Hazardous Material Supplementary Investigation Faro Mine Remediation Project

PREPARED FOR: Government of Yukon

PREPARED BY: CH2M HILL Canada Limited

DATE: December 17, 2013

PROJECT NUMBER: 472645.09.W1

This technical memorandum summarizes observations noted during a supplementary investigation of hazardous materials (HAZMAT) from various locations at the Faro Mine Complex (FMC) on Wednesday, October 2, 2013. Please refer to the location plans in Attachment A for the hazardous material storage locations.

Background

The Government of Yukon (YG) retained EBA Engineering Consultants Limited (EBA) to conduct two investigations at the FMC (October 24 through 28, 2011 and July 9 through 13, 2012) to complete the following primary tasks:

1. Sample, classify and quantify unknown soils and liquids in drums and tanks.
2. Conduct intrusive sampling of building materials suspected to contain asbestos and lead.
3. Visually assess building features suspected of containing polychlorinated biphenyls (PCBs), ozone-depleting substances (ODS), and mercury.

EBA summarized the investigation results in *Hazardous Materials Classification – Faro Mine Site: EBA File: W23101482* (EBA, 2011) and *Hazardous Materials Classification – Faro Mine Site: EBA FILE: W23103015-01, Faro, Yukon* (EBA, 2012) (the EBA HAZMAT Reports).

Objectives

The objective of CH2M HILL Canada Limited's (CH2M HILL's) supplementary investigation was to gather additional information on the wastes identified in the EBA HAZMAT Reports, and other wastes discovered during the investigation. CH2M HILL was then to develop recommendations for interim mitigation of human health and environmental risks.

The EBA HAZMAT Reports contained an inventory of HAZMAT materials at the FMC during the inspection, including: cleaners, lubricants, and mercury thermostats. Many of these items are classified as dangerous goods but are not necessarily hazardous wastes (i.e., the cleaners and lubricants are currently in use by the FMC care and maintenance contractor, and the mercury thermostats are still functioning and in use within operational buildings at the FMC).

The supplementary investigation compared the existing conditions of the stored containerized materials with the applicable storage procedures for special wastes, prescribed by the Yukon Environment Act Special Waste Regulations (O.I.C. 1995/047):

1. Use external secondary containment when storing more than twenty-four 205-litre (L) drums in one group. Secondary containment prevents leaks and spills from contaminating adjacent media.
2. Keep records of the wastes being stored, including type, volume, origin, and storage location. Records must be accessible, as they may assist response teams if a spill or fire occurs.

3. Cover containers stored outside to protect them from the weather. Containers should be stored in aisles, with at least 1.5 metres of aisle spacing to allow visual inspection.
4. Ensure containers are always closed, except when waste is added or removed.
5. Label the containers with the waste identity (including identification number), Transportation of Dangerous Goods (TDG) class, and packing group.

In addition, the following generally accepted best management practices (*Hazardous Waste Storage Guidelines, Alberta Environment Environmental Protection Services, June 1988*) were used to assess the existing conditions of the stored containerized materials:

1. Communicate related hazards of the containerized materials to workers and maintain current Material Safety Data Sheets (MSDS) onsite and accessible to all workers (Yukon Workplace Hazardous Materials Information System Regulations O.I.C. 1988/107 2[4]).
2. Do not store containers in direct contact with the earth (i.e., containers should be placed on pallets or racks and stored in a manner to provide shelter from the weather).

Observations

The majority of the FMC was inspected; however, the Mill Building was deemed inaccessible for health and safety reasons. As a result, materials contained within the Mill Building did not undergo investigation. The investigation findings reflect the following four areas of concern at the locations indicated in Attachment A to this memo:

1. North Drum Dump (waste methyl isobutyl carbinol storage)
2. Northwest Drum Dump (waste oil and empty drums with residue of waste oil and hydrocarbon lubricants storage)
3. Northwest Drum Dump (degraded waste sodium isopropyl xanthate storage)
4. Vangorda Drums (low-pH hydrocarbons waste storage)

Table 1 summarizes the observations from the supplementary investigation and recommended interim risk mitigation measures. Attachment B includes photographs of the material storage areas.

