field equipment.

Laboratory QA measures included replicate analyses of selected soil and water samples. Replicate analytical results were submitted with each analytical report.

4.0 ENVIRONMENTAL SETTING

4.1 MINERALIZATION

The Red Mountain property as described in *Geology and mineralization of the Red Mountain porphyry molybdenum deposit, south-central Yukon* is underlain by argillaceous sedimentary rocks associated with the Yukon Cataclastic Complex.

Intrusive to the argillaceous sedimentary rocks is a complex of quartz monzonite porphyry, quartz-eye diorite porphyry and granodiorite porphyry. An extensive hornfels aureole has developed in the adjacent sedimentary rocks. Hydrothermal alteration in the form of sericitization, silicification and chlortization extended into, and superimposed upon, the sedimentary rocks.

Molybdenite (MoS_2) mineralization is hosted within the quartz monzonite porphyry and immediately adjacent hornfels. Pyrite (FeS_2) is the most common sulphide mineral associated with the deposit and it is inversely proportional to the molybdenite concentration. Within the sedimentary rocks, peripheral to better grade molybdenite mineralization, pyrite averages 5% to 10%. Within hornfels containing substantial molybdenite mineralization, pyrite content is 1% to 3%, whereas well mineralized quartz monzonite porphyry contains only 1% to 2%. Weakly mineralized quartz monzonite porphyry contains 3% to 5% pyrite. Minor pyrrhotite (Fe1-xS) occurs in association with pyrite.

Chalcopyrite ($CuFeS_2$), sphalerite (Zn, Fe), galena (PbS) and scheelite ($CaWO_4$) mineralization occur in the upper sericitic portion of the quartz-eye diorite porphyry. Tungsten occurs as scheelite in late pyrite-quartz veinlets. Base metals and scheelite have not been observed in molybdenite-quartz veins.

4.2 SURFACE HYDROLOGY

Site drainage from the mine workings in the north cirque of Red Mountain is north-north east via a first order stream into Silco Creek and subsequently into Boswell

River. Chalco Creek located south of Red Mountain runs east and also drains into Boswell River. Chalco Creek is upstream of mine workings. (see Figure 1).

Hydrological and water quality data are not available for Silco Creek, Chalco Creek or Boswell River.

No seepage from the waste rock piles was detected, however the Silco Creek tributary runs through the mine site and topography lends itself to seepage through the waste rock piles as a result of site drainage and surface infiltration from precipitation.

4.3 CLIMATE

The closest climatological information is from the city of Whitehorse 60° 43' N, 135° 4' W; 703 m above sea level (Environment Canada, 1980). Total annual precipitation is 268.8 mm. This consists of 159.6 mm of rainfall and 145.2 mm of snowfall. Highest levels of rainfall occur in July and highest levels of snowfall occur in November. Temperature averages range from -18.7° C in January to 14.0° C in July. The mean annual temperature is -1.0° C. Due to its higher elevation, Slate Mountain experiences colder temperatures.

4.4 VEGETATION

The Slate Mountain mine site is in the Yukon Southern Lakes ecoregion. Boreal forests are composed of open stands of white spruce and lodgepole pine intermixed with aspen. South-facing slopes at lower elevations support grassland communities. Subalpine elevations above 1200 m ASL are occupied by open forest communities of alpine fir, white spruce and lodgepole pine. Colder, more exposed alpine areas, are characterized by mountain avens, dwarf shrubs, forbs, grasses and lichen.

The Slate Mountain site is situated at an subalpine-alpine interface with the three camp areas located in open subalpine forest and the drill site access roads, at higher elevations, in a distinct alpine habitat.

4.5 FISH AND WILDLIFE RESOURCES

Typical carnivores in the area include grizzly bear, wolf, caribou and Dall's and Stone's sheep. Fresh grizzly bear sign was noted during the site visit. Arctic ground squirrel, pika and hoary marmot are common rodents in the area. Bird species

representative of the alpine habitat include several ptarmigan species and rosy finch. A number of raptors hunt and nest in the area, including gyrfalcon and golden eagle.

4.6 SITE TOPOGRAPHY AND SOILS

The soils within the Yukon Southern Lakes ecoregion are predominantly eutric brunisolic. Cryosolic soils occur sporadically on poorly drained areas.

The site is located on the peak of Red Mountain as well as a smaller satellite peak. Surface mine disturbances are mostly confined to a north-north east facing cirque on the taller peak and the two camp areas and the core sample storage area are located on the lower peak. Both peaks are relatively flat and vegetated throughout, except for the cleared areas of the drill site access roads on the tall peak and the constructed laydown yard on top of the lower peak. The developed north side of the mountain slopes gradually towards the valley north of the site, dominated by Boswell River.

4.7 PERMAFROST

Slate Mountain is in an area of discontinuous permafrost. No evidence of permafrost was discovered during the site visit and is not likely to affect project components.

5.0 SITE DESCRIPTION AND FINDINGS

5.1 BUILDING, INFRASTRUCTURE, EQUIPMENT

The buildings, infrastructure and equipment observed in and around the site are listed in Table 2. As with the remainder of the site, Amoco Petroleum Canada holds a valid claim to the site and many of these materials are still useable.

Table 2: Buildings, Infrastructure and Equipment

Inventoried Material	Location	Comments
3 - 4.9 x 4.9 m wood frame bldgs.	Main mine camp at base of Red Mountain; 1 bldg. slightly removed	Two bldgs. in satisfactory condition; generator shack destroyed
6 - 4.9 x 6.1 m wood frame bldgs.	Main mine camp at base of Red Mountain	Satisfactory condition
14,000 L AST	Adjacent to generator shack	Satisfactory condition; ~1000 L fuel
4,500 L AST	Adjacent to generator shack	Satisfactory condition but imminent valve failure; ~1000 L fuel
3 - 21,000 L AST	Top of lower peak on main equip. pad	Good condition; empty
12,500 L AST	Top of lower peak on main equip. pad	Good condition; empty
Large vol. core sample containers	Lower elevation east of main equip. pad	Much of material remains usable

5.2 NON-HAZARDOUS WASTE MATERIALS

The non-hazardous waste material observed in and around the site are listed in Table 3.

Table 3: Non-Hazardous Waste Materials

Waste Material	Number/ Volume	Location
wood materials (Much of material remains useable)	6.1 m x 30.5 m	Top of lower peak on main equip. pad
metal materials (culvert, cable, etc.) (Much of material remains useable)	6.1 m x 30.5 m	Top of lower peak on main equip. pad
Empty 205 L barrels	80	Adj. to main camp & main equip. pad

5.3 HAZARDOUS MATERIALS

Barrel & Storage Tank Liquids

Hazardous wastes noted at the site were associated with the storage of petroleum hydrocarbon fuels, including residuals in two large aboveground storage tanks and a number of 205 L barrels at the main camp, the main equipment pad and a barrel dump south of the mine site. In addition, there were two small containers of hazardous materials located near the generator shack. Locations and volumes of these contents are listed in Table 4. Laboratory analysis results are listed in Table 5. Complete analytical results are provided in Appendix C. Sample locations are included in Drawing 1.

Table 4: Barrel/Storage Tank Contents & Sample Locations

Hazardous Material	Number/ Volume	Location	Sample #
residual fuel in 15,000 L AST	~1000 L	Adj. to generator shack	SM-B201
residual fuel in 4,500 L AST	~1000 L	Adj. to generator shack	SM-B202
residual fuel 205 L barrels	12	NW corner of main equip. pad	(composite) SM-B203
residual fuel in 205 L barrels	5	NE corner of main equip. pad	(composite) SM-B204
residual fuel in 205 L barrels	18	Centre of main equip. pad	(composite) SM-B205
205 L barrels ½ full or greater	5	E of large ASTs	(blue): SM-B206 (orange): SM-B207
residual fuel in 205 L barrels	5	Off site bog S of Red Mountain	SM-B208
4 L antifreeze	1	Adj. to generator shack	Clean; none
23 L pails gear lubricant	3	Adj. to generator shack	Clean; none

Table 5: Barrel Sample Laboratory Results (ppm)

Parameter	Barrel Protocol Criteria	Sample #							
		SM-B201	SM-B202	SM-B203	SM-B204	SM-B205	SM-B206	SM-B207	SM-B208
PCBs	2	-	< 2	na	< 2	na	< 2	< 2	< 2
Total Halogenated Organics	1000	8.0	6.0	< 2	3.0	< 2	< 2	4.0	-
Cadmium	2	< 1	< 1	< 1	< 1	< 1	< 1	< 1	-
Chromium	10	< 1	< 1	< 1	< 1	< 1	< 1	< 1	-
Lead	100	< 1	< 1	< 1	< 1	< 1	< 1	< 1	-

- parameter not analyzed.

All parameters included in the barrel and storage tank sample analyses were below remediation criteria.

Soil Stains

Three soil samples were collected from stained soils at three separate locations including: under the old generator shack (SM-S201); at the north end of the west storage tank on the equipment pad (SM-S202); and at a barrel dump south of Red Mountain (SM-S102). While the barrel dump was located at a location remote from the mine site, it is probable that this contamination was caused by the mine operations. The barrel dump was located in a bog and groundwater was found to be less than 10 cm below the surface. The site does not appear to be accessible to heavy equipment.

Based on the presence of barrels and fuel storage tanks in close proximity to the stained areas and a noticeable hydrocarbon odour, it was assumed that the stains were the result of petroleum hydrocarbon spillage. As such, samples were analyzed for the presence of total extractable hydrocarbons (TEHs) and heavy metals. Laboratory results are shown in Table 6 below. Complete analytical results are provided in Appendix C.

Table 6: Soil Sample Laboratory Results (ppm)

Parameter	Yukon Contaminated Sites Schedule 1 Industrial Criteria	CCME Commercial/ Industrial Remediation Criteria	Sample #		
			SM-S102	SM-S201	SM-S202
Antimony	40	40	> 20	< 20	< 20
Arsenic	-	50	17.8	**54.8**	48.3
Barium	2000	2000	356	98	86
Beryllium	8	8	< 0.5	1	0.7
Cadmium	-	20	< 2	< 2	< 2
Chromium	800	800	25	57	68
Cobalt	300	300	7	6	2
Copper	-	500	70	147	95
Lead	-	1000	108	132	82
Mercury	10	10	0.033	0.007	0.011
Molybdenum	40	40	< 4	5	17
Nickel	500	500	12	28	19
Selenium	10	10	< 50	< 50	< 50
Silver	40	40	< 2	< 2	< 2
Tin	300	300	< 30	< 30	< 30
Vanadium	-	-	5	56	89
Zinc	-	1500	225	361	71
Total extractable hydrocarbons	5000	-	**304000**	**25000**	**51500**

- no criteria exist for these parameters.

The concentration of arsenic was slightly above CCME commercial/industrial remediation criteria for sample SM-S201. Sample SM-S201 was taken near the storage tanks at the laydown yard where soils have been extensively disturbed during the yard's construction. Waste rock collected from other locations at the

laydown yard also showed elevated concentrations of arsenic. As such, arsenic concentrations do not appear to be elevated above background levels.

The concentration of TEHs was above Yukon remediation criteria in all three samples. Hydrocarbon distributions of the samples indicate that contamination is the result of diesel (or petroleum hydrocarbons of similar molecular weight). A substantial portion of sample SM-S201 also appears to be attributable to heavier oil, such as waste oils or lubricants. Refueling heavy machinery at the storage tanks, adjacent to sample SM-S201, may have leaked lubricants or hydraulic fluids with hydrocarbon distributions similar to that noted.

5.4 SURFACE WATER QUALITY

Table 7 identifies the significant findings of the sampling program conducted to determine the potential impact of the site on surface water bodies. Samples were taken from downstream waters from the stream running below the site, shown in Drawing 1. Upstream samples were also collected on the north and south side of Red Mountain to represent site background conditions for which downstream sample results will be compared. Field measurements of pH and conductivity were taken to guide the sampling for laboratory analysis, as well as for a secondary measurement. Complete analytical results are provided in Appendix C.

Water samples were collected from a first order stream, a tributary of Silco Creek, on the north side cirque of Red Mountain. Samples were taken above the main camp site (background) (SM-WQ-Str201) and downstream at the main camp (SM-WQ-Str101). A background water sample was also collected in Chalco Creek, upstream of the site, on the south side of Red Mountain (SM-WQ-Str301). Both creeks are tributaries of Boswell River. No seeps from the equipment area (laydown yard) were noted.

Sample SM-WQ-Str201 was collected from the tributary where it flows through the mineralized section of the slope above the camp near the headwaters. This sample is representative of background water quality of the north side of Red Mountain. The results are typical of an area naturally rich in mineralized material. The Chalco Creek sample (SM-WQ-Str301) was collected from an unmineralized area.

The water quality of the two samples collected from the Silco Creek tributary are below the criteria outlined in Schedule 1 of the Metal Mining Liquid Effluent Regulations and Guidelines for all parameters except pH in sample SM-WQ-Str201. Sample SM-WQ-Str101 slightly exceeded both the background level, established

by SM-WQ-Str201, and the CCME freshwater aquatic life criteria only for iron. For some metals, detection limits are above background values.

Table 7: Surface Water Samples - Significant Results

Sample ID	Sample Location	pH	Conductivity (μmhos/cm)	Metallic Parameters
SM-WQ-Str101	Silco Cr. tributary downstream of mine workings	5.11	59.9	low
SM-WQ-Str201	Silco Cr. tributary upstream of mine workings	4.08	289	Al, Cu, Zn (background)
SM-WQ-Str301	Chalco Cr. upstream of mine workings	7.89	164	low

5.5 WASTE ROCK DISPOSAL AREAS

No waste rock has been generated at the site from mining operations, however, the road cuts created for drill access roads and the laydown (storage) yard above the camp site have disturbed acid generating rock. Bulldozers were used to construct the roads and to level out the yard. The distribution of secondary mineralization occurring at the laydown yard is shown on a site map, Drawing 1.

Three pits were dug in the rock at the laydown yard, from which five samples were gathered for laboratory analysis. Two samples were collected along the drill access roads. Paste pH and paste conductivity tests were completed on the site. The sample locations and field paste test results are shown on the site map. Rock samples (SM/WR/*) P301, P302/1, P302/2, P303/1 and P303/2 were collected from the hornfels rock at the laydown yard. Sample SM/WR/P304 was collected from quartz monzonite rich rock along the drill access road. Sample SM/WR/P305 was collected from altered quartz diorite along the drill access road.

All rock samples had acidic paste pH values ranging from 4.26 to 5.06 and negative neutralization potential values (NP). Paste conductivities were somewhat elevated in the hornfels rock samples and were relatively low in the quartz monzonite and altered diorite samples. Summary acid/base accounting test results are shown in Table 8.

Table 8: Summary Acid/Base Accounting Test Results

Sample #	Paste pH	Total S (%)	SO^4 (%)	AP	NP	Net NP	NP/AP
SM/WR/P301	4.88	0.51	no assay	15.94	-1.94	-17.88	< 0.1
SM/WR/P302/1	3.02	0.49	no assay	15.31	-2.38	-17.69	< 0.1
SM/WR/P302/2	5.16	0.50	no assay	15.63	-1.00	-16.63	< 0.1
SM/WR/P303/1	4.56	0.45	no assay	14.06	-2.63	-16.69	< 0.1
SM/WR/P303/2	2.88	1.20	1.20	0.00	-4.00	-4.00	< 0.1
SM/WR/P304	2.88	0.60	no assay	18.75	-1.94	-20.69	< 0.1
SM/WR/P305	3.05	0.21	no assay	6.56	-0.38	-6.94	< 0.1

5.6 MINE OPENINGS AND EXCAVATIONS

There were no adits excavated at the site.

