Quality Assurance and Quality Control
For
Water Sampling at FOX-C
Intermediate DEW Line Site
Ekalugad Fiord
Nunavut

PWGSC Environmental Services
Western Region

1.0 INTRODUCTION

As the custodian of most federal lands in the north, the Department of Indian Affairs and Northern Development (DIAND) has responsibility, through the Northern Contaminated Sites Program (CSP), to manage a number of contaminated properties that are no longer maintained by the original occupant. DIAND's portfolio of contaminated sites in the north originates from private sector mining, oil and gas activities and government military activity dating back over half a century, many years before the environmental impacts of such activities were adequately understood. The former FOX-C Intermediate DEW Line Site at Ekalugad Fiord, Nunavut is one of these sites.

The site will require remedial activities to remove contaminants either off site or to place contaminants into an engineered containment facility or landfill. Water sampling will be conducted throughout the remediation process for the following reasons:

1) To maintain a contractors camp at site with drinking water and waste facilities.
2) To determine potential leachate sources at site.
3) To determine concentrations of contaminants at site.

The purpose of this document is to provide a quality assurance and quality control program for the management of water sampling during the remediation process.

2.0 SAMPLE COLLECTION

Water samples will be collected during various activities. The following indicates the locations to be sampled and the frequency. A spreadsheet can be found in Appendix A that details the sampling protocol, frequency and parameters. Site maps can be found in Appendix B indicating facilities and, where possible, proposed sample locations.

2.1 Site Camp

A contractor's camp will be set up at the site to provide services and support for the remediation activities. The camp is scheduled to be at site for a period of two years with the duration of the construction season from mid June to the end of September. Sampling of water supplies will be conducted during the duration of camp operations.

2.1.1 Wastewater (Sewage)

The current camp sewage treatment system consists of two temporary lagoons that can operate independently. The lagoon area has been sited so as to meet the requirements specified in the Water License.

UMA Engineering Ltd. has provided documentation for the justification of the wastewater discharge criteria. This documentation can be found in Appendix C of this report. Table 1 in Appendix C is a comparison of project wastewater criteria to other Canadian and Northern Standards including NWT, Nunavut and CCME guidelines and criteria.

The total water requirement for the construction camp has been estimated at approximately 30 cubic metres (as per UMA calculations). The parameters to be analyzed within the wastewater include heavy end hydrocarbon chains as the contamination at this site historically occurred 40 plus years ago. Light end volatiles would have since dissipated. It should be noted that those hydrocarbon products used at site were diesel fuel and lubricating oils.

Wastewater will be sampled each month during the field season and prior to discharge.

2.1.2 Drinking Water

Drinking water at the site will be sampled on a weekly basis to ensure the water quality meets the Health Canada Guidelines for Canadian Drinking Water Guidelines. The sampling and analyses will be provided at the water supply source and at the distribution source prior to consumption. Bottled distilled drinking water will be supplied at the camp should there exceedances be noted in the water sampling analysis.

2.1.3 Construction Camp Waste

All liquid hydrocarbon waste which cannot be incinerated will be turned over to the Construction Contractor for proper disposal on an as required basis.

2.2 Remediation Activities

Remediation activities or site contaminants that may impact site water resources are to be mitigated by providing the following:

1) Excavation of contaminants and materials,
2) Leachate testing of barrel residuals,
3) Waste processing and rinsing,

4) Testing of landfarm runoff, and
5) Testing of landfarm monitoring wells.

All soils that are to be either landfilled or transported off site will be stored in such a manner so as not to provide surface run off to water sources. All contaminated materials (residuals in barrels etc) will be either incinerated at site or transported off site for disposal. Temporary storage will be provided for these materials to ensure no run off is entering into the surrounding environment.

Site locations for the above activities are listed in approximate areas as per site maps in Appendix B.

3.0 SAMPLING EQUIPMENT AND METHODOLOGY

Sampling equipment to be used at site will be dependent on the parameters and materials to be sampled. The following is a breakdown of the sampling equipment required for the site activities as well as the associated methodology. The *CCME Guidance Manual on Sampling, Analysis and Data Management for Contaminated Sites* will be complied with.

During all sampling episodes there is the requirement for the use of new disposable nitrile gloves for each individual sample collection to avoid the potential for cross-contamination of samples. Also all water sampling equipment will be used on a one time basis to avoid cross-contamination within samples. All bottles required for the sampling episodes will be new and no bottles will be reused for sampling purposes.

Duplicate, trip and field blanks will be required for each parameter during each sampling episode as detailed in the spreadsheet in Appendix A. A blank consists of a laboratory method blank of all analytical steps but excluding the sample. It is used to determine any laboratory background contamination or contamination for the test method. A duplicate sample is a repeat analysis of a sample within the same batch including all steps of the testing method is and used as a control to assess the precision of the test method for the sample matrix. Duplicates will be provided “blind” to the laboratory. A trip blank is a sealed sample bottle containing an inert matrix that is carried to the field and returned unopened to the laboratory. Field blanks are sealed sample bottles containing an inert matrix that is carried into the field and opened under the same conditions and length of time as the regular sample. It is then re-sealed and shipped to the laboratory for analysis with the other samples. This control is used to assess possible sample contamination due to sample procedure completed in the field.

Sampling frequency for blanks, trip blanks and field blanks for each parameter can be found in Appendix A.

3.1 Wastewater

The wastewater in the lagoons will be sampled on a monthly basis during the field season.

Sampling will be completed from the same areas of the lagoon to provide consistency and contents will be placed in the appropriate analytical bottles as identified by the accredited laboratory for specific chemical analysis.

3.2 Drinking Water

All sampling and analyses of the drinking water at the construction camp supply source must satisfy the Health Canada Guidelines for Canadian Drinking Water Quality.