TABLE 1
Supplementary Investigation Summary and Recommended Interim Risk Mitigation Measures
Faro Mine Remediation Project

Location	Expected Contents	Estimated Quantity	General Properties	Conditions Observed	Recommended Interim Risk Mitigation Measures
North Drum Dump	MIBC and Water[a] pH of contents varies between 2.80 and 5.40[a]	~100 – 205-L drums (mostly steel, some plastic)	MIBC is regulated as a Dangerous Good under The Transportation of Dangerous Goods Regulation (SOR/2012-245) in Schedule 1 as a Class 3 flammable liquid (PIN UN2053). Waste materials containing MIBC in appreciable concentrations are expected to exhibit similar properties; as such, should be deemed Special Waste under the Yukon Environment Act Special Waste Regulations (O.I.C. 1995/047). MIBC is moderately volatile and moderately soluble in water. MIBC is highly mobile in soil, but is not expected to adsorb to sediments or particulate matter in water. It has a predicted half life of 10.6 days in a model pond environment.	Drums are placed in direct contact with waste rock. Drum labels are not clearly visible. Drums contain varying levels of material. Some drums are open (bungs missing). Some drums are displaying significant deformation because the contained product has frozen. The ground surface is visibly stained in some areas.	Include location and warning to avoid storage area in facility orientation information. Place snow fencing around the open face of the barrel storage area to mitigate unauthorized access. Post signs indicating a hazardous waste storage area, at the entrance to the barrel storage area. Inspect the area on a biweekly basis and immediately after rainfall events until final disposal occurs.

TABLE 1

Supplementary Investigation Summary and Recommended Interim Risk Mitigation Measures

Faro Mine Remediation Project

Location	Expected Contents	Estimated Quantity	General Properties	Conditions Observed	Recommended Interim Risk Mitigation Measures
					Investigate requirement for a Special Waste Permit for onsite management options of the containers.
Northwest Drum Dump	Waste oil and empty drums with residue of waste oil and hydrocarbon lubricants[a]	~ 250 - 205-L drums (mostly steel with some plastic, plus 20-L plastic pails in four distinct staging areas)	Thick (viscous) hydrocarbon liquids with varying concentrations of metals, PAHs and surfactants. Not generally considered flammable but will propagate combustion. Regulated as a Special Waste under the Yukon Environment Act Special Waste Regulations (O.I.C. 1995/047).	Drums are placed in direct contact with waste rock – newer drums appear to be placed on pallets – most are overturned to promote drainage. Drum labels are not clearly visible. Drums contain varying levels of material. Some drums are open (bungs missing), with open tops and perforated sides. Some drums are displaying significant deformation because the contained product has frozen. The ground surface is visibly stained in most areas.	Include location and warning to avoid storage area in facility orientation information. Place snow fencing around the open face (between waste rock berm and concrete spoil pile). Inspect the area on a biweekly basis and immediately after rainfall events until final disposal occurs. Investigate requirement for a Special Waste Permit for onsite management options of the containers.
Northwest Drum Dump	Degraded Sodium Isopropyl Xanthate[b] pH of contents is 2.33[a]	~ 40 - 205-L metal drums (all showing extensive corrosion)	Xanthates are regulated as a Dangerous Good under The Transportation of Dangerous Goods Regulation (SOR/2012-245) in Schedule 1 as a Class 4.2 spontaneously combustible solid (PIN UN3342). Given the properties observed, this will likely be deemed a Special Waste under the Yukon Environment Act Special Waste Regulations (O.I.C. 1995/047). Xanthates are generally stable when kept cool and dry. Exposure to heat causes decomposition, resulting in disulphide vapours. MSDS indicates Xanthate pH to be 13 +/- 1. The corrosion observed is not consistent with the pH reported by EBA. Carbon disulphide may react with water vapour to form acid gases, which may explain the low pH of the solids and corrosion observed. Carbon disulphide is generally considered incompatible with air, metals (including rust), and oxidants. Recommended storage conditions include: airtight drums, storage in shade during summer, and spraying the drums with water to prevent pressure from developing.	Drums placed on pallets are exhibiting varying degrees of corrosive decomposition. Drum labels are not clearly visible. Drums contain varying levels of material; some has been released because of drum wall failures. Some drums display perforated sides. The ground surface is visibly stained downgradient from the drums. The area below these drums (waste rock) was used for chemical drum disposal during the operating life of the FMC[b].	Include location and warning to avoid storage area in facility orientation information. Place snow fencing across the open access way. Post signs indicating a hazardous waste storage area, at the entrance to the barrel storage area. Inspect the area on a biweekly basis and immediately after rainfall events until final disposal occurs. Investigate requirement for a Special Waste Permit for onsite management options of the residuals and deteriorated containers.

TABLE 1

Supplementary Investigation Summary and Recommended Interim Risk Mitigation Measures

Faro Mine Remediation Project

Location	Expected Contents	Estimated Quantity	General Properties	Conditions Observed	Recommended Interim Risk Mitigation Measures
Vangorda Drum Storage	Low pH hydrocarbon[a]	4 – 205-L plastic drums	General properties unknown. May be flammable. Hydrocarbons are regulated as Special Waste under the Yukon Environment Act Special Waste Regulations (O.I.C. 1995/047).	Drums are placed in direct contact with ground. Drums are not labelled.	Include location and warning to avoid storage area in facility orientation information. Place snow fencing around area. Post signs indicating a hazardous waste storage area, at the entrance to the barrel storage area. Inspect the area on a biweekly basis and immediately after rainfall events until final disposal occurs. Investigate requirement for a Special Waste Permit for onsite management options of the residuals and deteriorated containers.