5.7 TAILINGS

Ore was not processed at the site and, therefore, no tailings are present at the Slate Mountain site.

6.0 CONCLUSIONS

Amoco Canada currently has a valid claim at Slate Mountain mine site and it is not an abandoned mine, however, concerns were noted at the site that should be addressed. The primary concern is the environmental risk associated with the barrels and storage tanks containing fuel and the petroleum hydrocarbon stained soils at three locations. Secondary concerns are the aesthetic appearance of the mine access roads on the mountain side and the large volume of materials and buildings remaining at the site.

6.1 HEALTH AND SAFETY

There were no health and safety issues identified at the Slate Mountain mine site.

6.2 ENVIRONMENTAL RISKS

Two large storage tanks and a number of barrels, currently in satisfactory condition, have significant volumes of petroleum hydrocarbons. If left as is, the tanks and barrels will degrade with time and eventually result in hazardous waste spills that may impact on the surrounding environment.

Three locations with stained soils were noted at the site and surrounding area. Based on the parameters included in laboratory analyses, contaminants noted at the sites were limited to petroleum hydrocarbons. The two stains at the mine site were small in size and the remaining off-site stain was inaccessible to heavy equipment.

Based on the surface water and waste rock sampling program at the Slate Mountain site and Acid Rock Drainage Assessment Report submitted by SRK (Feb, 1997), only a low environmental risk was identified at the site. Due to the naturally acidic water in the stream running through the site and the relatively low sulphur grades that appear to be predominantly sulphate, the site is not likely to become more acid generating than at present.

6.3 AESTHETIC CONCERNS

Aesthetic concerns arise from the two large piles of materials on the equipment pad, six storage tanks, a large pile of core samples, a large number of fuel barrels and nine buildings remaining at the site, however, there is a valid claim on the site and equipment at the site may still be useable.

7.0 RECOMMENDATIONS

Recommended remediation and management actions are compliant with applicable federal or territorial regulations and criteria, are reliant upon available technology, and are intended to be appropriate for local conditions and sensitivities.

Recommendation 1.

It is recommended that residual petroleum hydrocarbons remaining in two storage tanks and a number of barrels be incinerated at a common area either on or off site.

REFERENCES

Brown, P. and B. Kahlert, Geology and mineralization of the Red Mountain porphyry molybdenum deposit, south-central Yukon, Amoco Canada Petroleum Co. Ltd.

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APPENDIX A

DETERMINATION OF ACID ROCK DRAINAGE POTENTIAL

P118105

SLATE (RED) MOUNTAIN
ACID ROCK DRAINAGE
ASSESSMENT REPORT

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P118105

SLATE (RED) MOUNTAIN
ACID ROCK DRAINAGE ASSESSMENT REPORT

1.0 INTRODUCTION

This site specific report has been prepared in conjunction with a *Phase II Environmental Assessment of the Slate Mountain Abandoned Mine Site*, prepared by Environmental Services, Public Works and Government Services Canada (PWGSC). As part of the Phase II assessment prepared by PWGC, Steffen Robertson and Kirsten (SRK) was requested to assess the potential for acid rock drainage associated with the site, which is the subject of this report. The reader is directed to the PWGSC report for a comprehensive environmental assessment of the Slate Mountain site.

This report assesses existing, and potential acid rock drainage (ARD) conditions at the Slate Mountain site and provides recommendations for remediation. This site specific report is part of the *Acid Rock Drainage Review Report, Yukon Abandoned Mine Site Assessments*, prepared by SRK, which includes similar assessments for a number of other sites. The reader is directed to that report for detail regarding the scope of work, site assessment methodology, ARD remediation options and the evaluation of potential remediation options.

The Slate Mountain site is located in south-central Yukon, approximately 80 kilometres east of Whitehorse. The site is accessible by helicopter and by a winter road from the Canol Road.

No mine development work has occurred on the site. The disturbance observed was the result of road and laydown (storage) yard construction. Between 1977 and 1983 a comprehensive exploration program was conducted on the site, consisting of mapping and 21,391 meters of diamond drilling in 32 holes.

The site is at the interface between the subalpine and the treeline. The camp site is located in a horseshoe shaped hollow on the north side of Red Mountain. It is within the coniferous forest. A tributary of Silco Creek flows through the camp. The laydown yard is located on a ridge on the east side of Red Mountain in the subalpine. Surface runoff from the laydown yard flows both north to Silco Creek and south towards Chalco Creek.

2.0 GEOLOGY AND MINERALIZATION

The Slate (Red) Mountain property as described in *Geology and mineralization of the Red Mountain porphyry molybdenum deposit, south-central Yukon* (Brown, P. and Kahlert, B) is underlain by argillaceous sedimentary rocks. Intrusive to the argillaceous sedimentary rocks is a complex of quartz monzonite porphyry, quartz-eye diorite porphyry and granodiorite porphyry, with dimensions of 1450 metres by 650 metres. An extensive hornfels aureole developed in the adjacent sedimentary rocks. Hydrothermal alteration in the form of sericitization, silicification and chloritization extended into, and was superimposed upon, the sedimentary rocks.

Molybdenite (MoS_2) mineralization is hosted within the quartz monzonite porphyry and immediately adjacent hornfels. Ferrimolybdenite, a bright yellow hydrous iron molybdenum oxide, occurs as fracture coatings, and along quartz vein rims within an oxidized surface zone.

Within the sedimentary rocks, peripheral to better grade molybdenite mineralization, pyrite (FeS_2) forms a halo averaging 5% to 10%. Within hornfels containing substantial molybdenite mineralization, pyrite content is 1% to 3%, whereas well mineralized quartz monzonite porphyry contains only 1% to 2%. Weakly mineralized quartz monzonite porphyry contains 3% to 5% pyrite.

Minor pyrrhotite ($Fe_{1-x}S$), chalcopyrite ($CuFeS_2$), sphalerite ((Zn, Fe)S), galena (PbS) and scheelite ($CaWO_4$) mineralization occur in quartz veins and as disseminations.

3.0 WASTE ROCK DISPOSAL AREAS

3.1 Description

No rock from mining has been generated at the site. Bulldozers were used to construct the roads and level out the laydown yard. The distribution of secondary mineralization occurring at the laydown yard is shown on the site map, Drawing 2.

3.2 Samples

Three pits were dug in the rock at the laydown yard, from which five samples were gathered for laboratory analysis. Two samples were collected along the drill access roads. Paste pH and paste conductivity test were completed on the site.

Rock samples (SMWR/*) P301, P302/1, P302/2, P303/1, and P303/2 were collected from the hornfels rock at the laydown yard. Sample SMWR/P304 was collected from quartz monzonite rich rock along the drill access road. Sample SMWR/P305 was collected from altered quartz diorite along the drill access road. Detailed sample descriptions are provided in Table 1.

Water samples were collected from the tributary to Silco Creek, in the mineralized horizon of Red Mountain above the camp site (SMWQ/Str201), and downstream at the camp (SMWQ/Str101). A water sample (SMWQ/Str301) was also collected in Chalco Creek, upstream from any site disturbance, on the south side of Red Mountain. Both creeks are tributaries of Boswell Creek. No seeps below the laydown yard were observed.

3.3 Analytical Results

Results of geochemical analyses of waste rock samples are provided in Table 2 and the analytical results for the water samples are provided in Table 3.

Paste Parameters

All rock samples had acidic paste pH values ranging from 4.26 to 5.06. Paste conductivities were somewhat elevated in the hornfels rock samples and were relatively low in the quartz monzonite and altered quartz diorite samples.

Acid Base Accounting

All rock samples had negative neutralization potential (NP) values, indicating that the samples contained acidity prior to the commencement of testwork.

Results for sample SMWR/P303/2 indicates that sulphur is present in the form of sulphate. The sulphur speciation for the remainder of the samples is not known. Since all of the samples exhibit acidic paste pH, residual sulphide oxidation appears to be ongoing. However, the remaining potential for acid generation is considered to be comparatively low.

Metals Concentrations

In general, metal concentrations are comparatively low in all the rock samples.

Water Quality

All metal parameters were below the method detection limits in the sample collected from Chalco Creek. The water quality of the two samples collected from the tributary of Silco Creek exceeded the CCME freshwater aquatic life criteria for pH and zinc. Sample SMWQ/Str201 also exceeded the CCME freshwater aquatic life criteria for copper.

As described in Section 3.2, sample SMWQ/Str201 was collected from the tributary of Silco Creek where it flows through the mineralized section of the slope above the camp near the headwaters. This sample is representative of background water quality of the north side of Red Mountain. The results are typical of an area naturally rich in mineralized material.

4.0 EXISTING AND POTENTIAL ACID ROCK DRAINAGE CONDITIONS

The laydown area is constructed on the hornfels and the drill roads cross through all of the rock types. They are cut out of naturally acid generating materials. However, the background stream quality in the area is also acidic. It is unlikely that the infrastructure at the Slate (Red) Mountain site is impacting the local environment significantly.

5.0 REMEDIATION OPTIONS

Typical reclamation and control options for acid generating mine waste and mine openings include:

- source control which includes limiting further oxidation, for instance, by placing the waste under water thus preventing oxygen entry;
- migration control which limits the mobility of oxidation products, for example, by reducing infiltration to the waste by placing a low permeability cover; and,
- release control by collecting and treating contaminated flows prior to discharge.

Collection and treatment of the runoff from Slate Mountain site is not required since the current runoff is represents background quality. Relocation of the road construction material and covering the laydown yard were also not considered since this would involve additional disturbance of the naturally acidic soils.

6.0 CONCLUSIONS AND RECOMMENDATIONS

Background water quality data indicates that the Silco Creek tributary is naturally acidic due to the mineralogy of Red Mountain. It does not appear that the presence of the site infrastructure has impacted significantly the tributary water quality.

Based on the relatively low sulphur grades, and since indications are that it may be predominantly sulphate, it is concluded that the site is not likely to become more acid

generating than it presently is. Therefore, no further reclamation work with respect to geochemical stability is required.

7.0 REFERENCES

Brown, P. and Kahlert. Geology and Mineralization of the Red Mountain Porphyry Molybdenum Deposit, South-Central Yukon. In Porphyry Deposits of the Northwestern Cordillera of North America edited by T.G. Schroeter, 1995. CIM Special Volume 46.

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TABLE 1 Slate Mountain Waste Rock Sample Descriptions

Sample ID	Sample Description
SMWR/P301	altered hornfels at laydown yard. Material exhibits chloritic and sericitic alteration. Sample collected over a thickness of 35 cm. The surface had an orange stain. The material sampled was 50% sand and 50 % gravel. The gravel was up to 1" and averaged 1/4" in diameter, it contained pyrite along fractures and on the surface. Bands of orange sand cut across the pit walls. The paste pH was 4.88 and the paste conductivity was 190 μs.
SMWR/302/1	hornfels at laydown yard. The top 15 cm of the pit was sampled. It consisted of pale orange/brown colored hornfels of sand and gravel size. The paste pH was 3.02 and the paste conductivity was 50 μs.
SMWR/P302/2	sample collected below SMWR/P302/1 over a thickness of 25 cm from gray/brown hornfels of sand and gravel size. The paste pH was 5.16 and the paste conductivity was 140 μs.
SMWR/P303/1	hematized hornfels at laydown yard. The surface was stained red. The material was red/brown in color and contained 5% silt, 70% sand and 25% gravel. The sample was collected over a thickness of 38 cm. The paste pH was 4.56 and the paste conductivity was 210 μs.
SMWR/P303/2	sample collected below SMWR/P303/1 over a thickness of 14 cm. The material contained pockets of clay and it was a brighter yellow color. It contained 10% gravel (hornfels). The paste pH was 2.88 and the paste conductivity was 80 μs.
SMWR/P304	sample collected on the south side of the bowl of Red Mountain in mineralized quartz monzonite rich overburden disturbed during road construction. It contained up to 20% subangular cobbles and was mineralized with molybdenite. The paste pH was 2.88 and the paste conductivity was 30 μs.
SMWR/P305	sample collected 200 meters south of the culvert draining Red Mountain (SMWQ/STR201). It contained altered quartz diorite. The surface had a slight reddish tinge. Cobbles up to 8" by 4" made up 30% of the material. The remainder being silt and gravel colored orange/brown. The paste pH was 3.05 and the paste conductivity was 30 μs.

TABLE 2 Slate (Red) Mountain Waste Rock ABA and ICP Results

Parameter	Units	Sample Number SMWR						
		P301	P302/1	P302/2	P303/1	P303/2	P304	P305
Field Paste pH		4.88	3.02	5.16	4.56	2.88	2.88	3.05
Field Cond	µS/cm	190	50	140	210	80	30	30
Lab Paste pH		4.73	4.46	4.60	4.30	4.26	4.81	5.06
Total Sulfur	%	0.51	0.49	0.50	0.45	1.20	0.60	0.21
Sulfate	%	na	na	na	na	1.20	na	na
AP		15.94	15.31	15.63	14.06	0.00	18.75	6.56
NP		-1.94	-2.38	-1.00	-2.63	-4.00	-1.94	-0.38
NET NP		-17.88	-17.69	-16.63	-16.69	-4.00	-20.69	-6.94
NP/AP		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Aluminum	%	2.01	1.29	1.38	0.77	1.09	0.80	0.62
Antimony	ppm	2	3	5	7	<1	31	7
Arsenic	ppm	22	58	91	<1	<1	<1	<1
Barium	ppm	59	141	77	96	133	322	253
Beryllium	ppm	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Bismuth	ppm	<1	<1	<1	<1	<1	<1	<1
Cadmium	ppm	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Calcium	%	0.27	0.06	0.22	0.02	<0.01	0.03	0.02
Chromium	ppm	162	93	109	86	97	67	86
Cobalt	ppm	7	7	6	5	6	5	4
Copper	ppm	136	142	104	44	85	88	82
Gallium	ppm	<1	<1	<1	<1	<1	<1	<1
Iron	%	4.66	5.10	3.51	4.26	6.85	3.72	2.48
Lead	ppm	10	37	44	52	2	316	265
Lithium	ppm	14	14	13	6	9	4	3
Magnesium	%	1.31	0.85	0.77	0.46	0.77	0.26	0.18
Manganese	ppm	269	197	155	69	129	72	169
Molybdenum	ppm	17	16	13	25	22	184	312
Nickel	ppm	35	26	23	17	25	14	8
Potassium	%	0.24	0.22	0.22	0.27	0.56	0.30	0.15
Phosphate	ppm	510	480	460	410	580	960	590
Silver	ppm	0.9	0.8	0.9	0.7	<0.1	1.9	1.2
Sodium	%	0.06	0.04	0.06	0.02	0.06	0.05	0.03
Strontium	ppm	55	40	45	12	15	79	48
Thorium	ppm	<1	<1	<1	<1	<1	<1	<1
Tin	ppm	3	3	2	2	4	2	<1
Titanium	%	0.07	0.04	0.04	0.03	0.05	<0.01	0.02
Tungsten	ppm	7	6	6	3	2	<1	4
Uranium	ppm	<1	<1	<1	<1	<1	<1	<1
Vanadium	ppm	44.8	40.3	33.9	42.6	57.7	16.5	11.0
Zinc	ppm	64	123	78	22	16	59	138

AP = Acid Potential in tonnes $CaCO_3$ equivalent per 100 tonnes of material

NP = Neutralization Potential in tonnes $CaCO_3$ equivalent per 1000 tonnes of material