The sampling and analysis will be provided at the water source and at the distribution source prior to consumption and continued thereafter on a weekly basis. Sampling will include the use of new bottles and the water collected will be stored in the laboratory identified bottles. A blank sample will be required every 1 in

3.3 Barrel Residues

Barrels will be sampled using disposable PVC barrel sleeves. The contents of the sleeves will then be deposited into the proper container for each parameter required. These residuals will be analysed and incinerated if possible. All residuals not slated for incineration will be stored in a water tight container and disposed of as hazardous materials.

The disposable PVC barrel sleeves will be disposed of in the appropriate landfarm after each use.

3.4 Landfarm Runoff

The runoff or ponding at the landfarm areas and the excavation areas (if required) will be removed from those areas via pump and placed in a holding tank for subsequent sampling. The tank will be sampled when it is full and again after treatment and prior to release or disposal.

3.5 Landfarm Monitoring Wells

The monitoring wells will be sampled on an annual basis at the end of each field season.

Water levels in each of the monitoring wells will be recorded using a Solinist oil/water interface probe. The instrument will be cleaned between boreholes by field rinsing/washing using a solution of bio-wash and rinsing with de-ionized water.

After monitoring and recording the above data, each monitoring well will be purged at least three well casing volumes or until field measurements for temperature, EC and pH have stabilized or until bailed dry. This will be completed using either PVC wattera tubing with foot valves or with disposable PVC bailers. The wells will be allowed to recharge and representative groundwater samples will be taken. There are various parameters to be sampled in the wells, therefore the sampling protocol will follow the *CCME Guidance Manual on Sampling, Analysis, and Data Management for Contaminated Sites* document. All samples will be placed in a laboratory-supplied container and stored in ice-chilled coolers until delivery to the laboratory.

3.6 Waste Processing and Rinsing

Rinsate from barrel and or tank cleaning will be treated on-site using an oil-water separate and filtration through an activated carbon filter. Following treatment, the water will be stored and sampled to ensure that it meets the discharge requirements defined in the specification (provided in Appendix C). Once it is confirmed that the treated wastewater meets the discharge criteria, it will be released at a location a minimum 30 m from natural drainage courses and 100 m from fish bearing waters.

4.0 SAMPLE HANDLING

All samples are to be sent to an accredited laboratory for chemical analyses and will be stored in coolers with ice to maintain the temperature below 4°C. Those samples requiring preservation will be completed as per the laboratory instructions.

4.2 Sample Identification

Sample bottles will contain a label of the accredited laboratory where the sample will be sent for chemical analyses. Just prior to collecting each individual sample, each label of the container/s will be marked with the appropriate site location, date, chemical analysis required and the name and company of the sampler. A permanent water resistant marker will be used to label the container.

4.3 Transportation

Transportation of the samples will be in a ice chilled cooler to ensure the temperature of the samples does not exceed 4°C. Each chemical analysis will have holding times that they can not exceed. These holding times will differ depending on the chemical analysis being conducted on the samples. Transportation of the samples will be via air to the accredited laboratory for chemical analysis. Please note that some of the analytical holding times can not be met (i.e. pH) and will be conducted at the site using pH pens or alternatively, meters that will enable on site field testing with some accuracy.

5.0 LABORATORY ANALYSES

Chemical analytical will be conducted by Maxxam Analytics Inc. who are accredited by the Canadian Associated for Environmental Analytical Laboratories (CAEAL). Verification of their accreditation can be provided if required.

Detection limits is predetermined by the laboratory and will be below the recommended criteria limits. Analytical methodology will be included in the laboratory chemical findings.

6.0 REFERENCES

1. Indian and Northern Affairs Canada and Northwest Territories Water Board, *Quality Assurance (QA) and Quality Control (QC) Guidelines for Use by Class "B" Licensees in Collecting Representative Water Samples in the Field and for Submission of a QA/QC Plan*, 1996.