[a] "*Hazardous Materials Classification – Faro Mine Site: EBA File: W23101482"* (EBA, 2011) and "*Hazardous Materials Classification – Faro Mine Site: EBA FILE: W23103015-01, Faro, Yukon"* (EBA, 2012).

[b] Legacy generator knowledge.

Notes:

~ = approximately
EBA = EBA Engineering Consultants Limited
FMC = Faro Mine Complex
L = litre
MIBC = methyl isobutyl carbinol
MSDS = Material Safety Data Sheet
PAH = polycyclic aromatic hydrocarbon

Recommendations

CH2M HILL recommends the interim measures noted in Table 1 be implemented immediately, to mitigate risk in the short-term until material can be properly consolidated, stored, and disposed of according to the Yukon Environment Act Special Waste Regulations (O.I.C. 1995/047). These measures advise minimal disturbance of the wastes at this time, because the condition of the containers is compromised and the potential exists to create further environmental and health and safety risks before appropriate long-term solutions can be instated. When seasonal conditions and logistics favour the safe handling of the materials, secondary containment and shelter from weather exposure should be provided, and the materials should be inventoried and labelled in accordance with regulatory requirements. These materials should not be handled until a hazardous materials management plan has been completed.

The recommended interim risk mitigation measures include:

1. Maintain current MSDS for the materials and make sure these are accessible to all workers.
2. Amend the site orientation to include a review of the materials (types, storage locations, MSDS).
3. Install barriers (i.e., snow fence) and signs around the storage areas.
4. Inspect the storage areas on a biweekly basis, barring weather-related access limitations (refer to the sample inspection form in Attachment C).

A comprehensive HAZMAT Management Plan will be developed for the long-term management of the containerized materials; this will consider regulatory requirements and the applicability of Special Waste Permits to manage wastes. The HAZMAT Management Plan is tentatively scheduled for development during December 2013. It will include a supplementary sampling plan, a detailed inventory of drums, and storage, treatment, or disposal methods for the materials in accordance with the Yukon Environment Act Special Waste Regulations (O.I.C. 1995/047) and the Transportation of Dangerous Goods Regulation (SOR/2012-245). The execution of the HAZMAT Management Plan is tentatively scheduled for 2014.

Disclaimer

This memorandum has been prepared in accordance with generally accepted environmental study and/or engineering practices. No other warranties, expressed or implied, are made as to the professional services provided.

The services performed and outlined in this memorandum were based, in part, upon visual observations of the FMC and attendant structures. CH2M HILL's opinion cannot be extended to portions of the FMC which were unavailable for direct observation, as this is reasonably beyond the control of CH2M HILL.

The objective of this memorandum is to assess the environmental conditions at the FMC at the time of this memorandum, given the context of CH2M HILL's contract, with respect to existing environmental regulations within the applicable jurisdiction. Compliance review of past owners with applicable local, provincial, and federal government laws and regulations was not included in this scope of work.

The FMC history research performed herein relies on information supplied by others as well as information supplied to CH2M HILL by the client. No attempt has been made to independently verify the accuracy of such information, unless specifically noted in this memorandum.

CH2M HILL's visual observations relating to potential contaminant materials in the environment at the FMC are described in this memorandum. No testing was performed. It should be noted that other compounds or materials may be present in the FMC environment.

The recommendations in this memorandum are based in part, on the information provided by others. The possibility remains that unexpected environmental conditions may be encountered at the FMC in locations not specifically investigated. Should such an event occur, CH2M HILL must be notified in order to determine if modifications are necessary to the recommendations presented herein.

This memorandum is for the sole use of the Yukon Government to whom this memorandum is specifically addressed. This memorandum, in whole or in part, shall not be used by others than the above mentioned client without the written consent of CH2M HILL Canada Limited.

References

Alberta Environment, Environmental Protection Services. 1988. *Hazardous Waste Storage Guidelines.* June.

EBA Engineering Consultants Limited (EBA). 2011. *Hazardous Materials Classification – Faro Mine Site: EBA File: W23101482.* Prepared for the Government of Yukon. December.

EBA Engineering Consultants Limited (EBA). 2012. *Hazardous Materials Classification – Faro Mine Site: EBA FILE: W23103015-01, Faro, Yukon.* Prepared for the Government of Yukon. August.

Government of Canada. *Transportation of Dangerous Goods Regulation.* SOR/2012-245.

Government of Yukon (YG). 1995. *Yukon Environment Act Special Waste Regulations*. O.I.C. 1995/047.

Government of Yukon (YG). 1988. *Yukon Workplace Hazardous Materials Information System Regulations.* O.I.C. 1988/107 2(4).