Net NP = Net Neutralization Potential = tonnes $CaCO_3$ equivalent per 1000 tonnes of material

na = no assay / analysis

< = lower detection limit

> = upper detection limit

TABLE 3 Slate (Red) Mountain Water Quality Results

Parameter	Units	Sample Number SMWQ/		
		Str 301	Str 201	Str 101
Field Conductivity	umhos/cm	150	170	80
Field pH		7.09	3.78	4.8
Lab Conductivity	umhos/cm	164	289	59.9
Lab pH		7.89	4.08	5.11
Acidity (to pH 8.3) CaCO3	mg/L	1.9	99.1	4.7
Alkalinity-Total CaCO3	mg/L	60.9	<1.0	<1.0
Sulphate SO4	mg/L	24.4	148	23.9
Aluminum T-Al	mg/L	<0.2	15.3	0.3
Antimony T-Sb	mg/L	<0.2	<0.2	<0.2
Arsenic T-As	mg/L	<0.2	<0.2	<0.2
Barium T-Ba	mg/L	0.05	0.04	0.08
Beryllium T-Be	mg/L	<0.005	<0.005	<0.005
Bismuth T-Bi	mg/L	<0.1	<0.1	<0.1
Boron T-B	mg/L	<0.1	<0.1	<0.1
Cadmium T-Cd	mg/L	<0.01	<0.01	<0.01
Calcium T-Ca	mg/L	26.8	7.38	4.16
Chromium T-Cr	mg/L	<0.01	<0.01	<0.01
Cobalt T-Co	mg/L	<0.01	0.04	<0.01
Copper T-Cu	mg/L	<0.01	0.33	0.03
Iron T-Fe	mg/L	<0.03	0.16	0.23
Lead T-Pb	mg/L	<0.05	<0.05	<0.05
Lithium T-Li	mg/L	<0.01	<0.01	<0.01
Magnesium T-Mg	mg/L	3.71	5.44	1.31
Manganese T-Mn	mg/L	<0.005	0.57	0.033
Molybdenum T-Mo	mg/L	<0.03	<0.03	<0.03
Nickel T-Ni	mg/L	<0.02	0.04	<0.02
Phosphorus T-P	mg/L	<0.3	<0.3	<0.3
Potassium T-K	mg/L	<2	<2	<2
Selenium T-Se	mg/L	<0.2	<0.2	<0.2
Silicon T-Si	mg/L	1.93	13.6	6.57
Silver T-Ag	mg/L	<0.01	<0.01	<0.01
Sodium T-Na	mg/L	<2	6	2
Strontium T-Sr	mg/L	0.079	0.08	0.046
Thallium T-Tl	mg/L	<0.1	<0.1	<0.1
Tin T-Sn	mg/L	<0.03	<0.03	<0.03
Titanium T-Ti	mg/L	<0.01	<0.01	0.01
Vanadium T-V	mg/L	<0.03	<0.03	<0.03
Zinc T-Zn	mg/L	<0.005	0.264	0.139

< = lower detection limit

Steffen Robertson and Kirsten
February, 1997

TABLE3.XLS/Slate Mtn/3/13/97

APPENDIX B

SITE PHOTOGRAPHS

SLATE MOUNTAIN

Photographic Record

July 29, 1996

Photos	Description
S.M. # 1	Large Storage Tanks on Edge of Equipment Pad
S.M. # 2	Stained Soil adjacent to Large Storage Tank
S.M. # 3	Storage Tank adjacent to Generator Shack
S.M. # 4	Demolished Generator Shack and Storage Tank
S.M. # 5	Used Barrels near Centre of Equipment Pad
S.M. # 6	Barrels containing Liquids adjacent to Large Storage Tanks
S.M. # 7	Used Barrels at Northwest Corner of Equipment Pad
S.M. # 8	Barrel Dump and Surrounding Burn Area
S.M. # 9	Barrel Dump and Surrounding Burned Area
S.M. # 10	Stacked Materials at Northeast Corner of Equipment Pad
S.M. # 11	Stacked Piping near Edge of Equipment Pad
S.M. # 12	Wood Frame Building at Main Drill Camp
S.M. # 13	Large Number of Core Boxes at Separate Area of Site
S.M. # 14	Contents of Core Boxes
S.M. # 15	Main Drill Camp from above Site
S.M. # 16	Culverted Stream at Main Drill Camp
S.M. # 17	Diverted Stream above Main Drill Camp