2. Public Works and Government Services Canada, *DEW Line Clean Up Project FOX-C: Ekalugad Fiord*, May 2005.

3. Public Works and Government Services Canada, *DEW Line Site Restoration FOX-C: Ekalugad Fiord*, March 2005.

APPENDIX A

CHEMICAL ANALYSIS SPREADSHEET

Material	Sampling Frequency and Location	Blank		Control standard		Reference material		Duplicate		Fortified sample		Trip blank		Field blank	
		Frequency	Min. per batch	Frequency	Min. per batch	Frequency	Min. per batch	Frequency	Min. per batch	Frequency	Min. per batch	Frequency	Min. per trip	Frequency	Min. per trip
Wastewater (Sewage)															
Oil & Greases	Monthly during field season	1/24	1	1/36	1	1/20	1	1/12	NA	NA	NA	1/12	1	1/12	1
pH	Monthly during field season	1/20	1	NA	NA	1/20	1	1/10	NA	NA	NA	NA	NA	NA	NA
TSS	Monthly during field season	1/24	1	NA	NA	1/24	1	1/8	NA	NA	NA	NA	NA	NA	NA
BOD	Monthly during field season	1/24	1	NA	NA	1/24	1	1/8	NA	NA	NA	NA	NA	NA	NA
Fecal coliforms	Monthly during field season	1/10	1	1/10	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Drinking water															
Copper	weekly	1/20	1	NA	NA	1/20	1	1/20	NA	1/20	NA	1/12	1	1/12	1
Iron	weekly	1/20	1	NA	1	1/20	1	1/20	---	1/20	---	1/12	1	1/12	1
Lead	weekly	1/20	1	NA	1	1/20	1	1/20	---	1/20	---	1/12	1	1/12	1
Manganese	weekly	1/20	1	NA	NA	1/20	1	1/20	NA	1/20	NA	1/12	1	1/12	1
Mercury	weekly	1/20	1	NA	NA	1/20	1	1/20	NA	1/20	NA	1/12	NA	1/12	NA
Cadmium	weekly	1/20	1	NA	NA	1/20	1	1/20	NA	1/20	NA	1/12	1	1/12	1
Chromium	weekly	1/20	1	NA	NA	1/20	1	1/20	NA	1/20	NA	1/12	NA	1/12	NA
Zinc	weekly	1/20	1	NA	NA	1/20	1	1/20	NA	1/20	NA	1/12	NA	1/12	NA
pH	weekly	1/20	1	NA	1	1/20	NA	1/20	NA	1/20	NA	1/12	NA	1/12	NA
Total Suspended Solids	weekly	1/24	1	NA	NA	1/24	1	1/8	NA	NA	NA	NA	NA	NA	NA
Nitrate	weekly	1/20	1	NA	NA	1/20	1	1/20	NA	1/20	NA	1/12	NA	1/12	NA
Nitrite	weekly	1/20	1	NA	NA	1/20	1	1/20	NA	1/20	NA	1/12	NA	1/12	NA
Faecal Coliforms	weekly	1/10	1	1/10	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Waste processing - Retention tank (including solvent rinsate)															
pH	When Tank is full and after treatment	1/20	1	NA	NA	1/20	1	1/10	NA	NA	NA	NA	NA	NA	NA
Oil & Greases	When Tank is full and after treatment	1/24	1	1/36	1	1/20	1	1/12	---	---	---	1/12	1	1/12	1
As	When Tank is full and after treatment	1/20	1	NA	NA	1/20	1	1/20	NA	1/20	NA	1/12	1	1/12	1
Cr, Co, Cu, Pb, Ni, Zn	When Tank is full and after treatment	1/20	1	NA	NA	1/20	1	1/20	NA	1/20	NA	1/12	1	1/12	1
Hg	When Tank is full and after treatment	1/20	1	NA	NA	1/20	1	1/20	NA	1/20	NA	1/12	1	1/12	1
BTEX	When Tank is full and after treatment	1/24	1	1/36	1	1/20	1	1/12	---	---	---	1/12	1	1/12	1
Chlorinated phenols	When Tank is full and after treatment	1/24	1	1/36	1	1/20	1	1/12	---	---	---	1/12	1	1/12	1
PCBs	When Tank is full and after treatment	1/20	1	NA	NA	1/20	1	1/20	NA	1/20	NA	1/12	1	1/12	1
CCME TPH F1	When Tank is full and after treatment	1/20	1	NAV	1	1/20	1	1/20	---	1/20	1	1/12	1	1/12	1
CCME TPH F2-F4	When Tank is full and after treatment	1/20	1	NAV	1	1/20	1	1/20	---	1/20	1	1/12	1	1/12	1
Testing of Liquids retained by Adsorbant (for disposal)															
PCBs	When container is full	1/20	1	NA	NA	1/20	1	1/20	NA	NA	NA	1/12	1	1/12	1
Cl	When container is full	1/20	1	NA	NA	1/20	1	1/20	NA	NA	NA	1/12	1	1/12	1
Cd, Cr, Pb	When container is full	1/20	1	NA	NA	1/20	1	1/20	NA	NA	NA	1/12	1	1/12	1
Ponded water (includes water from landfill facilities and resulting from excavation areas)															
pH	When Tank is full and after treatment	1/20	1	NA	NA	1/20	1	1/10	NA	NA	NA	NA	NA	NA	NA
Oil & Greases	When Tank is full and after treatment	1/24	1	1/36	1	1/20	1	1/12	---	---	---	1/12	1	1/12	1
As	When Tank is full and after treatment	1/20	1	NA	NA	1/20	1	1/20	NA	1/20	NA	1/12	1	1/12	1
Cd, Cr, Co, Cu, Pb, Ni, Zn	When Tank is full and after treatment	1/20	1	NA	NA	1/20	1	1/20	NA	1/20	NA	1/12	1	1/12	1
BTEX	When Tank is full and after treatment	1/24	1	1/36	1	1/20	1	1/12	---	---	---	1/12	1	1/12	1
Chlorinated phenols	When Tank is full and after treatment	1/24	1	1/36	1	1/20	1	1/12	---	---	---	1/12	1	1/12	1
PCBs	When Tank is full and after treatment	1/20	1	NA	NA	1/20	1	1/20	NA	1/20	NA	1/12	1	1/12	1
Confirmatory testing following removal of PCB contaminated concrete (>50 mg/kg)															
PCBs	One composite for entire surface	1/20	1	NA	NA	1/20	1	1/20	NA	1/20	NA	1/12	1	1/12	1
Testing for the classification of hazardous contaminated soil for shipment south															
PCBs	1 Composite per container	1/20	1	NA	NA	1/20	1	1/20	NA	1/20	NA	1/12	1	1/12	1
Metals	1 Composite per container	1/20	1	NA	NA	1/20	1	1/20	NA	1/20	NA	1/12	1	1/12	1
Chlorinated phenols	1 Composite per container	1/24	1	1/36	1	NA	NA	1/12	---	---	---	1/12	1	1/12	1
CCME TPH F1	1 Composite per container	1/20	1	NAV	1	1/20	1	1/20	---	1/20	1	1/12	1	1/12	1
CCME TPH F2-F4	1 Composite per container	1/20	1	NAV	1	1/20	1	1/20	---	1/20	1	1/12	1	1/12	1
pH	1 Composite per container	1/20	1	NA	NA	1/20	1	1/10	NA	NA	NA	NA	NA	NA	NA
BTEX	1 Composite per container	1/24	1	1/36	1	1/20	1	1/12	---	---	---	1/12	1	1/12	1
Leachate extraction testing of the solid residual material resulting from the incineration of barrel contents, as required															
PCBs	1 composite per incineration event	1/20	1	NA	NA	1/20	1	1/20	NA	1/20	NA	1/12	1	1/12	1
Metals	1 composite per incineration event	1/20	1	NA	NA	1/20	1	1/20	NA	1/20	NA	1/12	1	1/12	1
Testing associated with the identification and characterization of soil and waste material excavated from landfill areas															
As	1 composite from 5 sub-samples from each sub-area	1/20	1	NA	NA	1/20	1	1/20	NA	1/20	NA	1/12	1	1/12	1
Hg	1 composite from 5 sub-samples from each sub-area	1/20	1	NA	NA	1/20	1	1/20	NA	1/20	NA	1/12	1	1/12	1
Cd, Cr, Co, Pb, Zn	1 composite from 5 sub-samples from each sub-area	1/20	1	NA	NA	1/20	1	1/20	NA	1/20	NA	1/12	1	1/12	1
PCBs	1 composite from 5 sub-samples from each sub-area	1/20	1	NA	NA	1/20	1	1/20	NA	1/20	NA	1/12	1	1/12	1
Chlorinated phenols	1 composite from 5 sub-samples from each sub-area	1/24	1	1/36	1	1/20	1	1/12	---	---	---	1/12	1	1/12	1
CCME TPH F1	1 composite from 5 sub-samples from each sub-area	1/20	1	NAV	1	1/20	1	1/20	---	1/20	1	1/12	1	1/12	1
CCME TPH F2-F4	1 composite from 5 sub-samples from each sub-area	1/20	1	NAV	1	1/20	1	1/20	---	1/20	1	1/12	1	1/12	1