Attachment A
Faro Mine Site Hazardous Material Storage Locations

VICINITY MAP

LEGEND

Methyl IsoButyl Carbonyl Drums (MIBC)

Notes:
1. Source: EBA (A TETRA TECH) Company, December 2011
2. Aerial photography acquired by Peregrine Aerial Surveyors Inc. and Eagle Mapping in August 2012.
3. Orthophotography prepared by Critigen Canada Corp.

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0 10 20 30 40

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CRITIGEN

FIGURE A-1

Methyl Isobutyl Carbonal Storage

Hazardous Materials Classification, Faro Minesite- Yukon

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VICINITY MAP

LEGEND

Waste Oil Drum Storage

Notes:
1. Source: EBA (A TETRA TECH) Company, December 2011
2. Aerial photography acquired by Peregrine Aerial Surveyors Inc. and Eagle Mapping in August 2012.
3. Orthophotography prepared by Critigen Canada Corp.

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FIGURE A-2
Northwest Dump
Hazardous Materials Classification, Faro Minesite- Yukon

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VICINITY MAP

LEGEND

Sodium Xanthate

Notes:
1. Source: EBA (A TETRA TECH) Company, December 2011
2. Aerial photography acquired by Peregrine Aerial Surveyors Inc. and Eagle Mapping in August 2012.
3. Orthophotography prepared by Critigen Canada Corp.

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FIGURE A-3
Sodium Xanthate
Hazardous Materials Classification, Faro Minesite- Yukon

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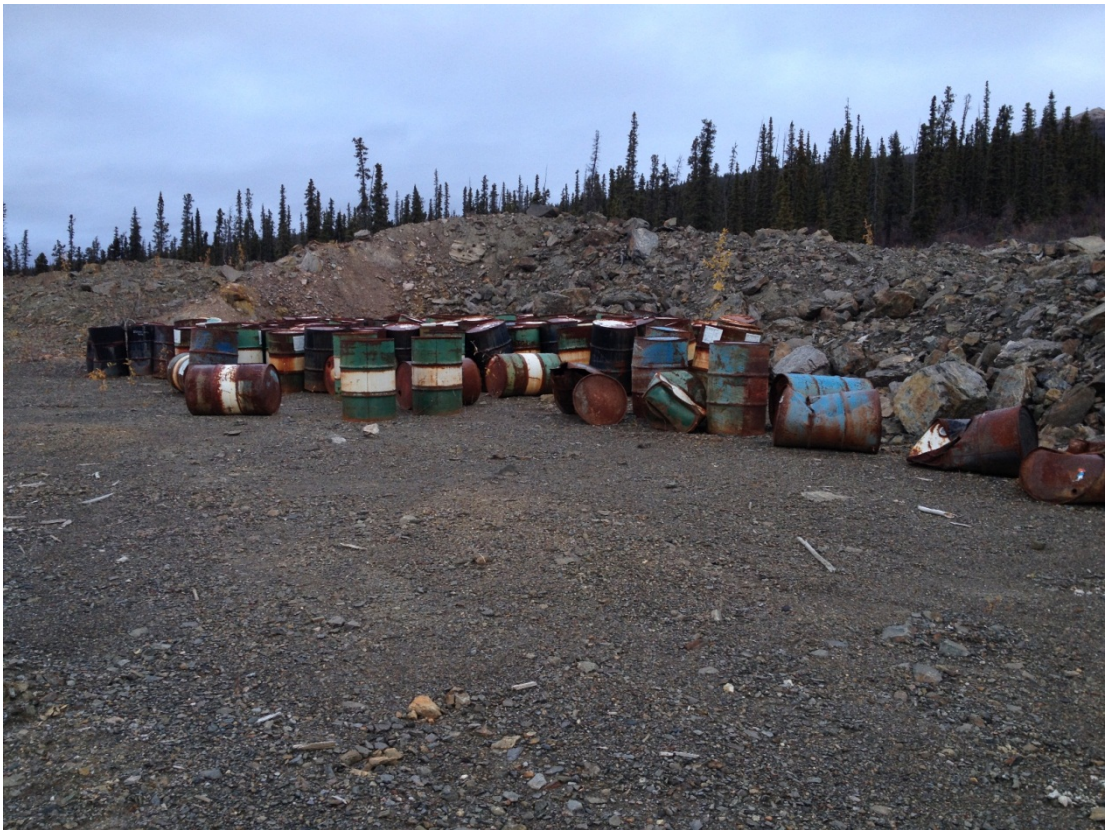
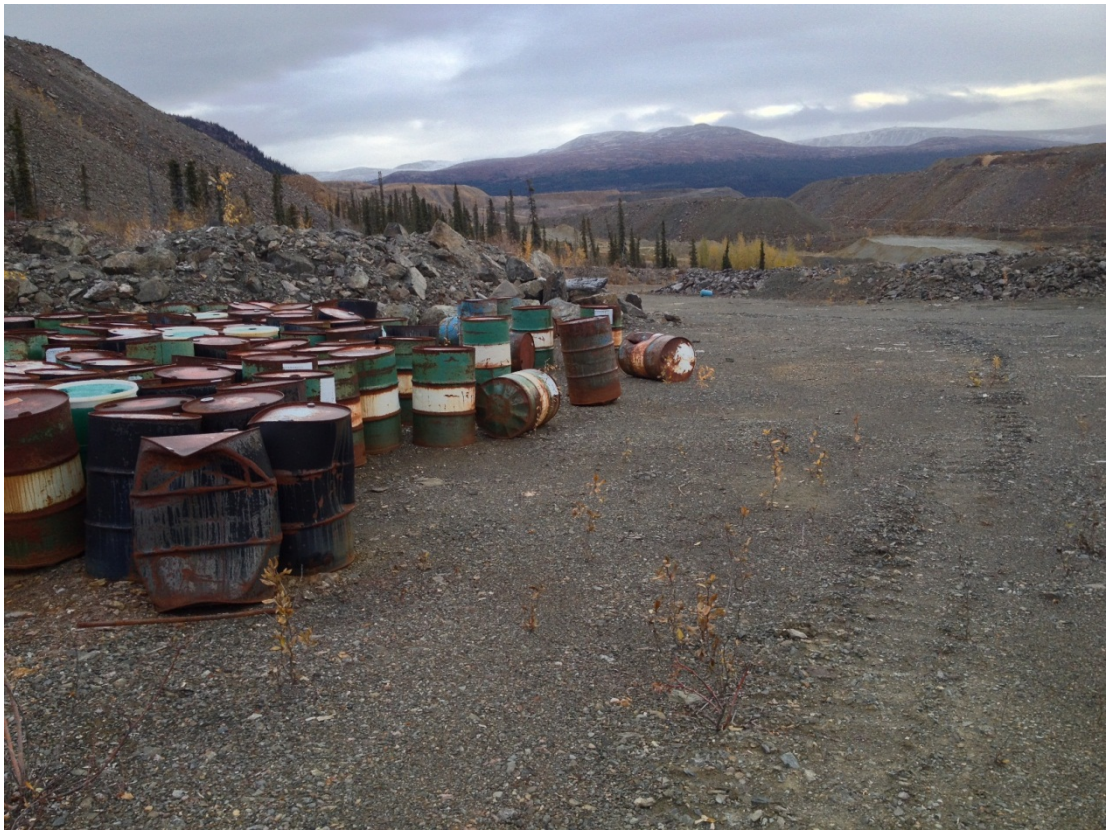
Attachment B
Photographs