Photo # 1 - Large Storage Tanks on Edge of Equipment Pad

Photo # 2 - Stained Soil adjacent to Large Storage Tank

Photo # 3 - Storage Tank adjacent to Generator Shack

Photo # 4 - Demolished Generator Shack and Storage Tank

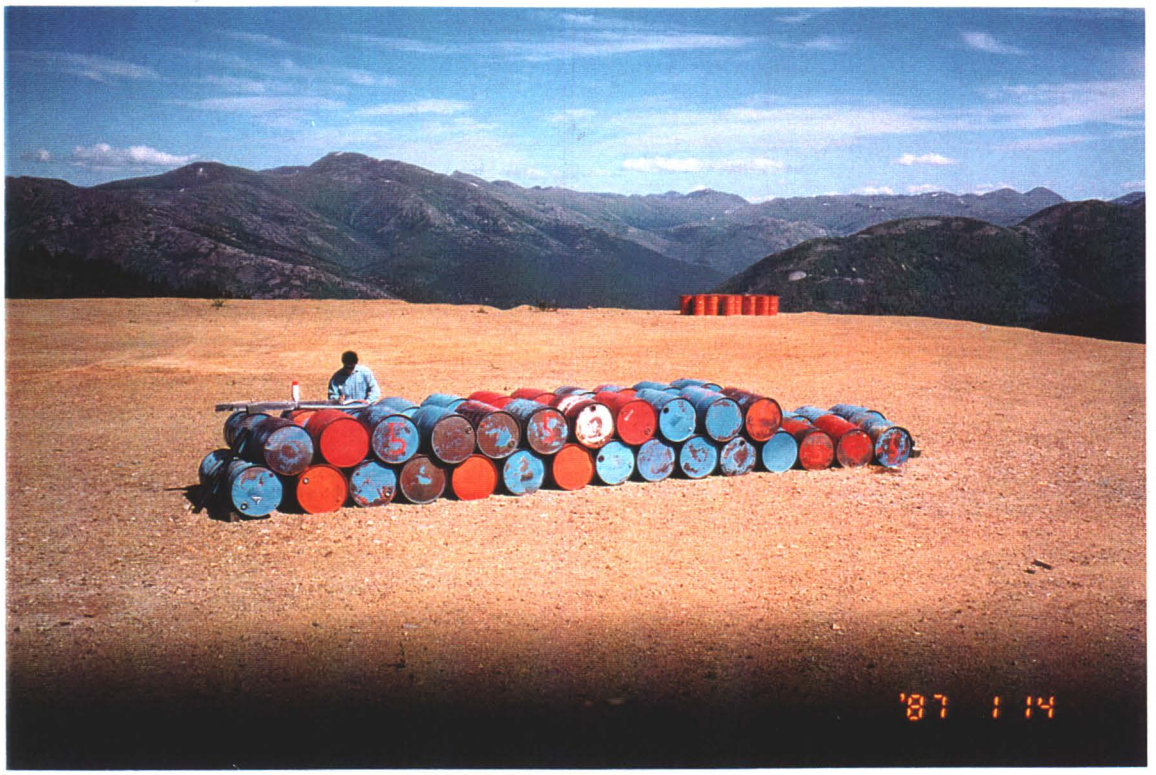

Photo # 5 - Used Barrels near Centre of Equipment Pad

Photo # 6 - Barrels containing Liquids adjacent to Large Storage Tanks

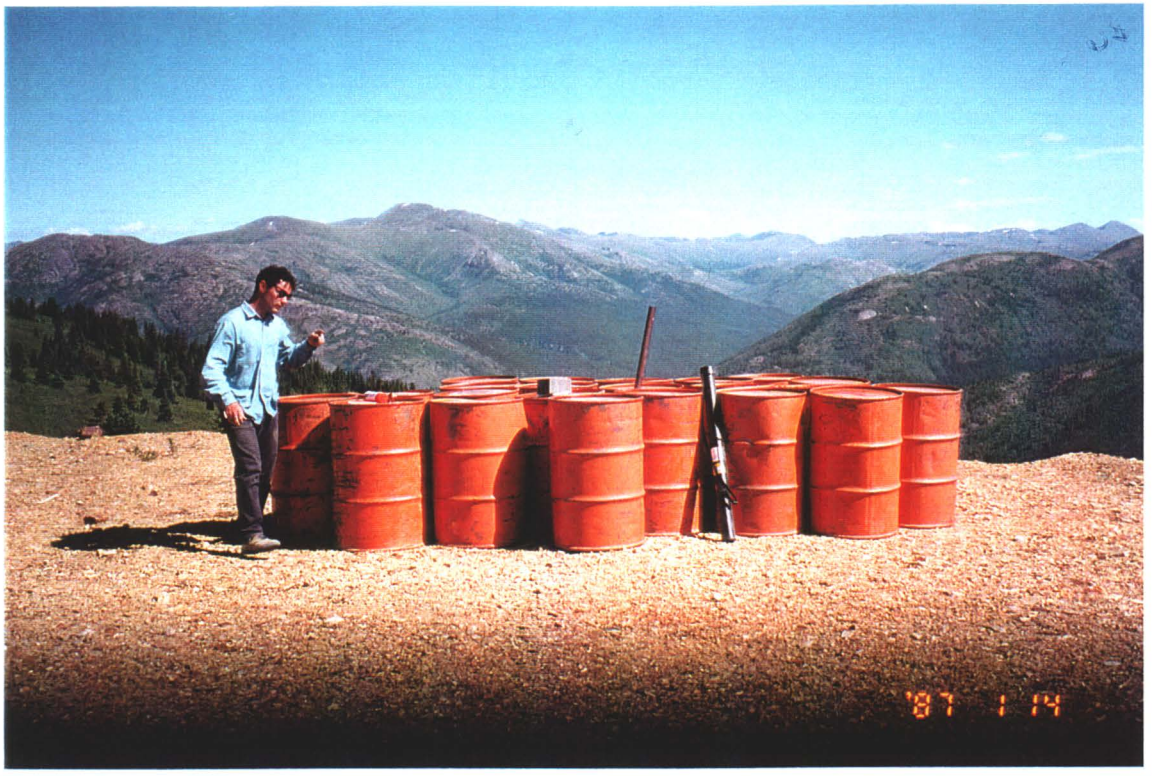

Photo # 7 - Used Barrels at Northwest Corner of Equipment Pad

Photo # 8 - Barrel Dump and Surrounding Burn Area

Photo # 9 - Barrel Dump and Surrounding Burned Area

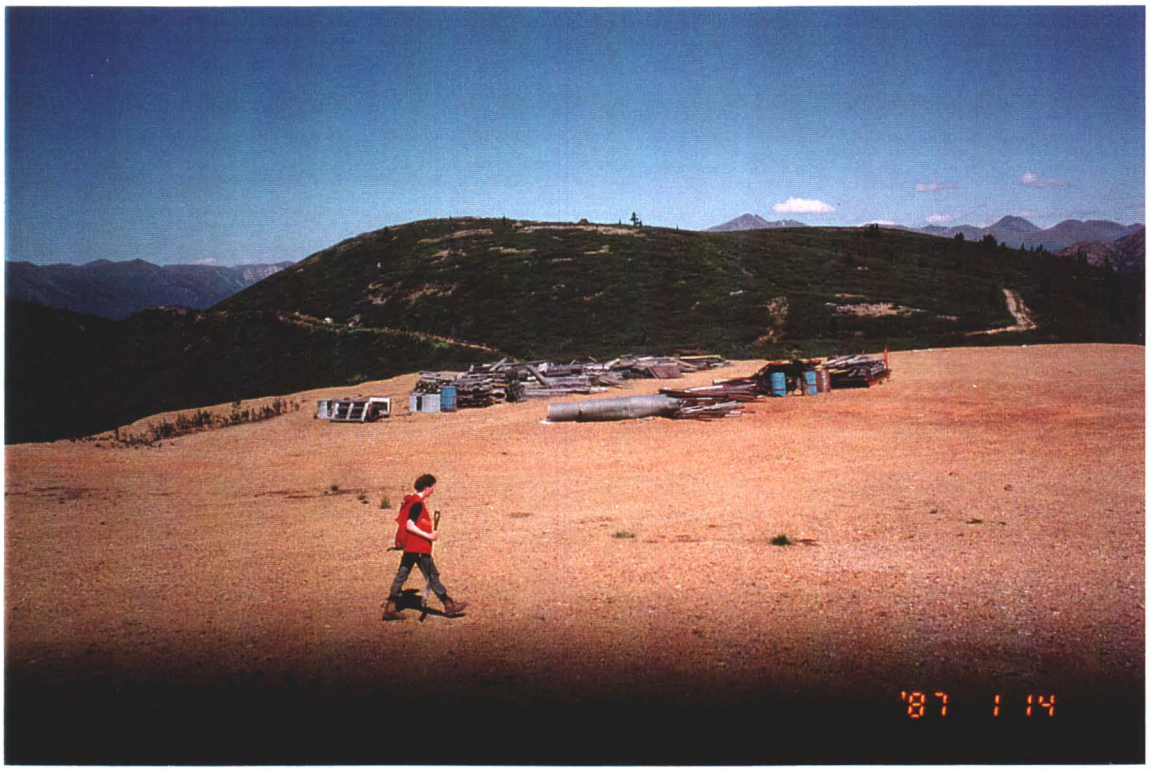

Photo # 10 - Stacked Materials at Northeast Corner of Equipment Pad

Photo # 11 - Stacked Piping near Edge of Equipment Pad

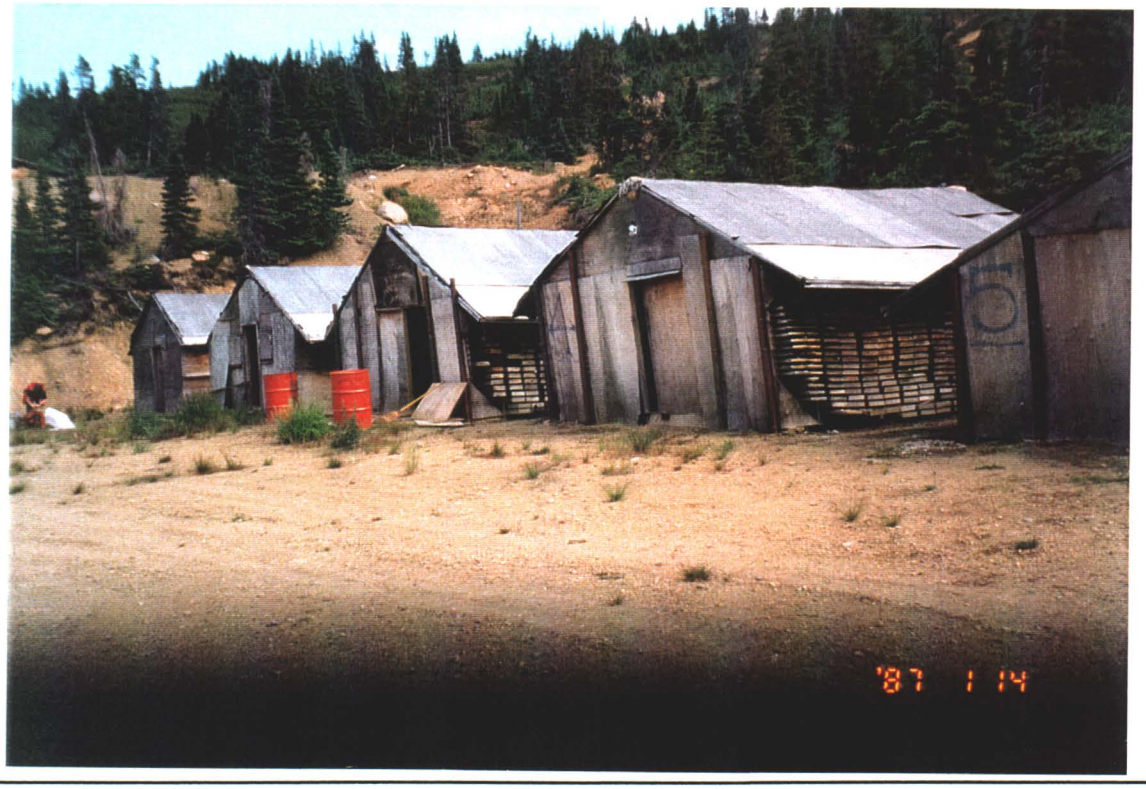

Photo # 12 - Wood Frame Building at Main Drill Camp

Photo # 13 - Large Number of Core Boxes at Separate Area of Site

Photo # 14 - Contents of Core Boxes

Photo # 15 - Main Drill Camp from above Site

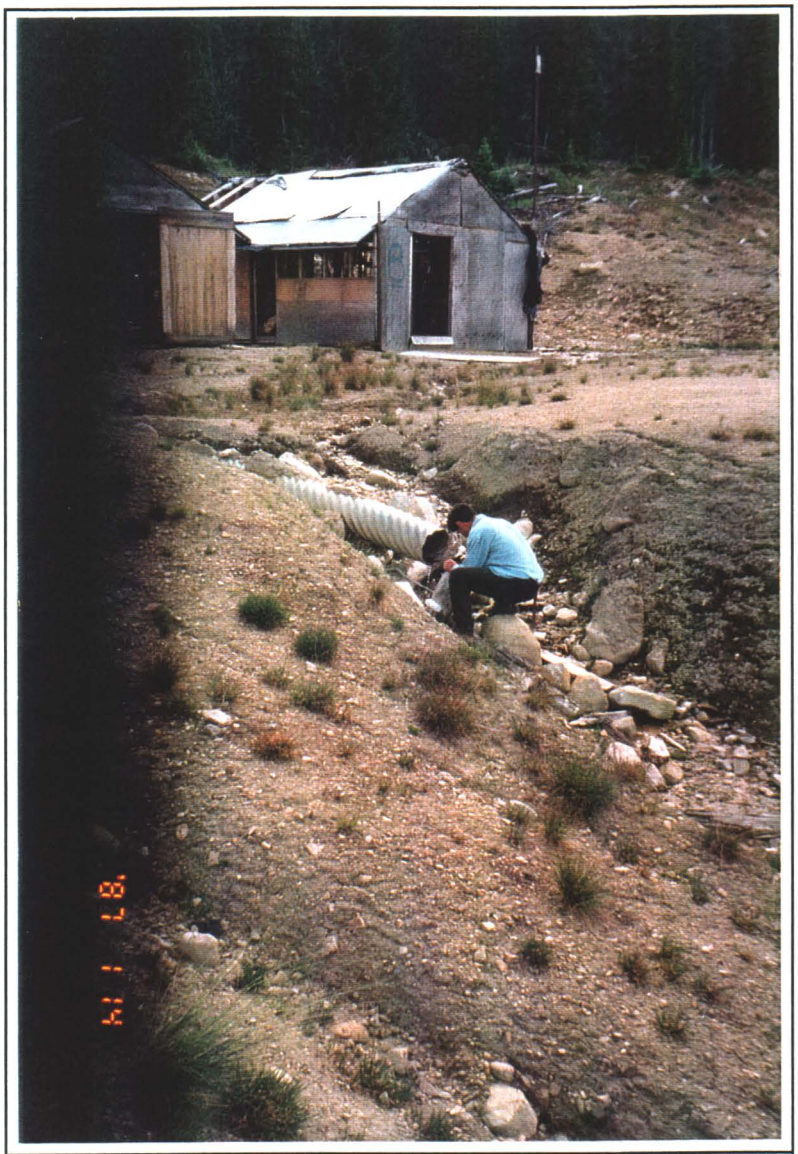

Photo # 16 - Culverted Stream at Main Drill Camp

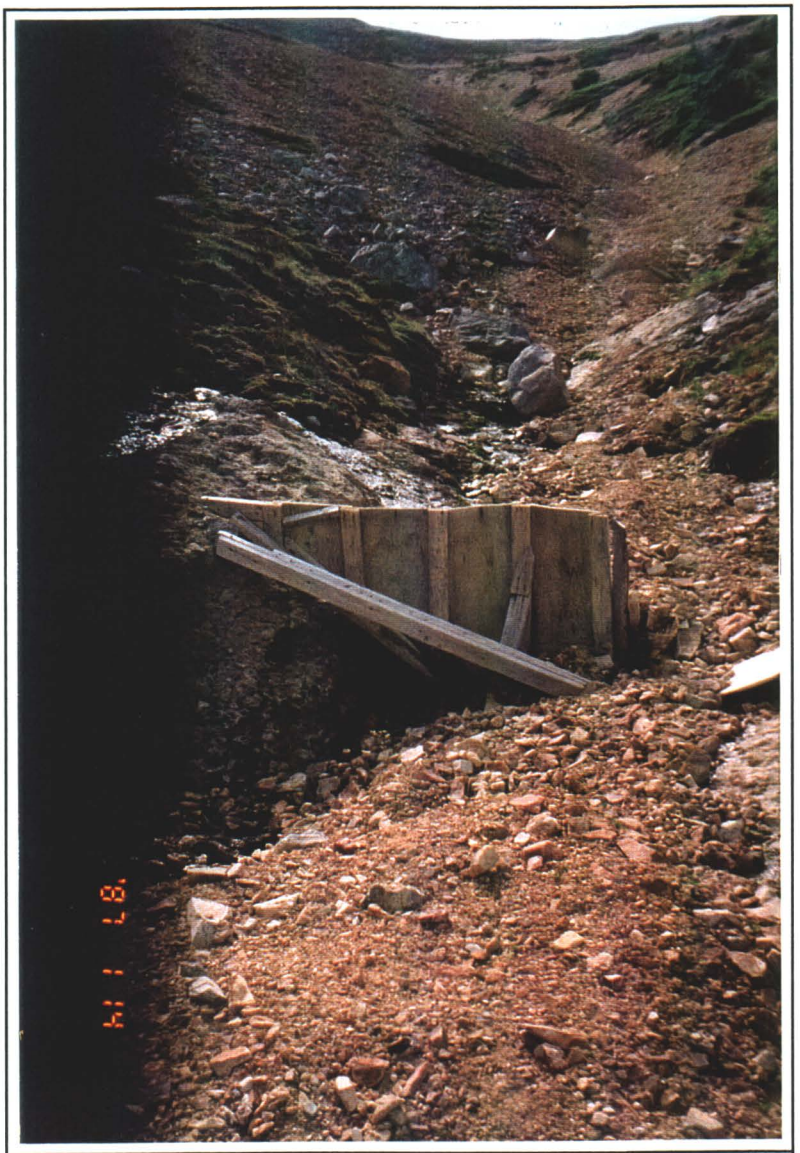

Photo # 17 - Diverted Stream above Main Drill Camp

APPENDIX C

ANALYTICAL RESULTS

RESULTS OF ANALYSIS - Product[1,2]

File No. G3879

		AC-B102A	AC-B101	AC-B102B	SM-B201	SM-B202
		96 07 27	96 07 27	96 07 27	96 07 29	96 07 29
Total Metals						
Cadmium	T-Cd	<1	<1	<1	<1	<1
Chromium	T-Cr	<1	<1	<1	<1	<1
Lead	T-Pb	1	<1	<1	<1	<1

Remarks regarding the analyses appear at the beginning of this report.
< = Less than the detection limit indicated.
[1]Adsorbable Organic Halide may be considered to be Total Organic Halide in product samples.
[2]Results are expressed as milligrams per litre.

RESULTS OF ANALYSIS - Product[1,2]

File No. G3879

		SM-B204	SM-B205	SM-B206	SM-B207
		96 07 29	96 07 29	96 07 29	96 07 29
Total Metals					
Cadmium	T-Cd	<1	<1	<1	<1
Chromium	T-Cr	<1	<1	<1	<1
Lead	T-Pb	<1	<1	<1	<1

Remarks regarding the analyses appear at the beginning of this report.
< = Less than the detection limit indicated.
[1]Adsorbable Organic Halide may be considered to be Total Organic Halide in product samples.
[2]Results are expressed as milligrams per litre.

RESULTS OF ANALYSIS - Product[1,2]

File No. G3879

	AC-B102A	AC-B101	AC-B102B	SM-B201	SM-B202
	96 07 27	96 07 27	96 07 27	96 07 29	96 07 29
Organic Parameters					
Adsorbable Organic Halide	7800	14900	7720	<300	<300

Remarks regarding the analyses appear at the beginning of this report.
< = Less than the detection limit indicated.
[1]Adsorbable Organic Halide may be considered to be Total Organic Halide in product samples.
[2]Results are expressed as milligrams per litre.

RESULTS OF ANALYSIS - Product[1,2]

File No. G3879

	SM-B204	SM-B205	SM-B206	SM-B207
	96 07 29	96 07 29	96 07 29	96 07 29
Organic Parameters				
Adsorbable Organic Halide	<300	<300	<300	<300

Remarks regarding the analyses appear at the beginning of this report.
< = Less than the detection limit indicated.
[1]Adsorbable Organic Halide may be considered to be Total Organic Halide in product samples.
[2]Results are expressed as milligrams per litre.

RESULTS OF ANALYSIS - Sediment/Soil[1]

File No. G3879

	AC-S201	AC-S202	AC-S203	SM-S102	SM-S201
Polycyclic Aromatic Hydrocarbons					
Acenaphthene	<0.5	<0.01	-	-	-
Acenaphthylene	<0.5	<0.01	-	-	-
Anthracene	<0.5	<0.01	-	-	-
Benzo(a)anthracene	<0.5	<0.01	-	-	-
Benzo(a)pyrene	<0.5	<0.01	-	-	-
Benzo(b)fluoranthene	<0.5	<0.01	-	-	-
Benzo(g,h,i)perylene	<0.5	<0.01	-	-	-
Benzo(k)fluoranthene	<0.5	<0.01	-	-	-
Chrysene	<0.5	<0.01	-	-	-
Dibenz(a,h)anthracene	<0.5	<0.01	-	-	-
Fluoranthene	<0.5	<0.01	-	-	-
Fluorene	<0.5	<0.01	-	-	-
Indeno(1,2,3-c,d)pyrene	<0.5	<0.01	-	-	-
Naphthalene	<0.5	<0.01	-	-	-
Phenanthrene	<0.5	<0.01	-	-	-
Pyrene	<0.5	<0.01	-	-	-
Extractables					
Total Extr Hydrocarbons (C10-30)	<40	<40	<40	304000	25000
Organic Parameters					
Extractable Organic Halide	<1.5	<1.5	<1.5	-	-

Remarks regarding the analyses appear at the beginning of this report.
< = Less than the detection limit indicated.
[1]Results are expressed as milligrams per dry kilogram except where noted.

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PUBLIC WORKS CANADA
ATTENTION : MICHAEL NAHIR

TOX SAMPLES

Sample Description : SM-B201
Sample Date & Time : 29-07-96
Sampled By :
Sample Type : GRAB
Sample Received Date: October 18, 1996
Sample Station Code :

Chemex Worksheet Number : 96-07805-26
Chemex Project Number : PUBI010-0502
Sample Access :
Sample Matrix : LIQUID
Report Date : November 15, 1996
Analysis Date : November 11, 1996

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	R E S U L T S	DETECTION LIMIT
Total Organic Halogens (TOX)		ug/g	8.0	2.

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PUBLIC WORKS CANADA
ATTENTION : MICHAEL NAHIR

TOX SAMPLES

Sample Description : SM-B201
Sample Date & Time : 29-07-96
Sampled By :
Sample Type : GRAB
Sample Station Code :

Chemex Worksheet Number : 96-07805-26
Chemex Project Number : PUBI010-0502
Sample Access :
Sample Matrix : LIQUID
Report Date : November 15, 1996

BATCH SPECIFIC QUALITY ASSURANCE REPORT

PARAMETER	DATE ANALYZED (DD-MM-YY)	QA/QC BATCH NUM ANAL	MATRIX SPIKES DUP Rr	MATRIX SPIKES RECOV %	MATRIX SPIKES CONTROL LIMITS LOWER	MATRIX SPIKES CONTROL LIMITS UPPER	CALIBRATION CHECK RECOV %	CALIBRATION CHECK CONTROL LIMITS LOWER	CALIBRATION CHECK CONTROL LIMITS UPPER
Total Organic Halogens (TOX)	11-11-96	2 DCF	N.A.	NOT APPLICABLE			104.7	80.0	120.0

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PUBLIC WORKS CANADA
ATTENTION : MICHAEL NAHIR

Sample Description : SM-B202
Sample Date & Time : 29-07-96
Sampled By :
Sample Type : GRAB
Sample Received Date: October 18, 1996
Sample Station Code :

TOX SAMPLES

Chemex Worksheet Number : 96-07805-29
Chemex Project Number : PUBI010-0502
Sample Access :
Sample Matrix : LIQUID
Report Date : November 15, 1996
Analysis Date : November 9, 1996

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	R E S U L T S	DETECTION LIMIT
Total Organic Halogens (TOX)		ug/g	6.0	2.

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PUBLIC WORKS CANADA
ATTENTION : MICHAEL NAHIR

TOX SAMPLES

Sample Description : SM-B202
Sample Date & Time : 29-07-96
Sampled By :
Sample Type : GRAB
Sample Station Code :

Chemex Worksheet Number : 96-07805-29
Chemex Project Number : PUBI010-0502
Sample Access :
Sample Matrix : LIQUID
Report Date : November 15, 1996

BATCH SPECIFIC QUALITY ASSURANCE REPORT

PARAMETER	DATE ANALYZED (DD-MM-YY)	QA/QC BATCH NUM ANAL	MATRIX SPIKES DUP Rr	MATRIX SPIKES RECOV %	MATRIX SPIKES CONTROL LIMITS LOWER	MATRIX SPIKES CONTROL LIMITS UPPER	CALIBRATION CHECK RECOV %	CALIBRATION CHECK CONTROL LIMITS LOWER	CALIBRATION CHECK CONTROL LIMITS UPPER
Total Organic Halogens (TOX)	09-11-96	2 RAV	N.A.	NOT APPLICABLE			98.5	80.0	120.0

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PUBLIC WORKS CANADA
ATTENTION : MICHAEL NAHIR

Sample Description : SM-B202
Sample Date & Time : 29-07-96
Sampled By :
Sample Type : GRAB
Sample Received Date: October 18, 1996
Sample Station Code :

TOX SAMPLES
Chemex Worksheet Number : 96-07805-29
Chemex Project Number : PUBI010-0502
Sample Access :
Sample Matrix : LIQUID
Report Date : November 15, 1996
Analysis Date : November 13, 1996

AROCLORS (PCBS) BY MODIFIED EPA METHOD 8081

COMPONENT	CONCENTRATION	UNIT	MDL
Aroclor 1016	< 2.	mg/Kg	2.
Aroclor 1221	< 2.	mg/Kg	2.
Aroclor 1232	< 2.	mg/Kg	2.
Aroclor 1242	< 2.	mg/Kg	2.
Aroclor 1248	< 2.	mg/Kg	2.
Aroclor 1254	< 2.	mg/Kg	2.
Aroclor 1260	< 2.	mg/Kg	2.
Aroclor 1262	< 2.	mg/Kg	2.
Aroclor 1268	< 2.	mg/Kg	2.