BTEX	1 composite from 5 sub-samples from each sub-area	1/24	1	1/36	1	1/20	1	1/12	---	---	---	1/12	1	1/12	1
Testing associated with the identification and characterization of hazardous waste materials (Barrel Content)															
PCBs	1 per barrel	1/20	1	NA	NA	1/20	1	1/20	NA	1/20	NA	1/12	1	1/12	1
Metals	1 per barrel	1/20	1	NA	NA	1/20	1	1/20	NA	1/20	NA	1/12	1	1/12	1
Chlorinated phenols	1 per barrel	1/24	1	1/36	1	1/20	1	1/12	---	---	---	1/12	1	1/12	1
CCME TPH F1	1 per barrel	1/20	1	NAV	1	1/20	1	1/20	---	1/20	1	1/12	1	1/12	1
CCME TPH F2-F4	1 per barrel	1/20	1	NAV	1	1/20	1	1/20	---	1/20	1	1/12	1	1/12	1
pH	1 per barrel	1/20	1	NA	NA	1/20	1	1/10	NA	NA	NA	NA	NA	NA	NA
BTEX	1 per barrel	1/24	1	1/36	1	1/20	1	1/12	---	---	---	1/12	1	1/12	1
Testing of landfarm soil															
CCME TPH F1	Monthly during field season	1/20	1	NAV	1	1/20	1	1/20	---	1/20	1	1/12	1	1/12	1
CCME TPH F2-F4	Monthly during field season	1/20	1	NAV	1	1/20	1	1/20	---	1/20	1	1/12	1	1/12	1
BTEX	Monthly during field season	1/24	1	1/36	1	1/20	1	1/12	---	---	---	1/12	1	1/12	1
Moisture	Monthly during field season	1/24	1	1/36	1	1/20	1	1/12	---	---	---	1/12	1	1/12	1
C:N:P ratio	Monthly during field season	1/24	1	1/36	1	1/20	1	1/12	---	---	---	1/12	1	1/12	1
pH	Monthly during field season	1/24	1	1/36	1	1/20	1	1/12	---	---	---	1/12	1	1/12	1
Testing of landfarm runoff															
CCME TPH F1	As required, prior to discharge	1/20	1	NAV	1	1/20	1	1/20	---	1/20	1	1/12	1	1/12	1
CCME TPH F2-F4	As required, prior to discharge	1/20	1	NAV	1	1/20	1	1/20	---	1/20	1	1/12	1	1/12	1
pH	As required, prior to discharge	1/20	1	NA	NA	1/20	1	1/10	NA	NA	NA	NA	NA	NA	NA
BTEX	As required, prior to discharge	1/24	1	1/36	1	1/20	1	1/12	---	---	---	1/12	1	1/12	1
Testing of landfarm monitoring wells															
CCME TPH F1	Annually at the end of each field season	1/20	1	NAV	1	1/20	1	1/20	---	1/20	1	1/12	1	1/12	1
CCME TPH F2-F4	Annually at the end of each field season	1/20	1	NAV	1	1/20	1	1/20	---	1/20	1	1/12	1	1/12	1
pH	Annually at the end of each field season	1/20	1	NA	NA	1/20	1	1/10	NA	NA	NA	NA	NA	NA	NA
BTEX	Annually at the end of each field season	1/24	1	1/36	1	1/20	1	1/12	---	---	---	1/12	1	1/12	1
Testing of landfill monitoring wells															
PCBs	Annually at the end of each field season	1/20	1	NA	NA	1/20	1	1/20	NA	1/20	NA	1/12	1	1/12	1
Metals	Annually at the end of each field season	1/20	1	NA	NA	1/20	1	1/20	NA	1/20	NA	1/12	1	1/12	1
CCME TPH F1	Annually at the end of each field season	1/20	1	NAV	1	1/20	1	1/20	---	1/20	1	1/12	1	1/12	1
CCME TPH F2-F4	Annually at the end of each field season	1/20	1	NAV	1	1/20	1	1/20	---	1/20	1	1/12	1	1/12	1
pH	Annually at the end of each field season	1/20	1	NA	NA	1/20	1	1/10	NA	NA	NA	NA	NA	NA	NA
BTEX	Annually at the end of each field season	1/24	1	1/36	1	1/20	1	1/12	---	---	---	1/12	1	1/12	1
Oil & Grease	Annually at the end of each field season	1/24	1	1/36	1	1/20	1	1/12	---	---	---	1/12	1	1/12	1
Explosive vapour testing for tanks and barrels with unknown contents															
%LEL, presence/absence	1 measurement per barrel	NA	NA	NA	NA	1/Week	NA	NA	NA						
Air monitoring - building demolition															
Particulates	Accumulation over 48 hours during demolition	NA	NA	NA	NA	NA	NA	NA	NA						
Asbestos	For Type 2 and 3, 1 per day	NA	NA	NA	NA	NA	NA	NA	NA						
Landfill development															
Air Monitoring - Particulates	Accumulation over 48 hours during construction														
Compaction to 95 % max dried density	As required	NA	NA	NA	NA	NA	NA	NA	NA						
Seive analysis for above	1 per 1,000 cubic meter	NA	NA	NA	NA	NA	NA	NA	NA						