PHOTOGRAPH 1
Methanol Drums in Active Storage Yard



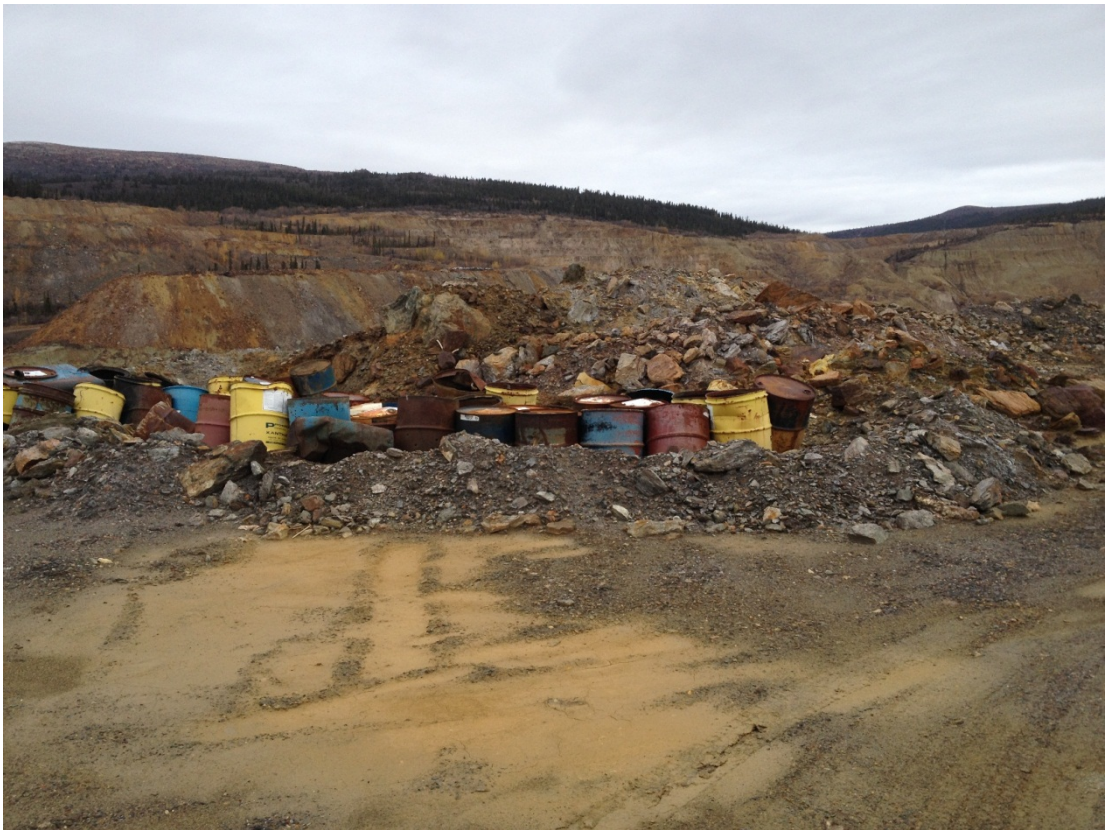
PHOTOGRAPH 2
Methyl Isobutyl Carbinol (MIBC) Drums