NOTES :

Results are reported in accordance with CCME guidelines, "Guidance Manual on Sampling, Analysis, and Data Management for Contaminated Sites, Volume I". All results are corrected for blank levels.

MDL - Method detection level. - Calculated on the basis of the instrument detection level, the dilution used, and the weight of the sample.

( ) - Bracketed results are values below the reliable detection level, and are subject to reduced levels of confidence. The reliable detection level is twice the method detection level.

QA/QC SUMMARY

All samples were spiked with a component whose recovery was monitored to maintain analysis accuracy.
Guidelines from SW846 for suggested surrogate recoveries for each matrix are shown below.

Surrogate Recovery : 78% LIQUID surrogate limits : 63% - 134%.

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PUBLIC WORKS CANADA
ATTENTION : MICHAEL NAHIR

TOX SAMPLES

Sample Description : SM-B202
Sample Date & Time : 29-07-96
Sampled By :
Sample Type : GRAB
Sample Received Date: October 18, 1996
Sample Station Code :

Chemex Worksheet Number : 96-07805-29
Chemex Project Number : PUBI010-0502
Sample Access :
Sample Matrix : LIQUID
Report Date : November 15, 1996
Analysis Date : November 13, 1996

BATCH SPECIFIC QUALITY ASSURANCE REPORT

BATCH : 11	BLANK	DUPLICATE			MATRIX SPIKE			CALIBRATION CHECK		
DATE : November 13, 1996	CONC.	CONC.1	CONC.2	RPD	RECOV	CONTROL LIMITS		RECOV	CONTROL LIMITS	
ANALYST:AAM	mg/Kg	mg/Kg	mg/Kg	%	%	LOWER	UPPER	%	LOWER	UPPER
Aroclor 1016	< 0.2	< 2.	< 2.	0						
Aroclor 1221	< 0.2	< 2.	< 2.	0						
Aroclor 1232	< 0.2	< 2.	< 2.	0						
Aroclor 1242	< 0.2	< 2.	< 2.	0				102	74.	130.
Aroclor 1248	< 0.2	< 2.	< 2.	0						
Aroclor 1254	< 0.2	< 2.	< 2.	0	108	64.	130.			
Aroclor 1260	< 0.2	< 2.	< 2.	0				100	61.	120.
Aroclor 1262	< 0.2	< 2.	< 2.	0						
Aroclor 1268	< 0.2	< 2.	< 2.	0						

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PUBLIC WORKS CANADA
ATTENTION : MICHAEL NAHIR

TOX SAMPLES

Sample Description : SM-B203
Sample Date & Time : 29-07-96
Sampled By :
Sample Type : GRAB
Sample Received Date: October 18, 1996
Sample Station Code :

Chemex Worksheet Number : 96-07805-31
Chemex Project Number : PUBI010-0502
Sample Access :
Sample Matrix : LIQUID
Report Date : November 15, 1996
Analysis Date : November 11, 1996

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	R E S U L T S	DETECTION LIMIT
Total Organic Halogens (TOX)		ug/g	< 2	2.

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PUBLIC WORKS CANADA
ATTENTION : MICHAEL NAHIR

TOX SAMPLES

Sample Description : SM-B203
Sample Date & Time : 29-07-96
Sampled By :
Sample Type : GRAB
Sample Station Code :

Chemex Worksheet Number : 96-07805-31
Chemex Project Number : PUBI010-0502
Sample Access :
Sample Matrix : LIQUID
Report Date : November 15, 1996

BATCH SPECIFIC QUALITY ASSURANCE REPORT

PARAMETER	DATE ANALYZED (DD-MM-YY)	QA/QC BATCH NUM ANAL	MATRIX SPIKES DUP Rr	MATRIX SPIKES RECOV %	MATRIX SPIKES CONTROL LIMITS LOWER	MATRIX SPIKES CONTROL LIMITS UPPER	CALIBRATION CHECK RECOV %	CALIBRATION CHECK CONTROL LIMITS LOWER	CALIBRATION CHECK CONTROL LIMITS UPPER
Total Organic Halogens (TOX)	11-11-96	2 DCF	N.A.	NOT APPLICABLE			104.7	80.0	120.0

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PUBLIC WORKS CANADA
ATTENTION : MICHAEL NAHIR

TOX SAMPLES

Sample Description : SM-B204
Sample Date & Time : 29-07-96
Sampled By :
Sample Type : GRAB
Sample Received Date: October 18, 1996
Sample Station Code :

Chemex Worksheet Number : 96-07805-5
Chemex Project Number : PUBI010-0502
Sample Access :
Sample Matrix : LIQUID
Report Date : November 15, 1996
Analysis Date : October 25, 1996

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	R E S U L T S	DETECTION LIMIT
Total Organic Halogens (TOX)		ug/g	3.0	2.

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PUBLIC WORKS CANADA
ATTENTION : MICHAEL NAHIR

TOX SAMPLES

Sample Description : SM-B204
Sample Date & Time : 29-07-96
Sampled By :
Sample Type : GRAB
Sample Station Code :

Chemex Worksheet Number : 96-07805-5
Chemex Project Number : PUBI010-0502
Sample Access :
Sample Matrix : LIQUID
Report Date : November 15, 1996

BATCH SPECIFIC QUALITY ASSURANCE REPORT

PARAMETER	DATE ANALYZED (DD-MM-YY)	QA/QC BATCH NUM ANAL	MATRIX SPIKES DUP Rr	MATRIX SPIKES RECOV %	MATRIX SPIKES CONTROL LIMITS LOWER	MATRIX SPIKES CONTROL LIMITS UPPER	CALIBRATION CHECK RECOV %	CALIBRATION CHECK CONTROL LIMITS LOWER	CALIBRATION CHECK CONTROL LIMITS UPPER
Total Organic Halogens (TOX)	25-10-96	1 RAV	N.A.	NOT APPLICABLE			103.0	80.0	120.0

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PUBLIC WORKS CANADA
ATTENTION : MICHAEL NAHIR

Sample Description : SM-B204
Sample Date & Time : 29-07-96
Sampled By :
Sample Type : GRAB
Sample Received Date: October 18, 1996
Sample Station Code :

TOX SAMPLES
Chemex Worksheet Number : 96-07805-5
Chemex Project Number : PUBI010-0502
Sample Access :
Sample Matrix : LIQUID
Report Date : November 15, 1996
Analysis Date : November 11, 1996

AROCLORS (PCBS) BY MODIFIED EPA METHOD 8081

COMPONENT	CONCENTRATION	UNIT	MDL
Aroclor 1016	< 0.2	mg/Kg	0.2
Aroclor 1221	< 0.2	mg/Kg	0.2
Aroclor 1232	< 0.2	mg/Kg	0.2
Aroclor 1242	< 0.2	mg/Kg	0.2
Aroclor 1248	< 0.2	mg/Kg	0.2
Aroclor 1254	< 0.2	mg/Kg	0.2
Aroclor 1260	< 0.2	mg/Kg	0.2
Aroclor 1262	< 0.2	mg/Kg	0.2
Aroclor 1268	< 0.2	mg/Kg	0.2

NOTES :

Results are reported in accordance with CCME guidelines, "Guidance Manual on Sampling, Analysis, and Data Management for Contaminated Sites, Volume I". All results are corrected for blank levels.

MDL - Method detection level. - Calculated on the basis of the instrument detection level, the dilution used, and the weight of the sample.

( ) - Bracketed results are values below the reliable detection level, and are subject to reduced levels of confidence. The reliable detection level is twice the method detection level.

QA/QC SUMMARY

All samples were spiked with a component whose recovery was monitored to maintain analysis accuracy. Guidelines from SW846 for suggested surrogate recoveries for each matrix are shown below.

Surrogate Recovery : 78% LIQUID surrogate limits : 63% - 134%.

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PUBLIC WORKS CANADA
ATTENTION : MICHAEL NAHIR

TOX SAMPLES

Sample Description : SM-B204
Sample Date & Time : 29-07-96
Sampled By :
Sample Type : GRAB
Sample Received Date: October 18, 1996
Sample Station Code :

Chemex Worksheet Number : 96-07805-5
Chemex Project Number : PUBI010-0502
Sample Access :
Sample Matrix : LIQUID
Report Date : November 15, 1996
Analysis Date : November 11, 1996

BATCH SPECIFIC QUALITY ASSURANCE REPORT

BATCH : 11	BLANK	DUPLICATE			MATRIX SPIKE			CALIBRATION CHECK		
DATE : November 11, 1996	CONC.	CONC.1	CONC.2	RPD	RECOV	CONTROL LIMITS		RECOV	CONTROL LIMITS	
ANALYST:AAM	mg/Kg	mg/Kg	mg/Kg	%	%	LOWER	UPPER	%	LOWER	UPPER
Aroclor 1016	< 0.2	< 0.3	< 0.3	0						
Aroclor 1221	< 0.2	< 0.3	< 0.3	0						
Aroclor 1232	< 0.2	< 0.3	< 0.3	0						
Aroclor 1242	< 0.2	< 0.3	< 0.3	0						
Aroclor 1248	< 0.2	< 0.3	< 0.3	0						
Aroclor 1254	< 0.2	< 0.3	< 0.3	0	100	64.	130.	94	80.	130.
Aroclor 1260	< 0.2	< 0.3	< 0.3	0				70	61.	120.
Aroclor 1262	< 0.2	< 0.3	< 0.3	0						
Aroclor 1268	< 0.2	< 0.3	< 0.3	0						

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PUBLIC WORKS CANADA
ATTENTION : MICHAEL NAHIR

Sample Description : SM-B205
Sample Date & Time : 29-07-96
Sampled By :
Sample Type : GRAB
Sample Received Date: October 18, 1996
Sample Station Code :

TOX SAMPLES

Chemex Worksheet Number : 96-07805-36
Chemex Project Number : PUBI010-0502
Sample Access :
Sample Matrix : LIQUID
Report Date : November 15, 1996
Analysis Date : November 11, 1996

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	R E S U L T S	DETECTION LIMIT
Total Organic Halogens (TOX)		ug/g	< 2	2.

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PUBLIC WORKS CANADA
ATTENTION : MICHAEL NAHIR

TOX SAMPLES

Sample Description : SM-B205
Sample Date & Time : 29-07-96
Sampled By :
Sample Type : GRAB
Sample Station Code :

Chemex Worksheet Number : 96-07805-36
Chemex Project Number : PUBI010-0502
Sample Access :
Sample Matrix : LIQUID
Report Date : November 15, 1996

BATCH SPECIFIC QUALITY ASSURANCE REPORT

PARAMETER	DATE ANALYZED (DD-MM-YY)	QA/QC BATCH NUM ANAL	MATRIX SPIKES DUP Rr	MATRIX SPIKES RECOV %	MATRIX SPIKES CONTROL LIMITS LOWER	MATRIX SPIKES CONTROL LIMITS UPPER	CALIBRATION CHECK RECOV %	CALIBRATION CHECK CONTROL LIMITS LOWER	CALIBRATION CHECK CONTROL LIMITS UPPER
Total Organic Halogens (TOX)	11-11-96	2 DCF	N.A.	NOT APPLICABLE			104.7	80.0	120.0

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PUBLIC WORKS CANADA
ATTENTION : MICHAEL NAHIR

TOX SAMPLES

Sample Description : SM-B206
Sample Date & Time : 29-07-96
Sampled By :
Sample Type : GRAB
Sample Received Date: October 18, 1996
Sample Station Code :

Chemex Worksheet Number : 96-07805-24
Chemex Project Number : PUBI010-0502
Sample Access :
Sample Matrix : LIQUID
Report Date : November 15, 1996
Analysis Date : November 9, 1996

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	R E S U L T S	DETECTION LIMIT
Total Organic Halogens (TOX)		ug/g	< 2	2.

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PUBLIC WORKS CANADA
ATTENTION : MICHAEL NAHIR

TOX SAMPLES

Sample Description : SM-B206
Sample Date & Time : 29-07-96
Sampled By :
Sample Type : GRAB
Sample Received Date: October 18, 1996
Sample Station Code :

Chemex Worksheet Number : 96-07805-24
Chemex Project Number : PUBI010-0502
Sample Access :
Sample Matrix : LIQUID
Report Date : November 15, 1996
Analysis Date : November 13, 1996

BATCH SPECIFIC QUALITY ASSURANCE REPORT

BATCH : 11	BLANK	DUPLICATE			MATRIX SPIKE			CALIBRATION CHECK		
DATE : November 13, 1996	CONC.	CONC.1	CONC.2	RPD	RECOV	CONTROL LIMITS		RECOV	CONTROL LIMITS	
ANALYST:AAM	mg/Kg	mg/Kg	mg/Kg	%	%	LOWER	UPPER	%	LOWER	UPPER
Aroclor 1016	< 0.2	< 2.	< 2.	0						
Aroclor 1221	< 0.2	< 2.	< 2.	0						
Aroclor 1232	< 0.2	< 2.	< 2.	0						
Aroclor 1242	< 0.2	< 2.	< 2.	0				102	74.	130.
Aroclor 1248	< 0.2	< 2.	< 2.	0						
Aroclor 1254	< 0.2	< 2.	< 2.	0	108	64.	130.			
Aroclor 1260	< 0.2	< 2.	< 2.	0				100	61.	120.
Aroclor 1262	< 0.2	< 2.	< 2.	0						
Aroclor 1268	< 0.2	< 2.	< 2.	0						

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PUBLIC WORKS CANADA
ATTENTION : MICHAEL NAHIR

Sample Description : SM-B207
Sample Date & Time : 29-07-96
Sampled By :
Sample Type : GRAB
Sample Received Date: October 18, 1996
Sample Station Code :

TOX SAMPLES
Chemex Worksheet Number : 96-07805-23
Chemex Project Number : PUBI010-0502
Sample Access :
Sample Matrix : LIQUID
Report Date : November 15, 1996
Analysis Date : November 9, 1996

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	R E S U L T S	DETECTION LIMIT
Total Organic Halogens (TOX)		ug/g	4.0	2.

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PUBLIC WORKS CANADA
ATTENTION : MICHAEL NAHIR

TOX SAMPLES

Sample Description : SM-B207
Sample Date & Time : 29-07-96
Sampled By :
Sample Type : GRAB
Sample Station Code :

Chemex Worksheet Number : 96-07805-23
Chemex Project Number : PUBI010-0502
Sample Access :
Sample Matrix : LIQUID
Report Date : November 15, 1996

BATCH SPECIFIC QUALITY ASSURANCE REPORT

PARAMETER	DATE ANALYZED (DD-MM-YY)	QA/QC BATCH NUM ANAL	MATRIX SPIKES DUP Rr	MATRIX SPIKES RECOV %	MATRIX SPIKES CONTROL LIMITS LOWER	MATRIX SPIKES CONTROL LIMITS UPPER	CALIBRATION CHECK RECOV %	CALIBRATION CHECK CONTROL LIMITS LOWER	CALIBRATION CHECK CONTROL LIMITS UPPER
Total Organic Halogens (TOX)	09-11-96	1 RAV	N.A.	NOT APPLICABLE			98.9	80.0	120.0

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PUBLIC WORKS CANADA
ATTENTION : MICHAEL NAHIR

Sample Description : SM-B207
Sample Date & Time : 29-07-96
Sampled By :
Sample Type : GRAB
Sample Received Date: October 18, 1996
Sample Station Code :

TOX SAMPLES
Chemex Worksheet Number : 96-07805-23
Chemex Project Number : PUBI010-0502
Sample Access :
Sample Matrix : LIQUID
Report Date : November 15, 1996
Analysis Date : November 13, 1996

AROCLORS (PCBS) BY MODIFIED EPA METHOD 8081

COMPONENT	CONCENTRATION	UNIT	MDL
Aroclor 1016	< 2.	mg/Kg	2.
Aroclor 1221	< 2.	mg/Kg	2.
Aroclor 1232	< 2.	mg/Kg	2.
Aroclor 1242	< 2.	mg/Kg	2.
Aroclor 1248	< 2.	mg/Kg	2.
Aroclor 1254	< 2.	mg/Kg	2.
Aroclor 1260	< 2.	mg/Kg	2.
Aroclor 1262	< 2.	mg/Kg	2.
Aroclor 1268	< 2.	mg/Kg	2.