Glossary

Blank	Laboratory method blank consisting of all analytical steps but excluding the sample. It is used to determine any laboratory background or contamination for the test method.
Control standard	An analytical instrument calibration standard from another source than that used to calibrate the instrument. This control is used to verify the instrumental calibration.
Reference material	Can be a laboratory made or a purchased certified reference material. It is used to assure the accuracy of the test method against known concentrations. It can also be used to monitor laboratory bias.
Duplicate	Repeat analysis of a sample within the same batch; including all steps of the testing method. This control is used to assess the precision of the test method for the sample matrix.
Fortified sample	This is a sample where a known concentration of the analyte of interest was added. After fortification (spiking) it is analyzed as a regular sample. This control assess the accuracy (recovery) of the method directly in the sample matrix. It also helps the identification of matrix effect.
Trip blank	A trip blank is a sealed sample bottle containing an inert matrix. It is carried to the field and returned to the laboratory for analysis. Those bottles are sealed in the laboratory prior to the field trip and are returned un-opened to the laboratory. This control helps to identify any possible sample contamination during shipping and handling from the laboratory to the field and back to the laboratory.
Field Blank	A field blank is a sealed sample bottle containing an inert matrix. It is carried to the field and opened under the same condition and for the same length of time as regular sample during sampling. It is then re-sealed and shipped to the laboratory with other samples for analysis. This control is used to assess possible sample contamination due to the sampling procedure used in the field.
Frequency	Controls are analyzed in a fixed frequency as required by our laboratory accreditation program. This frequency is expressed as 1/n for one control for every n samples.
Batch	A batch consist of one series of sample extraction, preparation and analysis at one specific time. A batch can consist of 1 sample or may consist of a large number of samples. Some controls are batch mandatory and are processed at least oncem. per batch even for batches of 1 sample.
Trip	For the purpuse of quality control, a trip is defined as a sampling event. A sampling event can last as little as one day and as long as months.