PHOTOGRAPH 3
MIBC Drums Damaged by Previous Freeze/Thaw Events

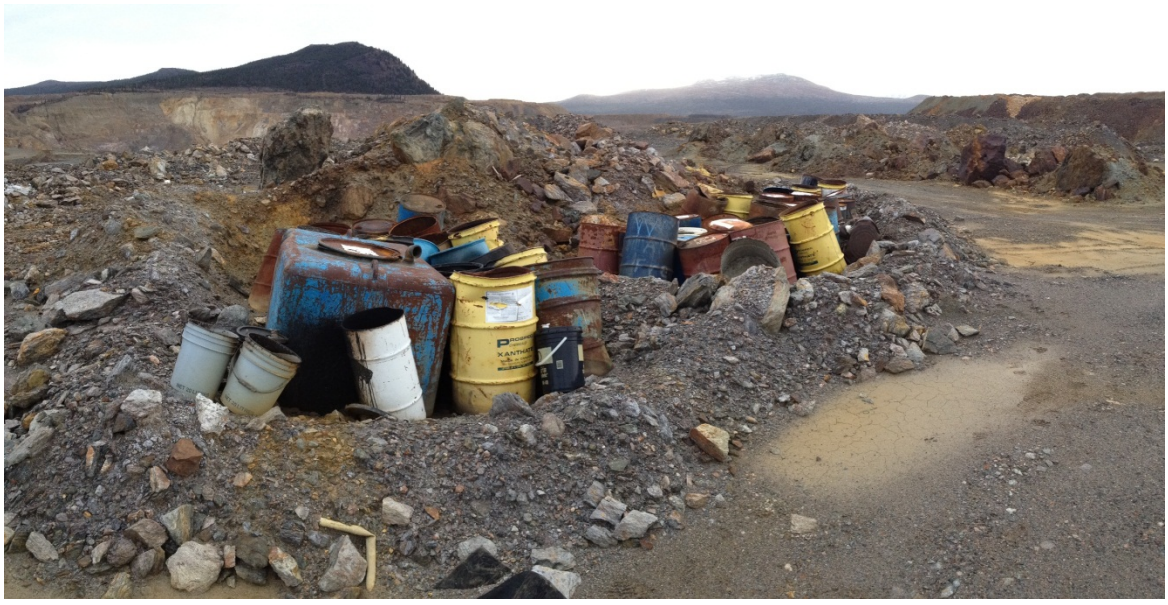
PHOTOGRAPH 4
MIBC Drums (without Bungs)