NOTES :

Results are reported in accordance with CCME guidelines, "Guidance Manual on Sampling, Analysis, and Data Management for Contaminated Sites, Volume I". All results are corrected for blank levels.

MDL - Method detection level. - Calculated on the basis of the instrument detection level, the dilution used, and the weight of the sample.

( ) - Bracketed results are values below the reliable detection level, and are subject to reduced levels of confidence. The reliable detection level is twice the method detection level.

QA/QC SUMMARY

All samples were spiked with a component whose recovery was monitored to maintain analysis accuracy. Guidelines from SW846 for suggested surrogate recoveries for each matrix are shown below.

Surrogate Recovery : 84% LIQUID surrogate limits : 63% - 134%.

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PUBLIC WORKS CANADA
ATTENTION : MICHAEL NAHIR

TOX SAMPLES

Sample Description : SM-B207
Sample Date & Time : 29-07-96
Sampled By :
Sample Type : GRAB
Sample Received Date: October 18, 1996
Sample Station Code :

Chemex Worksheet Number : 96-07805-23
Chemex Project Number : PUBI010-0502
Sample Access :
Sample Matrix : LIQUID
Report Date : November 15, 1996
Analysis Date : November 13, 1996

BATCH SPECIFIC QUALITY ASSURANCE REPORT

BATCH : 11	BLANK	DUPLICATE			MATRIX SPIKE			CALIBRATION CHECK		
DATE : November 13, 1996	CONC.	CONC.1	CONC.2	RPD	RECOV	CONTROL LIMITS		RECOV	CONTROL LIMITS	
ANALYST:AAM	mg/Kg	mg/Kg	mg/Kg	%	%	LOWER	UPPER	%	LOWER	UPPER
Aroclor 1016	< 0.2	< 2.	< 2.	0						
Aroclor 1221	< 0.2	< 2.	< 2.	0						
Aroclor 1232	< 0.2	< 2.	< 2.	0						
Aroclor 1242	< 0.2	< 2.	< 2.	0				102	74.	130.
Aroclor 1248	< 0.2	< 2.	< 2.	0						
Aroclor 1254	< 0.2	< 2.	< 2.	0	108	64.	130.			
Aroclor 1260	< 0.2	< 2.	< 2.	0				100	61.	120.
Aroclor 1262	< 0.2	< 2.	< 2.	0						
Aroclor 1268	< 0.2	< 2.	< 2.	0						

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PUBLIC WORKS CANADA
ATTENTION : MICHAEL NAHIR

Sample Description : SM-B208
Sample Date & Time : 29-07-96
Sampled By :
Sample Type : GRAB
Sample Received Date: October 18, 1996
Sample Station Code :

TOX SAMPLES

Chemex Worksheet Number : 96-07805-20
Chemex Project Number : PUBI010-0502
Sample Access :
Sample Matrix : LIQUID
Report Date : November 15, 1996
Analysis Date : November 11, 1996

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	R E S U L T S	DETECTION LIMIT
Total Organic Halogens (TOX)		ug/g	< 2	2.

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Edmonton : 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

PUBLIC WORKS CANADA
ATTENTION : MICHAEL NAHIR

TOX SAMPLES

Sample Description : SM-B208
Sample Date & Time : 29-07-96
Sampled By :
Sample Type : GRAB
Sample Station Code :

Chemex Worksheet Number : 96-07805-20
Chemex Project Number : PUBI010-0502
Sample Access :
Sample Matrix : LIQUID
Report Date : November 15, 1996

BATCH SPECIFIC QUALITY ASSURANCE REPORT

PARAMETER	DATE ANALYZED (DD-MM-YY)	QA/QC BATCH NUM	ANAL	MATRIX SPIKES DUP Rr	RECOV %	CONTROL LIMITS LOWER	UPPER	CALIBRATION CHECK RECOV %	CONTROL LIMITS LOWER	UPPER
Total Organic Halogens (TOX)	11-11-96	1	DCF	N.A.	NOT APPLICABLE			101.4	80.0	120.0

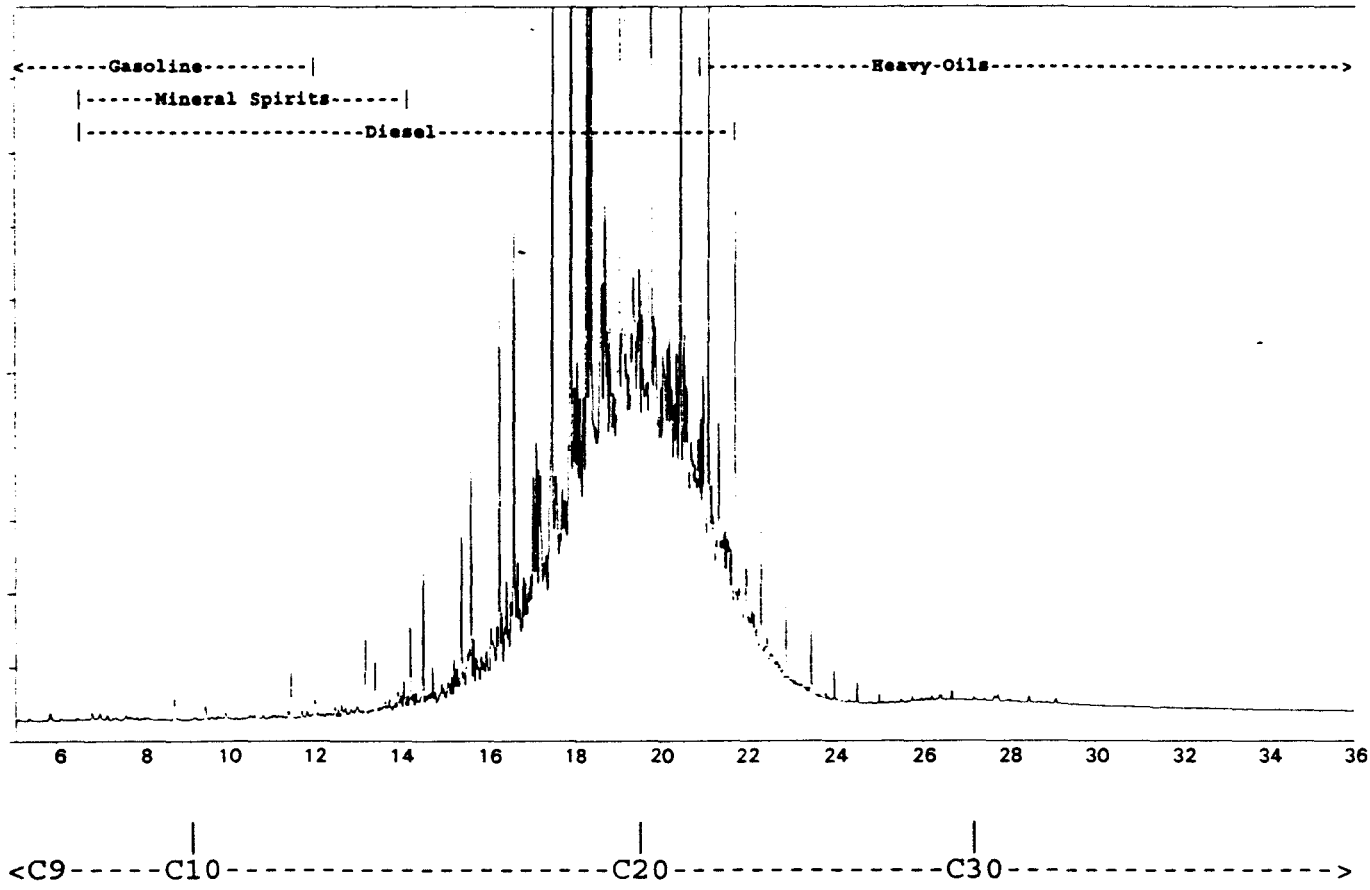
HYDROCARBON DISTRIBUTION REPORT

SAMPLE NAME: G3879 36 SM-S102

Sample acquired: AUG 24, 1996 22:19:21

File Name: c:\TEH\TEHAUG23.72R , Sample Name: G3879 36

Sequence file: TEHAUG23



ASL Sample ID: G3879 36* 10 X Dilution

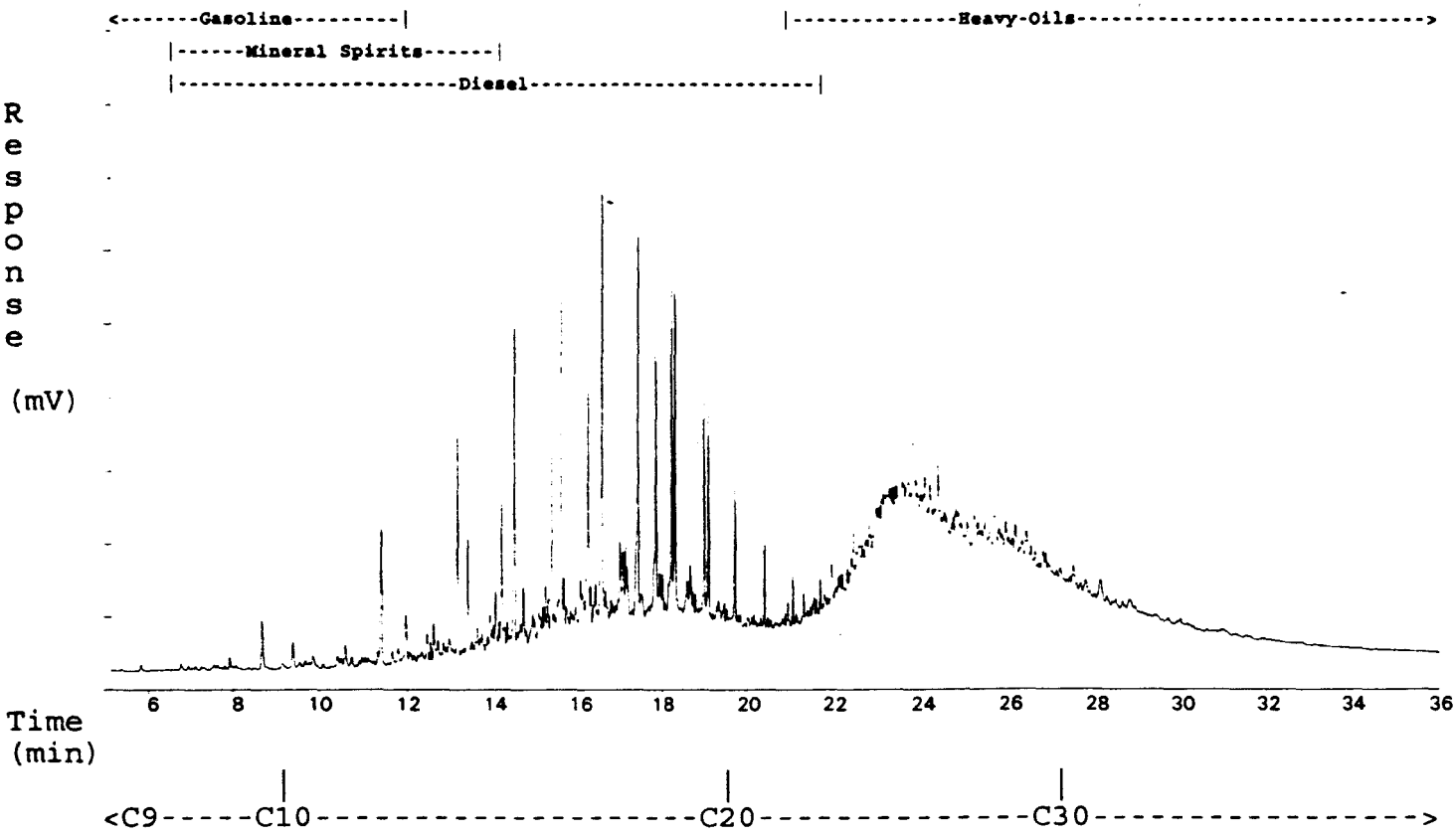
HYDROCARBON RANGE (C#)		RELATIVE AMOUNT (%)
Less than Carbon 10	(<C10)	0.3
Carbon 10 to Carbon 20	(C10-C20)	75.3
Carbon 20 to Carbon 30	(C20-C30)	22.5
Greater than Carbon 30	(>C30)	1.9

The Hydrocarbon Distribution Report is intended to assist you in characterizing the hydrocarbon product present in a given sample. The scale at the top of the chromatographic trace represents the hydrocarbon range of common petroleum products. Comparison of this report with those of reference standards may also assist you in the identification of the hydrocarbon product detected in your sample. The second part of the report is a table that expresses the relative amount of hydrocarbon product present in the ranges specified.

HYDROCARBON DISTRIBUTION REPORT

SAMPLE NAME: G3879 37 SM-S201

Sample acquired: AUG 24, 1996 23:08:04
File Name: c:\TEH\TEHAUG23.73R , Sample Name: G3879 37
Sequence file: TEHAUG23



ASL Sample ID: G3879 37* 10 X Dilution

HYDROCARBON RANGE (C#)		RELATIVE AMOUNT (%)
Less than Carbon 10	(<C10)	0.5
Carbon 10 to Carbon 20	(C10-C20)	35.2
Carbon 20 to Carbon 30	(C20-C30)	43.8
Greater than Carbon 30	(>C30)	20.4

The Hydrocarbon Distribution Report is intended to assist you in characterizing the hydrocarbon product present in a given sample. The scale at the top of the chromatographic trace represents the hydrocarbon range of common petroleum products. Comparison of this report with those of reference standards may also assist you in the identification of the hydrocarbon product detected in your sample. The second part of the report is a table that expresses the relative amount of hydrocarbon product present in the ranges specified.