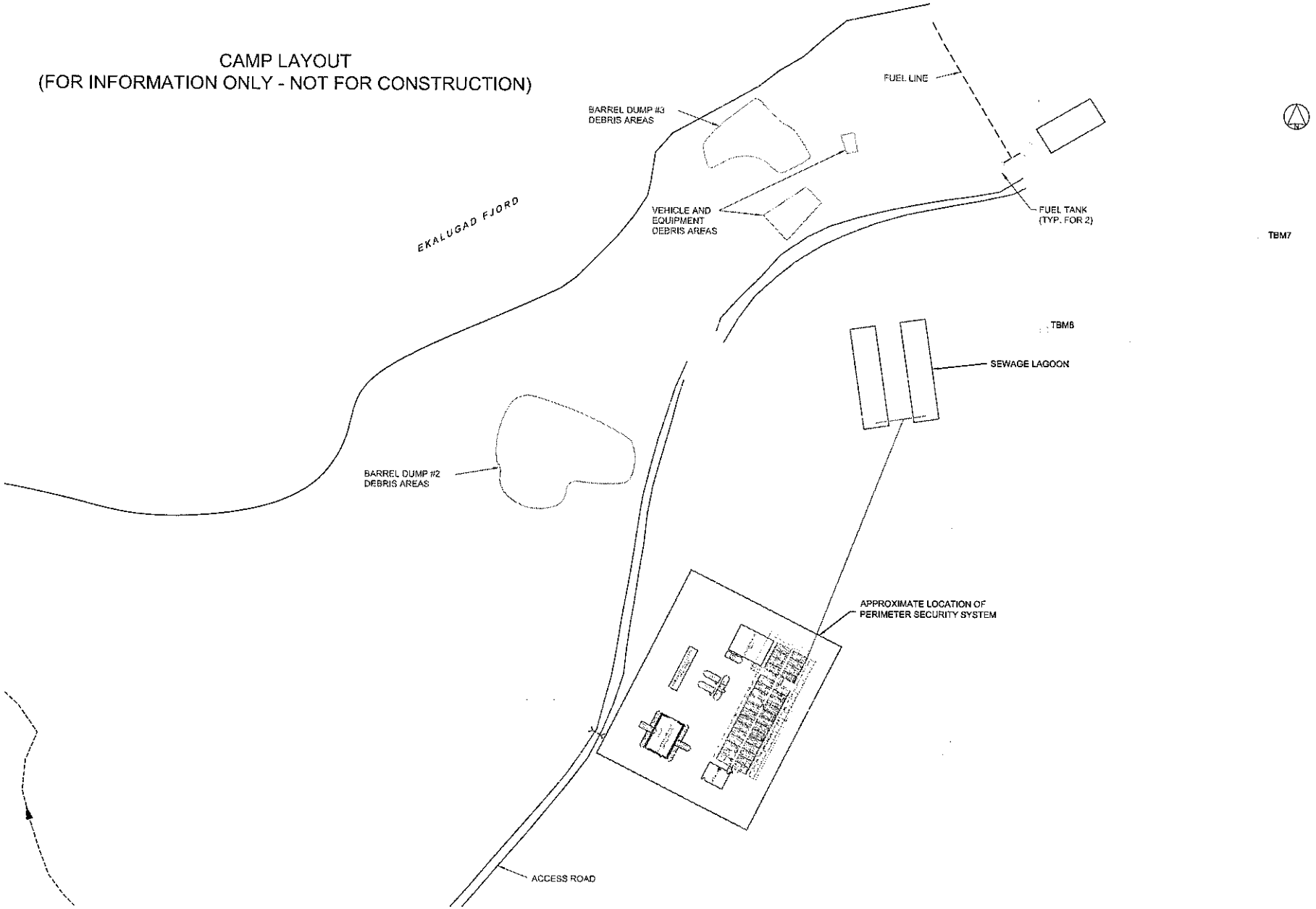
NA = Not applicable

NAV = Information not available at this time

APPENDIX B

SITE MAPS

CAMP LAYOUT
(FOR INFORMATION ONLY - NOT FOR CONSTRUCTION)



APPENDIX C

WASTE WATER DISCHARGE INFORMATION

UMA | AECOM

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Mr. Brad Thompson, P.Eng.
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VIA EMAIL: Brad.Thompson@pwgsc.gc.ca

Dear Mr. Thompson:

Re: Restoration of FOX-C and CAM-F Intermediate DEW Line Sites
Application for a Water License from the Nunavut Water Board (NWB)
Response to NWB Outstanding Issues for the Water License Applications

UMA Engineering Ltd. (UMA) has been retained to provide services to support the application for Water Use Licenses for the environmental restoration at the CAM-F, Sarcpa Lake and FOX-C, Ekalugad Fiord Intermediate DEW Line sites. The Nunavut Water Board (NWB) has submitted a letter, dated May 26, 2006, outlining outstanding issues for these water license applications. The purpose of this letter is to provide a response to the NWB issues. This response letter is structured to follow the format of the NWB letter.

RESPONSES RELATIVE TO BOTH APPLICATIONS (1BR-SAR & 1BR-EKA)

1. Justificiation of the Wastewater Discharge Criteria:

a. The Environment Canada reference document: "An Approach for Assessing and Managing Wastewater Effluent Quality for Federal Facilities" (2000) has been pulled from circulation; however, this does not affect the wastewater discharge criteria, as there are other guidelines to back up each parameter (see response to 1 d).

b. The Wastewater Discharge Criteria parameters are the same for both the 1982 and 1992. The guideline comparison table (see response to 1 d) has been updated to reference the 1992 Guidelines.

c. Attached to this letter are the specification pages with the corresponding Wastewater Discharge Criteria from the current DND Clean Up Sites (FOX-5, FOX-M and DYE-M).

d. I have updated and attached Table 1 – Comparison of Project Wastewater Criteria to other Canadian and Northern Standards – to show that each parameter has a match to an existing environmental guideline.

2. PWGSC to respond to QA/QC plan issues.

RESPONSES RELATIVE TO APPLICATION 1BR-SAR

3. PWGSC to provide response for the fuel storage facility based on communications with the Contractor.

RESPONSES RELATIVE TO APPLICATION 1BR-EKA

1. The total requirement for water, including camp and construction activities, is estimated at 30 cubic metres per day.

2. The volume of solid waste that will be generated by the camp is estimated at 150 kg per day. All combustible waste will be incinerated and the ash/residual will be disposed of in the on-site non-hazardous waste landfill.

3. It is not expected that there will be any hazardous waste generated from the camp and laboratory. Any hazardous waste generated from construction, camp or laboratory will be containerized appropriately and shipped off-site for disposal at a licensed hazardous waste disposal facility.

4. PWGSC to provide response for the fuel storage areas based on communications with the Contractor.

5. PWGSC / INAC to forward Landfarm Questionnaire Response.

6. PWGSC to provide response for wastewater storage based on communications with the Contractor.

OTHER ISSUES

Total Petroleum Hydrocarbons (TPH) and BTEX constituents have not been included in the Wastewater Discharge Criteria for CAM-F, FOX-C or any of the DND DEW Line Sites.

The hydrocarbon contamination at the FOX-C and CAM-F sites are typically the result of diesel fuel and/or lubricating oil spills. These hydrocarbon products consist of heavy end hydrocarbon chains, rather than the lighter end, such as the BTEX constituents, and are not very soluble in water. In addition, the hydrocarbon contamination at these sites occurred during the operational timeframe (from the mid-1950's to the mid-1960's) before the sites were closed. As such, there would be little, if any, BTEX present in the soils, as they are easily volatilized. Therefore, the most meaningful and practical parameter to monitor in the wastewater would be oil and grease. Previously, we have monitored this by the presence/absence of a visible sheen. On occasion, the water has been sampled for oil and grease. The visible sheen is an indication of phase-separated hydrocarbons and can easily be dealt with by skimming the surface or filtering the wastewater with a hydrophobic, sorbent boom or blanket.