PHOTOGRAPH 5
Vangorda Drums

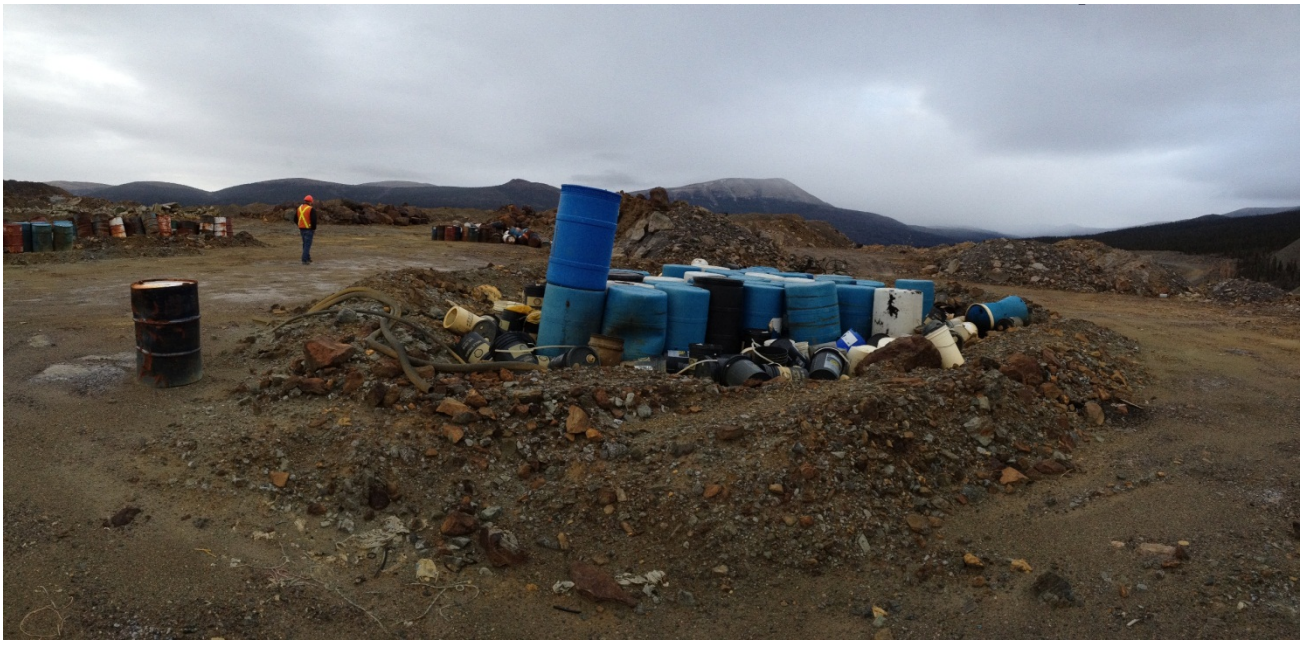


PHOTOGRAPH 6
Waste Oil Drums

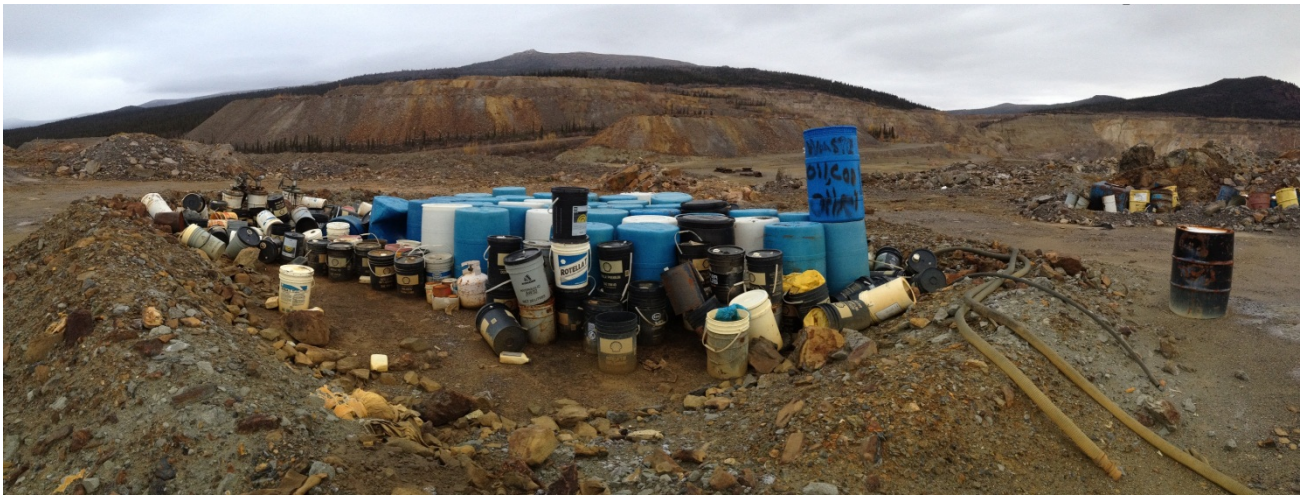
PHOTOGRAPH 7
Waste Oil Containers



PHOTOGRAPH 8
Waste Oil Containers



PHOTOGRAPH 9
Waste Oil Containers

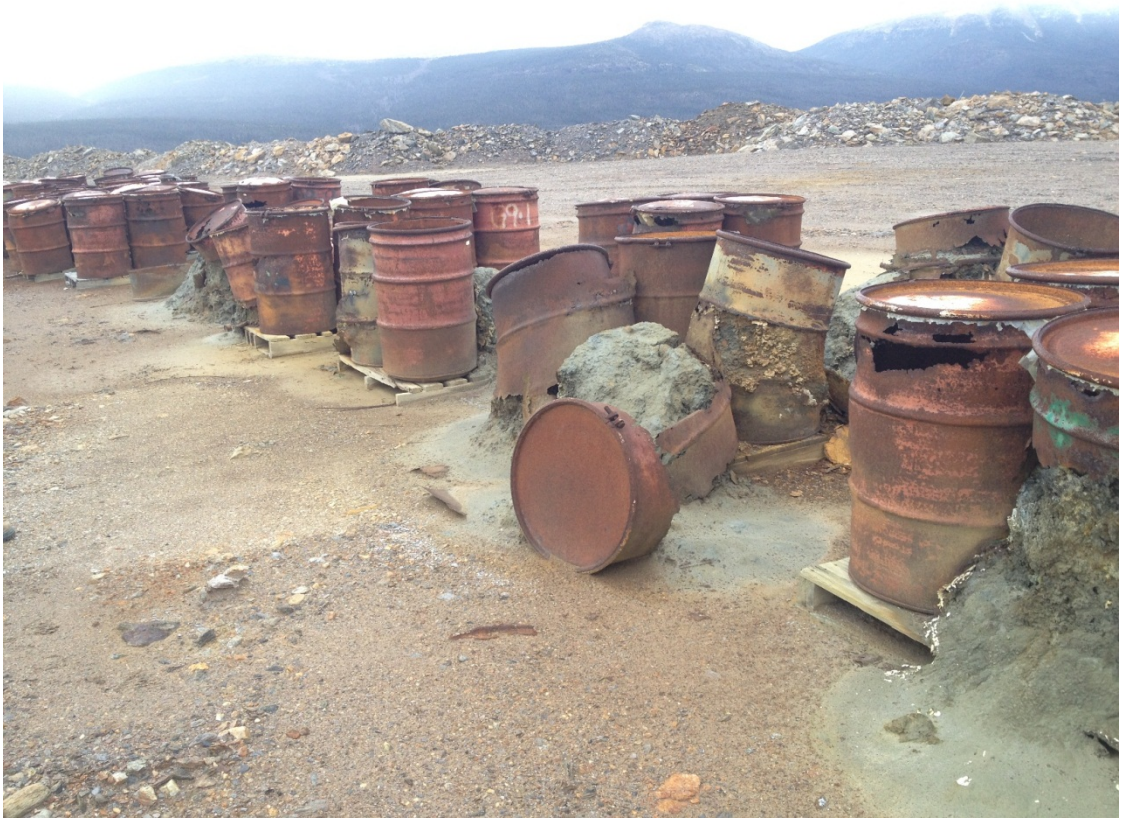


PHOTOGRAPH 10
Waste Oil Containers

PHOTOGRAPH 11
Waste Oil Drums

PHOTOGRAPH 12
Xanthate Drums

PHOTOGRAPH 13
Xanthate Drums



PHOTOGRAPH 14
Xanthate Drums

Attachment C
Material Storage Area Inspection Checklist

MATERIAL STORAGE AREA INSPECTION CHECKLIST

SITE NAME:		WEATHER:	
SITE LOCATION:		TEMPERATURE:	
INSPECTOR:		INSPECTION DATE:	

INSPECTION REPORT

STORAGE AREA:		**MATERIALS:**	
INSPECTION ITEM	**YES**	**NO**	**COMMENTS**
IS THE FENCING INTACT?			
ARE THE MATERIALS WITHIN THE STORAGE AREA?			
IS PROPER SIGNAGE IN PLACE?			
IS PROPER HOUSEKEEPING MAINTAINED?			
REMEDIAL ACTIONS:			**EXPECTED COMPLETION DATE:**