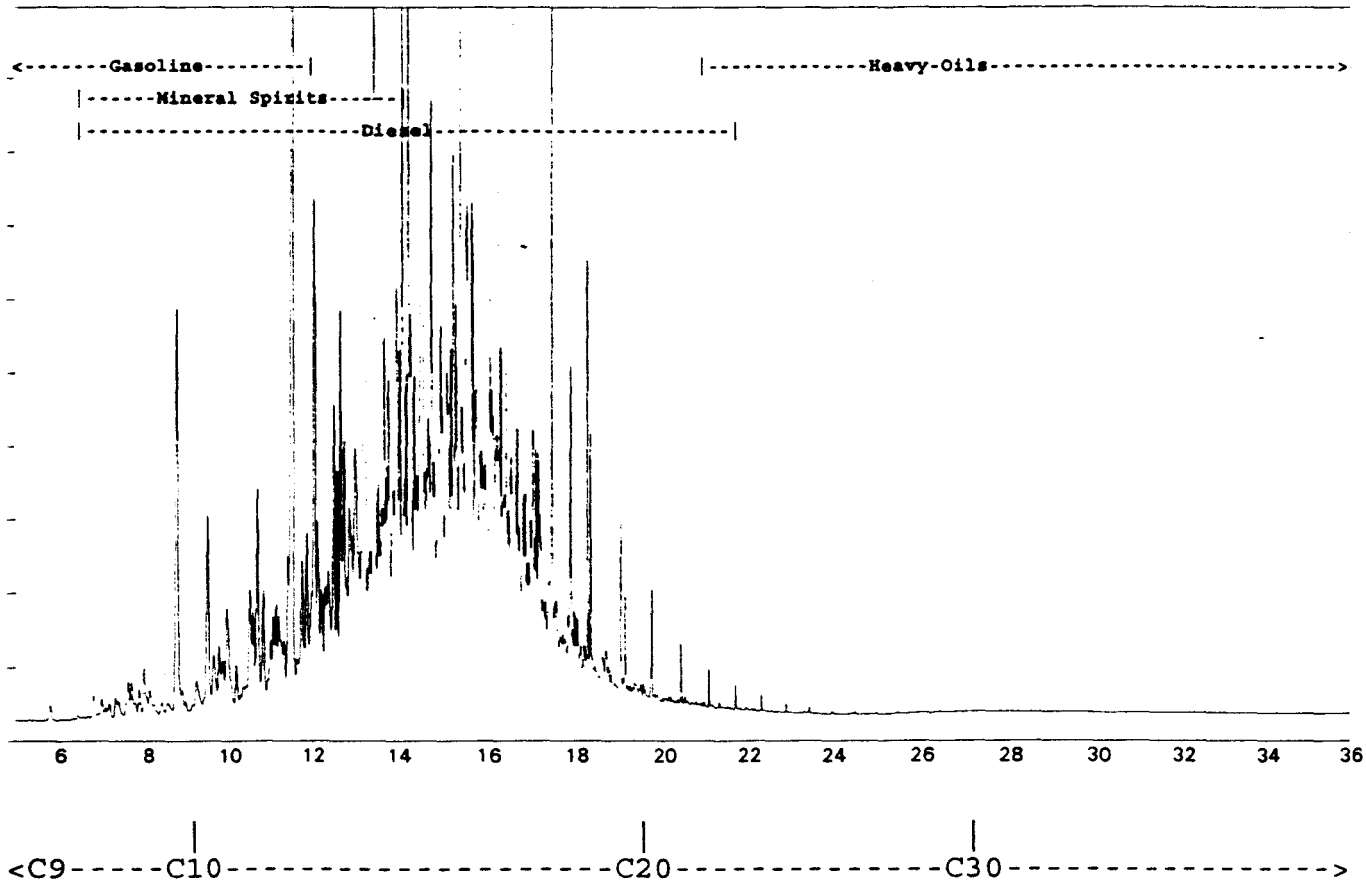
HYDROCARBON DISTRIBUTION REPORT

SAMPLE NAME: G3879 38 SM-S202

Sample acquired: AUG 24, 1996 23:08:04

File Name: c:\TEH\TEHAUG23.74R , Sample Name: G3879 38

Sequence file: TEHAUG23



ASL Sample ID: G3879 38* 10 X Dilution

HYDROCARBON RANGE (C#)		RELATIVE AMOUNT (%)
Less than Carbon 10	(<C10)	2.7
Carbon 10 to Carbon 20	(C10-C20)	96.2
Carbon 20 to Carbon 30	(C20-C30)	1.0
Greater than Carbon 30	(>C30)	0.1

The Hydrocarbon Distribution Report is intended to assist you in characterizing the hydrocarbon product present in a given sample. The scale at the top of the chromatographic trace represents the hydrocarbon range of common petroleum products. Comparison of this report with those of reference standards may also assist you in the identification of the hydrocarbon product detected in your sample. The second part of the report is a table that expresses the relative amount of hydrocarbon product present in the ranges specified.

RESULTS OF ANALYSIS - Sediment/Soil[1]

File No. G3879

		AC-S201	AC-S202	AC-S203	SM-S102	SM-S201
Physical Tests						
Moisture	%	10.4	16.4	8.4	77.8	4.0
Total Metals						
Antimony	T-Sb	<20	<20	<20	<20	<20
Arsenic	T-As	4170	637	42.4	17.8	54.8
Barium	T-Ba	52	25	23	356	98
Beryllium	T-Be	0.6	<0.5	<0.5	<0.5	1.0
Cadmium	T-Cd	24	3	<2	<2	<2
Chromium	T-Cr	4	4	6	25	57
Cobalt	T-Co	44	9	6	7	6
Copper	T-Cu	276	40	63	70	147
Lead	T-Pb	136	<50	<50	108	132
Mercury	T-Hg	0.028	0.006	<0.005	0.033	0.007
Molybdenum	T-Mo	16	<4	<4	<4	5
Nickel	T-Ni	16	5	3	12	28
Selenium	T-Se	<50	<50	<50	<50	<50
Silver	T-Ag	<2	<2	<2	<2	<2
Tin	T-Sn	<30	<30	<30	<30	<30
Vanadium	T-V	13	9	10	5	56
Zinc	T-Zn	546	108	48	225	361
Non-halogenated Volatiles						
Benzene		<0.05	<0.05	-	-	-
Ethylbenzene		<0.05	<0.05	-	-	-
Toluene		<0.05	<0.05	-	-	-
meta- & para-Xylene		<0.05	<0.05	-	-	-
ortho-Xylene		<0.05	<0.05	-	-	-
Light Hydrocarbons (C5-9)		<5	<5	-	-	-

Remarks regarding the analyses appear at the beginning of this report.
< = Less than the detection limit indicated.
Results are expressed as milligrams per dry kilogram except where noted.

RESULTS OF ANALYSIS - Sediment/Soil[1]

File No. G3879

	SM-S202	BT-S201	BT-S202	BT-S203
Polycyclic Aromatic Hydrocarbons				
Acenaphthene	2.8	-	-	-
Acenaphthylene	2.3	-	-	-
Anthracene	0.6	-	-	-
Benzo(a)anthracene	<0.1	-	-	-
Benzo(a)pyrene	<0.1	-	-	-
Benzo(b)fluoranthene	<0.1	-	-	-
Benzo(g,h,i)perylene	<0.1	-	-	-
Benzo(k)fluoranthene	<0.1	-	-	-
Chrysene	0.1	-	-	-
Dibenz(a.h)anthracene	<0.1	-	-	-
Fluoranthene	0.2	-	-	-
Fluorene	12.2	-	-	-
Indeno(1.2,3-c.d)pyrene	<0.1	-	-	-
Naphthalene	1.3	-	-	-
Phenanthrene	12.6	-	-	-
Pyrene	0.9	-	-	-
Extractables				
Total Extr Hydrocarbons (C10-30)	51500	13700	28400	23200
Organic Parameters				
Extractable Organic Halide	<1.5	-	-	-

Remarks regarding the analyses appear at the beginning of this report.
< = Less than the detection limit indicated.
[1]Results are expressed as milligrams per dry kilogram except where noted.

RESULTS OF ANALYSIS - Sediment/Soil[1]

File No. G3879

		SM-S202	BT-S201	BT-S202	BT-S203
Physical Tests					
Moisture	%	14.7	2.8	4.5	2.8
Total Metals					
Antimony	T-Sb	<20	<20	33	28
Arsenic	T-As	48.3	2370	2540	2230
Barium	T-Ba	86	69	76	62
Beryllium	T-Be	0.7	0.7	<0.5	0.5
Cadmium	T-Cd	<2	4	7	8
Chromium	T-Cr	68	11	51	25
Cobalt	T-Co	2	5	12	8
Copper	T-Cu	95	42	107	119
Lead	T-Pb	82	254	410	302
Mercury	T-Hg	0.011	0.011	0.015	0.012
Molybdenum	T-Mo	17	7	19	7
Nickel	T-Ni	19	6	26	14
Selenium	T-Se	<50	<50	<50	<50
Silver	T-Ag	<2	6	8	7
Tin	T-Sn	<30	<30	<30	<30
Vanadium	T-V	89	15	23	29
Zinc	T-Zn	71	255	536	651

Remarks regarding the analyses appear at the beginning of this report.
< = Less than the detection limit indicated.
[1]Results are expressed as milligrams per dry kilogram except where noted.

RESULTS OF ANALYSIS - Water File No. G3765

			VE-WQ-S 101	VE-WQ-A 101	VE-WQ-A 102	SM-WQ-Str 301	SM-WQ-S 201
			96 07 27	96 07 27	96 07 27	96 07 29	96 07 29
Physical Tests							
Conductivity (umhos/cm)			339	323	439	164	289
pH			7.82	7.92	8.02	7.89	4.08
Dissolved Anions							
Acidity		CaCO3	4.1	1.9	2.3	1.9	99.1
Alkalinity - Total		CaCO3	123	118	173	60.9	<1.0
Sulphate	SO4		57.4	48.8	72.7	24.4	148
Total Metals							
Aluminum	T-Al		0.3	0.3	0.3	<0.2	15.3
Antimony	T-Sb		<0.2	<0.2	<0.2	<0.2	<0.2
Arsenic	T-As		0.2	0.5	0.3	<0.2	<0.2
Barium	T-Ba		0.02	0.03	0.02	0.05	0.04
Beryllium	T-Be		<0.005	<0.005	<0.005	<0.005	<0.005
Bismuth	T-Bi		<0.1	<0.1	<0.1	<0.1	<0.1
Boron	T-B		<0.1	<0.1	<0.1	<0.1	<0.1
Cadmium	T-Cd		<0.01	<0.01	<0.01	<0.01	<0.01
Calcium	T-Ca		49.5	46.6	49.5	26.8	7.38
Chromium	T-Cr		<0.01	<0.01	<0.01	<0.01	<0.01
Cobalt	T-Co		<0.01	<0.01	<0.01	<0.01	0.04
Copper	T-Cu		<0.01	<0.01	<0.01	<0.01	0.33
Iron	T-Fe		<0.03	0.35	<0.03	<0.03	0.16
Lead	T-Pb		<0.05	<0.05	<0.05	<0.05	<0.05
Lithium	T-Li		<0.01	<0.01	0.01	<0.01	<0.01
Magnesium	T-Mg		12.2	11.7	26.9	3.71	5.44
Manganese	T-Mn		<0.005	0.008	<0.005	<0.005	0.570
Molybdenum	T-Mo		<0.03	<0.03	<0.03	<0.03	<0.03
Nickel	T-Ni		<0.02	<0.02	<0.02	<0.02	0.04
Phosphorus	T-P		<0.3	<0.3	<0.3	<0.3	<0.3
Potassium	T-K		<2	<2	<2	<2	<2
Selenium	T-Se		<0.2	<0.2	<0.2	<0.2	<0.2
Silicon	T-Si		3.67	3.61	3.95	1.93	13.6
Silver	T-Ag		<0.01	<0.01	<0.01	<0.01	<0.01
Sodium	T-Na		4	4	6	<2	6
Strontium	T-Sr		0.650	0.690	1.14	0.079	0.080
Thallium	T-Tl		<0.1	<0.1	<0.1	<0.1	<0.1
Tin	T-Sn		<0.03	<0.03	<0.03	<0.03	<0.03
Titanium	T-Ti		<0.01	<0.01	<0.01	<0.01	<0.01
Vanadium	T-V		<0.03	<0.03	<0.03	<0.03	<0.03

< = Less than the detection limit indicated.
Results are expressed as milligrams per litre except for pH and Conductivity (umhos/cm).

RESULTS OF ANALYSIS - Water File No. G3765

		VE-WQ-S 101	VE-WQ-A 101	VE-WQ-A 102	SM-WQ-Str 301	SM-WQ-S 201
		96 07 27	96 07 27	96 07 27	96 07 29	96 07 29
Total Metals						
Zinc	T-Zn	<0.005	0.184	0.023	<0.005	0.264

< = Less than the detection limit indicated.
Results are expressed as milligrams per litre except for pH and Conductivity (umhos/cm).

RESULTS OF ANALYSIS - Water File No. G3765

			WM-WQ-S 201	TH-WQ-Str 302	TH-WQ-S 301	SM-WQ-Str 101	AC-WQ-Str 101
			96 07 28	96 07 28	96 07 28	96 07 29	96 07 26
Physical Tests							
Conductivity (umhos/cm)			106	252	424	59.9	44.5
pH			7.60	7.80	7.33	5.11	6.82
Dissolved Anions							
Acidity		CaCO3	1.7	3.5	10.8	4.7	3.1
Alkalinity - Total		CaCO3	61.4	61.4	171	<1.0	11.8
Sulphate	SO4		1.7	27.2	58.9	23.9	7.4
Total Metals							
Aluminum	T-Al		0.2	<0.2	1.6	0.3	0.3
Antimony	T-Sb		<0.2	<0.2	<0.2	<0.2	<0.2
Arsenic	T-As		<0.2	<0.2	<0.2	<0.2	<0.2
Barium	T-Ba		0.02	0.10	0.16	0.08	<0.01
Beryllium	T-Be		<0.005	<0.005	<0.005	<0.005	<0.005
Bismuth	T-Bi		<0.1	<0.1	<0.1	<0.1	<0.1
Boron	T-B		<0.1	<0.1	<0.1	<0.1	<0.1
Cadmium	T-Cd		<0.01	<0.01	<0.01	<0.01	<0.01
Calcium	T-Ca		17.0	36.2	42.0	4.16	6.08
Chromium	T-Cr		<0.01	<0.01	<0.01	<0.01	<0.01
Cobalt	T-Co		<0.01	<0.01	<0.01	<0.01	<0.01
Copper	T-Cu		<0.01	<0.01	0.03	0.03	<0.01
Iron	T-Fe		<0.03	<0.03	3.21	0.23	<0.03
Lead	T-Pb		<0.05	<0.05	0.06	<0.05	<0.05
Lithium	T-Li		<0.01	<0.01	0.01	<0.01	<0.01
Magnesium	T-Mg		2.72	6.85	27.2	1.31	0.80
Manganese	T-Mn		<0.005	<0.005	0.231	0.033	<0.005
Molybdenum	T-Mo		<0.03	<0.03	<0.03	<0.03	<0.03
Nickel	T-Ni		<0.02	<0.02	<0.02	<0.02	<0.02
Phosphorus	T-P		<0.3	<0.3	<0.3	<0.3	<0.3
Potassium	T-K		<2	<2	2	<2	<2
Selenium	T-Se		<0.2	<0.2	<0.2	<0.2	<0.2
Silicon	T-Si		2.30	1.90	4.13	6.57	1.45
Silver	T-Ag		<0.01	<0.01	<0.01	<0.01	<0.01
Sodium	T-Na		<2	2	7	2	<2
Strontium	T-Sr		0.026	0.307	1.88	0.046	0.031
Thallium	T-Tl		<0.1	<0.1	<0.1	<0.1	<0.1
Tin	T-Sn		<0.03	<0.03	<0.03	<0.03	<0.03
Titanium	T-Ti		<0.01	<0.01	0.02	0.01	<0.01
Vanadium	T-V		<0.03	<0.03	<0.03	<0.03	<0.03

< = Less than the detection limit indicated.
Results are expressed as milligrams per litre except for pH and Conductivity (umhos/cm).