For the PCB concentration in wastewater, we propose a criterion of 1 ppm (mg/L), which is derived from the Chlorobiphenyls Regulations (1991). Section 5 (2 b) from this regulation states that: "the concentration that may be released is 5 ppm by weight of the liquid in respect of an application to a road surface". We have chosen the criteria of 1.0 mg/L to provide a slightly more conservative value than CEPA requires.

For the zinc concentration in wastewater, we propose to lower the criteria from 1 mg/L to 0.5 mg/L to match the 1992 NWT Guidelines for Municipal Wastewater Discharge.

CLOSURE

We trust this meets your current requirements. If you require additional information or clarification, please call me on my direct line at (780) 486-7624.

Respectfully Submitted,

UMA Engineering Ltd.

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BWF:js

cc: Jared Buchko, PWGSC - via email: jared.buchko@pwgsc.gc.ca

Encl: Table 1 - Comparison of Project Wastewater Criteria to other Canadian and Northern Standards
Wastewater Discharge Criteria for FOX-5, FOX-M and DYE-M
Water Quality Results from the Site Clean Up at PIN-3, Lady Franklin Point

Table 1: Comparison of Project Wastewater Criteria to other Canadian and Northern Standards

Parameter	Construction Wastewater Discharge Criteria (µg/L)	NWT Guideline, 1992 (µg/L)	Nunavut Effluent Guidelines, Sept. 2002 (µg/L)	CCME Interim Irrigation Criteria, 1991 (µg/L)	Chlorobiphenols Regulations (1991)
pH	6 - 9 (unitless)	N.G.	N.G.	6.5 - 9.0 (unitless)	N.G.
Oils and Grease	5000	5000 / none visible	N.G.	N.G.	N.G.
Arsenic (total)	100	50	500	100	N.G.
Cadmium (dissolved)	10	5	1.7	10	N.G.
Chromium (dissolved)	100	100	890 (trivalent)	100	N.G.
Cobalt (dissolved)	50	100	N.G.	50	N.G.
Copper (dissolved)	200	200	N.G.	200 - 1000	N.G.
Lead (dissolved)	50	50	N.G.	200	N.G.
Mercury (dissolved)	0.6	0.6	10	N.G.	N.G.
Nickel (dissolved)	200	300	N.G.	200	N.G.
PCB (total)	1000	N.G.	N.G.	N.G.	5000
Zinc (dissolved)	500	500	3000	N.G.	N.G.
[1] Guideline numbers derived from Table 4.2					
[2] Guideline numbers derived from Table 6.2 "Fresh Water Maximum Concentration"					

Parameter	Maximum Allowable Level
pH	6 to 9
Oil and Grease	5 mg/L & None Visible
Arsenic (total)	100 µg/L
Cadmium (dissolved)	10 µg/L
Chromium (total)	100 µg/L
Cobalt (dissolved)	50 µg/L
Copper (dissolved)	200 µg/L
Lead (dissolved)	50 µg/L
Mercury (total)	0.6 µg/L
Nickel (dissolved)	200 µg/L
PCB: discharge to barren area	50 µg/L
PCB: discharge to vegetated area	5 µg/L
Phenols	20 µg/L
Zinc (total)	1,000 µg/L

.2 Dispose of any liquid effluent not conforming to these guidelines as hazardous material in accordance with Section 02090 - Hazardous Waste Material.

5 Sewage Disposal Requirements

.1 An existing sewage lagoon services the Hamlet of Qikiqtarjuaq. The Contractor is required to use this sewage lagoon for disposal of all sewage related to this contract, unless capacity or other issues disallow use.

.2 Comply with the requirements of this section, unless written application has been made to and written permission has been received from the Hamlet. Provide proof of same to Engineer.

.3 If capacity or other issues disallow use of Hamlet's sewage lagoon, discharge sewage into two temporary lagoons within the DND reserve. Provide the necessary piping to ensure the lagoons can be operated independently.

.4 Size each of the two temporary lagoons to provide capacity for 45 days of wastewater storage or one-half the duration of the construction season, whichever is less. The maximum fluid depth shall not exceed one metre.

.5 Locate the temporary lagoon area:

.1 A minimum of 100 m from the construction camp, Engineer's Office, and/or other temporary facilities.
.2 A minimum of 100 m from drainage paths.
.3 A minimum of 450 metres from water bodies supporting aquatic life.
.4 Downwind of the construction camp based on the prevailing wind direction.
.5 Within the DND reserve.

.2 Submit one complete copy of all submittals and agency approvals to the Engineer.

4 Wastewater Discharge Criteria

.1 Wash water, meltwater collection, rinse water resulting from the cleaning of fuel tanks and pipelines, and/or any other liquid effluent stream shall be released onto the ground at a location that is a minimum of 30 metres from natural drainage courses, and shall conform to the following guidelines:

Parameter	Maximum Allowable Level
pH	6 to 9
Oil and Grease	None Visible
Arsenic (total)	100 µg/L
Cadmium (dissolved)	10 µg/L
Chromium (total)	100 µg/L
Cobalt (dissolved)	50 µg/L
Copper (dissolved)	200 µg/L
Lead (dissolved)	50 µg/L
Mercury (total)	0.6 µg/L
Nickel (dissolved)	200 µg/L
PCB: discharge to barren area	50 µg/L
PCB: discharge to vegetated area	5 µg/L
Phenols	20 µg/L
Zinc (total)	1,000 µg/L

.2 Dispose of any liquid effluent not conforming to these guidelines as hazardous material in accordance with Section 02090 - Hazardous Waste Material.

5 Sewage Disposal Requirements

.1 An existing sewage lagoon services the Hamlet of Hall Beach. The use of this lagoon is subject to the Contractor receiving approval from the Hamlet.