STORAGE AREA:		**MATERIALS:**	
INSPECTION ITEM	**YES**	**NO**	**COMMENTS**
IS THE FENCING INTACT?			
ARE THE MATERIALS WITHIN THE STORAGE AREA?			
IS PROPER SIGNAGE IN PLACE?			
IS PROPER HOUSEKEEPING MAINTAINED?			
REMEDIAL ACTIONS:			**EXPECTED COMPLETION DATE:**
STORAGE AREA:		**MATERIALS:**	
INSPECTION ITEM	**YES**	**NO**	**COMMENTS**
IS THE FENCING INTACT?			
ARE THE MATERIALS WITHIN THE STORAGE AREA?			
IS PROPER SIGNAGE IN PLACE?			
IS PROPER HOUSEKEEPING MAINTAINED?			
REMEDIAL ACTIONS:			**EXPECTED COMPLETION DATE:**
STORAGE AREA:		**MATERIALS:**	
INSPECTION ITEM	**YES**	**NO**	**COMMENTS**
IS THE FENCING INTACT?			
ARE THE MATERIALS WITHIN THE STORAGE AREA?			
IS PROPER SIGNAGE IN PLACE?			
IS PROPER HOUSEKEEPING MAINTAINED?			
REMEDIAL ACTIONS:			**EXPECTED COMPLETION DATE:**
INSPECTOR'S SIGNATURE			**DATE**

PHOTOGRAPHS		
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