RESULTS OF ANALYSIS - Water File No. G3765

		WM-WQ-S 201	TH-WQ-Str 302	TH-WQ-S 301	SM-WQ-Str 101	AC-WQ-Str 101
		96 07 28	96 07 28	96 07 28	96 07 29	96 07 26
Total Metals						
Zinc	T-Zn	<0.005	<0.005	0.073	0.139	<0.005

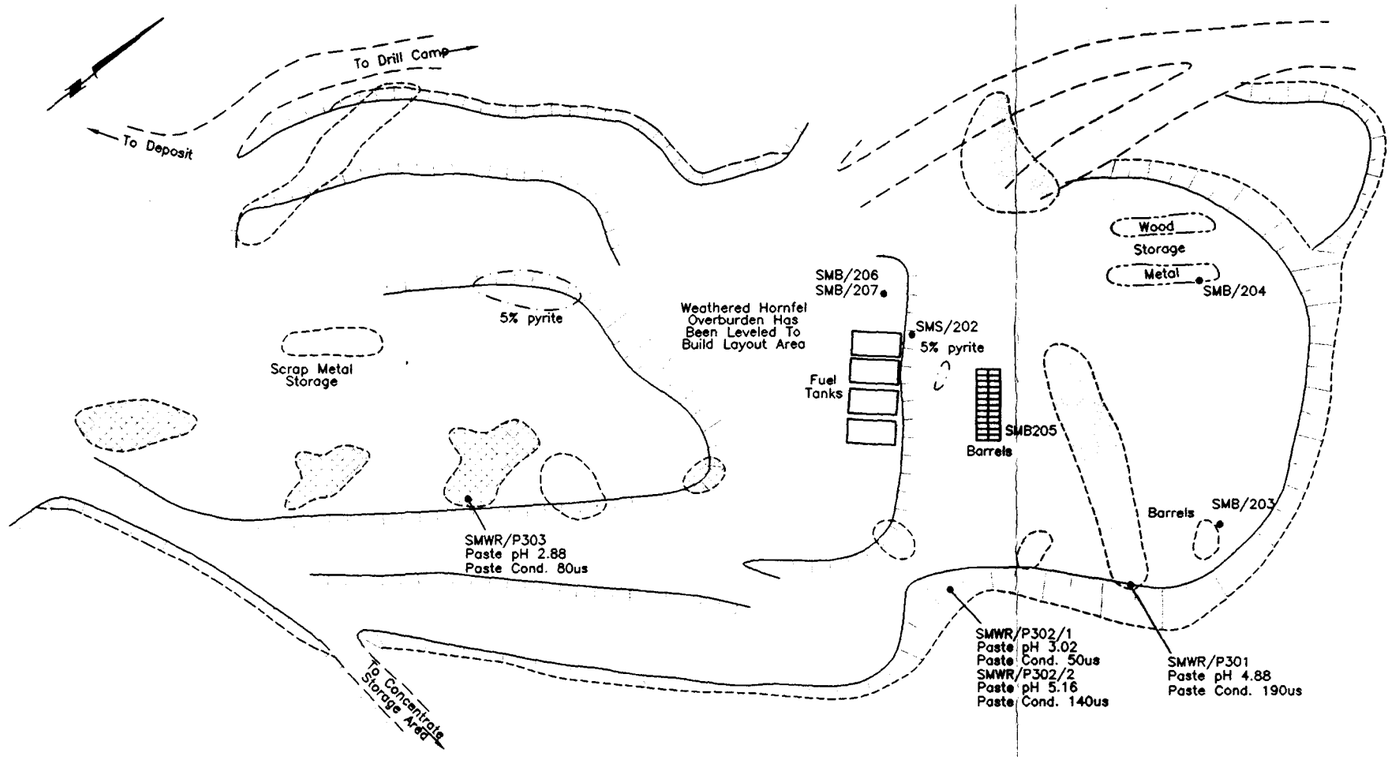
< = Less than the detection limit indicated.
Results are expressed as milligrams per litre except for pH and Conductivity (umhos/cm).

APPENDIX D

DRAWINGS

Legend

- Outcrop Boundry
- W/R — Waste Rock
- O/C — Outcrop
- Road
- Extent Of Waste Rock
- • SMWR/P1/1 — Waste Rock (site designation)
- • SMB/1 — Barrel Sample (site designation)
- • SMS/1 — Soil Sample (site designation)
- Slope Down
- Secondary Mineralized Waste Rock
- Chlorite–rich Waste Rock
- Buildings
- Extent of Debris, Timber, Cable, Pipe, etc.



0 10 20 30 40

Scale 1:1000

PLOT: 1=1
CAD FILE: INVEN-96\SLATEMTN\SLATE-1

Public Works And Government Services Canada / Travaux publics et Services gouvernementaux Canada

Architectural & Engineering Services
Western Region

Drawing title / Titre du dessin:

Slate Mountain Mine
Laydown Yard
Yukon Territory

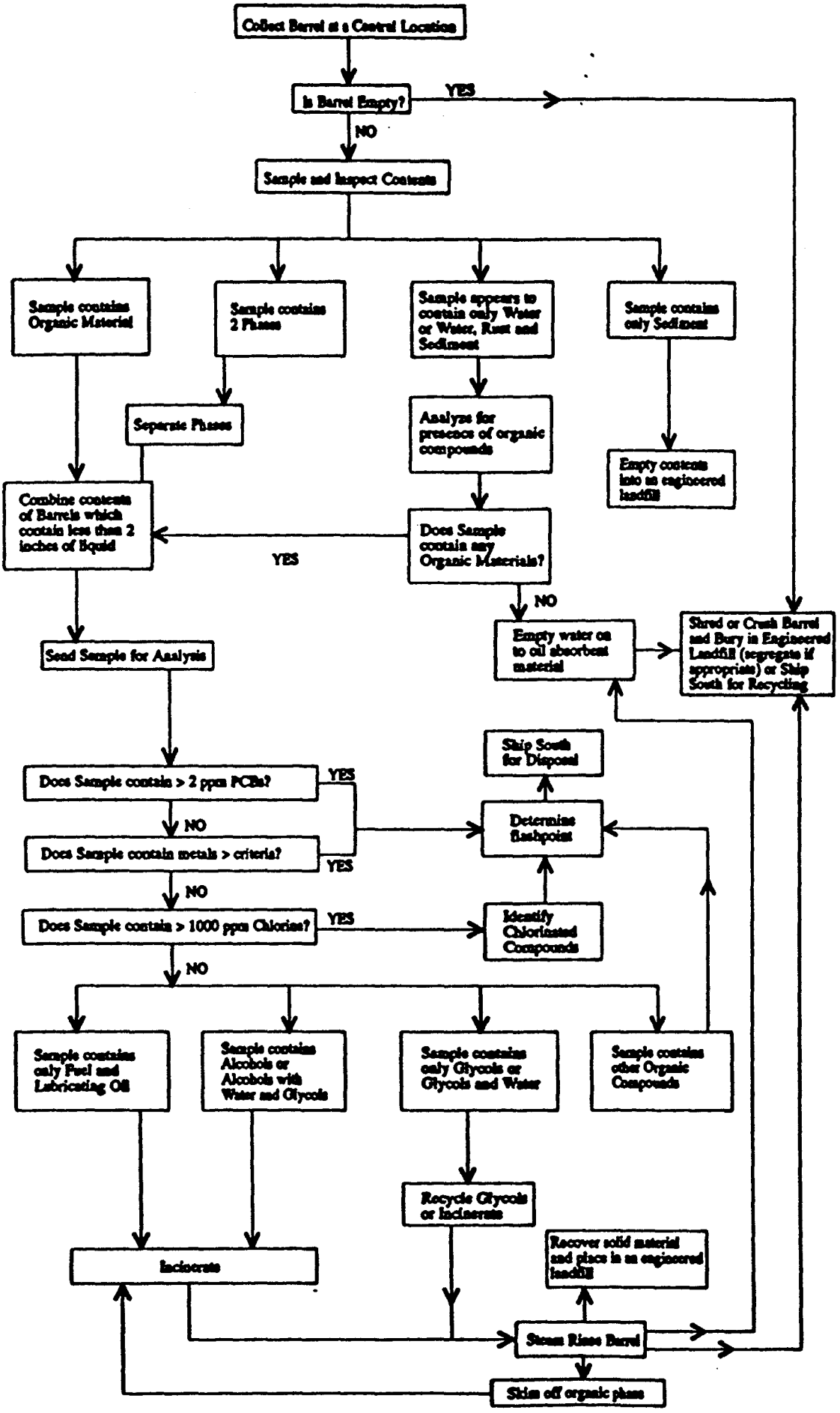
Project no. / N° du projet: 668724

Dwg. no. / N° du dessin: 1 of 1

APPENDIX E

BARREL PROTOCOL

FLOW CHART FOR THE DEW LINE CLEANUP OF BARRELS



BARREL CLEAN UP PROTOCOL

A flow diagram of the methodology for the processing, cleanup and disposal of barrels is attached.

A. Inspection

1. *The area around the barrels should be tested with a VOC metre to ensure safe working conditions. If the VOC levels exceed 20% of the Lower Explosive Limit (LEL), then all work shall be conducted in accordance with appropriate sections of the NIOSH Guidelines, the National Fire Code of Canada and the TDGA for flammable and combustible materials.*

2. *All barrels are to be inspected to address the following items which shall be recorded and used as a guide when opening barrels (section B.3):*

    1. *Symbols, words, or other marks on the barrel that identify its contents, and/or that its contents are hazardous: e.g. radioactive, explosive, corrosive, toxic, flammable.*
    2. *Symbols, works, or other marks on the barrel that indicate that it contains discarded laboratory chemicals, reagents, or other potentially dangerous materials in small-volume containers.*
    3. *Signs of deterioration or damage such as corrosion, rust, or leaks at seams, rims, and V grooves.*
    4. *Spillage or discolouration on the top and sides of the barrel.*
    5. *Signs that the barrel is under pressure such as bulging and swelling.*

B. Opening and Sampling

1. *Pressurized barrels are extremely hazardous and shall be opened with extreme caution. Only non-sparking equipment shall be used to open barrels. All personnel responsible for opening barrels shall be provided with appropriate safety equipment and clothing. Procedures outlined in NIOSH USEPA 1988 Safety and Health Compliance for Managers (165.8) USEPA-29-CFR, 1910-1920, shall be followed.*

2. *If the bungs can readily be moved; then the barrels shall be opened slowing allowing time for any pressure in the barrel to be released before the bung is fully removed.*

3. *If the bungs are not readily moved, or inspection suggests that opening of the barrel presents a special hazard, then the barrels shall be vented remotely to relieve any internal pressure that may be present prior to opening. Remote venting shall be conducted using a suitable device such as a sharp spear weighted and dropped from an appropriate height or released from a tube housing a spring to penetrate the barrel. The remote venting operation shall be conducted from a safe distance from other site operations and from behind suitable walls or barricades. After sampling, the spear opening shall be plugged.*

4. *Samples of the contents of all barrels shall be extracted using a drum thief. All barrels shall be clearly numbered using spray paint or other suitable marker.*

5. *Barrels shall not be transported until it has been determined that they are not under pressure, do not leak and are sufficiently sound for transport.*

6. *Barrels containing less than 50 mm of liquid may be combined with compatible material prior to sampling; samples inferred to contain only water on a visual examination shall be tested prior to this consolidation. Barrel contents which consist of black oil shall not be consolidated.*

7. *Consolidation of barrel contents shall take place in a secure barrel processing area. At many DEW Line sites several caches of barrels are present and, therefore, it may be desirable to establish several secure sorting areas; barrels scattered on the tundra may be vented, then closed, and then transported to a barrel sorting area for sampling and possible consolidation.*

C. Testing

1. *Liquid samples shall be inspected and classified as either containing water or organic materials. Samples thought to contain water shall be analysed on-site to confirm that they are indeed water and contain less than 2% glycols or alcohols by Fourier transform infrared spectroscopy (FTIR).*

2. *The contents of barrels containing organic materials, including aqueous samples which contain more than 2% glycols or alcohols, shall be tested for PCBs, Total chlorine, cadmium, chromium and lead, in addition to identification of the major components e.g. fuel oil, lubricating oil. Samples containing greater than 1000 ppm chlorine shall be further tested to identify the chlorinated compounds present.*

3. *Contents of barrels which contain two or more phrases shall have all phrases analysed; the organic phases as described above and the aqueous phases to ascertain whether it contains less than 2% organics. In addition, the aqueous phases shall be tested for any components found in the organic phases above the criteria described below.*

D. Disposal of Barrel Contents

1. *Barrels containing only rust and sediment shall be treated as empty barrels.*

2. *Barrel contents comprising water only (less than 2% glycols or alcohols) shall be transferred to an open vessel such as a utility tub or half-barrel and any organic material removal by agitation with a pillow or segment of oil absorbent material. The water may then be discarded on to the ground that is a minimum of 30 metres distance from natural drainage courses. Used oil absorbent material shall be treated as described in Section D.5.*

3. *Barrel contents which are composed of water with glycols and/or alcohols or*

organics phases, and which contain less than 2 ppm PCBs, 1000 ppm chlorine, 2 ppm cadmium, 10 ppm chromium and 100 ppm lead, may be disposed of by incineration. Alternatively these contents may be disposed of off-site at a licensed disposal facility. The solid residual material resulting from incineration shall be subjected to a leachate extraction test. Material found to be not leachate toxic material shall be treated as hazardous waste, packaged in accordance with TDGA and/or IATA regulations as required, and disposed of off-site at a licensed disposal facility.

4. *Barrel contents which contain greater than 2 ppm PCBs, 1000 ppm chlorine, 2 ppm cadmium, 10 ppm chromium or 1000 ppm lead shall be disposed of off-site at a licensed disposal facility. Contents may be combined with compatible materials for shipping purposes (note section E.1). Flash point may be required to be determined if they cannot be inferred from the product identification.*

5. *Used oil absorbent material should be treated as hazardous waste and disposed of off-site at a licensed disposal facility unless, it is shown to be uncontaminated with PCBs (<2 ppm), chlorine (<1000 ppm) cadmium (<2 ppm), chromium (<10 ppm) and lead (<100 ppm) in which case it may be incinerated on site.*

E. Cleaning and Disposing of Barrels

1. *Empty barrels resulting from consolidation of contaminated material (Section D.4) shall be triple rinsed with solvent (varsol, diesel, etc.) Prior to steam cleaning; solvent washings shall be added to the bulked contaminated products unless analysed separately and shown to be suitable for incineration. Alternatively, the empty barrels may be shipped off-site and labelled appropriately (TDGA).*

2. *Only empty barrels resulting from consolidation of small volumes (section B.6), from incineration (section D.3) and from solvent washing (section E.1) require steam cleaning; after cleaning they shall be treated as described in E.3. Recycling of rinsate is permitted. The resulting wash water shall have any organic material removed by agitation with a pillow or segment of oil absorbent material. The water shall then be analysed for cadmium, chromium and lead. If these metals are present at less than 0.01, 0.10 and 0.10 ppm respectively, then the water may be discarded on land that is a minimum of 30 metres from natural drainage courses, but if not then it shall be disposed of off-site at a licensed disposal facility. Alternatively, the wash water may be shipped off site without testing for disposal at a licensed disposal facility. Used absorbent material shall be disposed of as described in section D.5.*

3. *Empty barrels may be crushed or shredded and be landfilled on-site as non-hazardous wastes. The barrels shall be crushed in such a manner so as to reduce their volume by a minimum of 75%. Shredded barrels may be disposed of off-site as recycled metals.*

FLOW CHART FOR THE DEW LINE CLEANUP OF BARRELS