.2 Comply with the requirements of this section, unless written application has been made to and written permission has been received from the Hamlet. Provide proof of same to Engineer.

.3 Comply with the requirements of the Land Use Permit, the Water License and the Public Health Act (Nunavut).

.4 If an existing sewage lagoon is not available discharge sewage into two temporary lagoon areas constructed within the DND reserve. Provide the necessary piping to

Parameter	Maximum Allowable Concentration
pH	6 to 9
Oil and Grease	5 mg/L and None Visible
Arsenic (total)	100 µg/L
Cadmium (dissolved)	10 µg/L
Chromium (total)	100 µg/L
Cobalt (dissolved)	50 µg/L
Copper (dissolved)	200 µg/L
Lead (dissolved)	50 µg/L
Mercury (total)	0.6 µg/L
Nickel (dissolved)	200 µg/L
PCB: discharge to barren area	50 µg/L
PCB: discharge to vegetated area	5 µg/L
Phenols	20 µg/L
Zinc (total)	1,000 µg/L

.2 Dispose of any liquid effluent not conforming to these guidelines as hazardous material in accordance with Section 02090 - Hazardous Waste Material.

5 Sewage Disposal Requirements

.1 Comply with the requirements of the Land Use Permit, the Water License and the Public Health Act (Nunavut).

.2 For each camp location, discharge sewage into two temporary lagoon areas constructed within the DND reserve. Provide the necessary piping to ensure the lagoons can be operated independently.

.3 Size each of the lagoons to provide capacity for 45 days of wastewater storage or one half the duration of the construction season, whichever is less. The maximum fluid depth shall not exceed one metre.

.4 Locate the temporary lagoon area:

.1 A minimum of 100 m from the construction camp, Engineer's Office, and/or other temporary facilities.
.2 A minimum of 100 m from drainage paths.
.3 A minimum of 450 metres from water bodies supporting aquatic life.
.4 Downwind of the construction camp based on the prevailing wind direction.
.5 Within the DND reserve.

.5 Treat all sewage to meet the following Minimum Sewage Discharge Criteria:

Parameter	Maximum Average Concentration
Oil and Grease	None Visible
pH	6 to 9
BODs	120 mg/L
Total Suspended Solids	180 mg/L
Faecal Coliforms	10 000 CFU/dL

Table 2: Summary of 2003 Water Quality Results at PIN-3

Parameter	pH	Oil & Grease	Total Arsenic	Dissolved Cadmium	Total Chromium	Dissolved Cobalt	Dissolved Copper	Dissolved Lead	Total Mercury	Dissolved Nickel	Total Zinc	PCBs	Phenols
Units	pH	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	ug/L	mg/L	mg/L	ug/L	ug/L
MAC[1]	6.0 - 9.0	No visible sheen	0.1	0.01	0.1	0.05	0.2	0.05	0.6	0.2	1	5 or 50	20
Beach POL Pad (12408631 E, 7596518 N)													
30/06/2003	8.22	None visible	<0.003	<0.001	<0.005	<0.003	0.006	<0.010	<0.4	<0.005	0.018	<3.0	<1.0
Sewage Outfall													
06/07/2003	7.21	None visible	0.004	<0.001	<0.005	<0.003	0.005	<0.010	<0.4	<0.005	0.036	<3.0	<1.0
West Module Train Holding Pond - North (12409012 E, 7598256 N)													
08/07/2003	7.48	None visible	<0.003	<0.001	<0.005	<0.003	0.005	<0.010	<0.4	<0.005	0.014	<3.0	<1.0
West Module Train Holding Pond - South (12409012 E, 7598256 N)													
08/07/2003	7.25	None visible	<0.003	<0.001	<0.005	<0.003	<0.005	<0.010	<0.4	<0.005	<0.010	<3.0	<1.0
Field Blank													
08/07/2003	6.59	None visible	<0.003	<0.001	<0.005	<0.003	<0.005	<0.010	<0.4	<0.005	<0.010	<3.0	<1.0
Travel Blank													
08/07/2003	5.40	None visible	<0.003	<0.001	<0.005	<0.003	<0.005	<0.010	<0.4	<0.005	<0.010	<3.0	<1.0
East Module Train Holding Pond - North (12409240 E, 7598259 N)													
10/07/2003	7.48	None visible	<0.003	<0.001	<0.005	<0.003	0.007	<0.010	<0.4	<0.005	0.025	<3.0	<1.0
East Module Train Holding Pond - North (12409240 E, 7598259 N)													
10/07/2003	7.92	None visible	<0.003	<0.001	<0.005	<0.003	0.006	<0.010	<0.4	<0.005	<0.010	<3.0	<1.0
7/10/2003*	8.01	None visible	<0.003	<0.001	<0.005	<0.003	0.008	<0.010	<0.4	<0.005	0.010	<3.0	<1.0
Beach POL Pad Excavation #1 (12408653 E, 7596461 N)													
05/08/2003	8.01	None visible	0.004	<0.001	0.005	<0.003	0.006	<0.010	<0.4	<0.005	<0.010	<3.0	1.0
Beach POL Pad Excavation #2 (12408630 E, 7596450 N)													
05/08/2003	7.95	None visible	0.005	<0.001	<0.005	<0.003	0.007	<0.010	<0.4	<0.005	0.010	<3.0	1.9
Hanger Excavation (12408221 E, 7597322 N)													
05/08/2003	8.06	None visible	<0.003	<0.001	<0.005	<0.003	0.006	<0.010	<0.4	<0.005	0.040	<3.0	<1.0

NOTE: [1] Target Maximum Acceptable Concentrations as proposed in the Monitoring Plan
5.4 Exceeds Guideline Criteria
* Duplicate Sample