Public Works and Government Services Canada

ISSUED FOR USE

ANALYTICAL SAMPLING PLAN
CAPE CHRISTIAN, NT

E22101581

June 2009

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1.0 SUMMARY OF ANALYTICAL TESTING

EBA Engineering Consultants Ltd. (the Engineer), and the contractor have specific responsibilities for the analytical testing for the Cape Christian Environmental Site Remediation.

The testing requirements for the Engineer and Contractor are summarized below. A detailed sampling program for EBA's testing is presented in the subsequent sections.

1.1 ENGINEER'S TESTING

1.1.1 Confirmatory or Delineation Soil Testing

Testing will be done according to the contaminant of concern. Three possible suites will be analyzed.

- Hydrocarbons (PHC): F1 to F4
- Metals: arsenic, cadmium, chromium, cobalt, copper, lead, mercury, nickel, zinc
- PCBs

1.1.1 Classification of Hazardous Contaminated Soil for Licensed Soil Disposal Facility Acceptance Requirements

The contractor is responsible for the testing for all testing of hazardous waste materials in accordance for packaging, transport and off-site disposal. It is assumed that engineer will only sample for confirmatory testing. Duplicate samples will be collected on 50% of the samples. It is proposed to test 25% of the duplicate samples. Testing will be done for the contaminant of concern.

1.1.2 Barrel Contents – For Characterization of Barrel Contents for Incineration Requirements

- DEW Line Barrel Protocol: flashpoint (conducted first), glycols, alcohols, PCBs, chlorine cadmium, chromium and lead.

1.1.3 Leachate Extraction of Solid Residual Material from Barrel Contents Extraction

- Leachable metals: arsenic, cadmium, chromium, cobalt, copper, lead, mercury, nickel, zinc
- Leachable BTEX and PAHs

1.1.4 Identification of Hazardous Material

- Hazmat testing will be done per the contaminant of concern i.e. Asbestos Containing Material (ACM), lead paint, and PCB in paint.

1.1.5 Testing for Quality Assurance

- Testing for quality assurance includes both quality assurance of the engineers testing, and testing to confirm contractor testing.
- Quality assurance for the Engineer's sampling will include duplicate sampling and testing of every 10th sample.
- Quality assurance of Contractor's sampling: The Contractor's sampling is to include testing for QA/QC purposes. The Engineer's role will be to verify that that the samples and QA samples are being taken. The engineer will duplicate sample at their discretion. The engineer will also duplicate sample the soils for off site disposal as described above.

1.2 CONTRACTOR'S TESTING

1. Testing of Potable Water.
2. Testing of hazardous waste materials for packaging transport and off-site disposal.
3. Testing solvent rinse used for barrel processing.
4. Testing for disposal of absorbent and filters, etc., used for decontamination, cleaning, cleaning and barrel processing.
5. Testing water from all dewatering operations.
6. Testing of vapour associated with degassing of tanks.
7. Leachate testing of solid residual from incineration of clean wood.
8. Sewage Effluent Testing.
9. Wash water from cleaning activities including barrel washing and equipment decontamination.
10. Testing required as per permits issued for the work.
11. Testing for dewatering and sewage effluent should be carried out as per the water licence as listed Tables 1 and 2.

TABLE 1 WATER LICENCE DISCHARGE WATER CRITERIA	
Parameter	**Maximum Allowable Concentration (µg/L)**
pH	6 to 9 (pH units)
Oil and Grease	5000
Arsenic (total)	100
Cadmium (dissolved)	10
Chromium (dissolved)	100
Cobalt (dissolved)	50
Copper (dissolved)	200
Lead (dissolved)	50
Mercury (total)	0.6
Nickel (dissolved)	200
PCB (total)	1000
Phenols	20
Zinc (total)	500

TABLE 2 WATER LICENCE SEWAGE DISPOSAL DISCHARGE CRITERIA	
Parameter	**Maximum Average Concentration**
BOD	120 mg/L
Total Suspended Solids	180 mg/L
Faecal Coliforms	10,000 CFU/1000 ml
pH	6 to 9 (pH units)
Oil and Grease	No visible sheen

2.0 SOIL CONFIRMATORY TESTING

2.1 AREAS REQUIRING REMEDIATION

The following areas of concern require remediation according to the remediation action plan.

AEC No.	Location Description	Comments on Delineation	Contaminants of Concern	Confirmatory Samples Required
1	Main Station Area ASTs	381 m^3 exceeds INAC PHC	PHC (F2 12,100 mg/kg)	6x6 m grid (40% tested) + perimeter (50% tested) 30 to 50 tested
2	Main Station Building North of West Wing	10 m^3 exceeds DCC II	Metals (Pb 723 mg/kg)	3x3 m grid (all tested) + perimeter (all tested) 4 to 5 tested
3	Main Station Building East of East Wing	287 m^3 exceeds INAC PHC	PHC (F2 9,370 mg/kg)	6x6 m grid (40% tested) + perimeter (50% tested) 25 to 40 tested

AEC No.	Location Description	Comments on Delineation	Contaminants of Concern	Confirmatory Samples Required
4	Main Station Building East of East Wing	18 m^3 exceeds DCC I	PCB (18 mg/kg)	3x3 m grid (all tested) + perimeter (all tested) 5 to 6 tested
5	Main Station Building East of East Wing	2 m^3 exceeds DCC II	Metals (Cd 6.9 mg/kg, Zn 1,200 mg/kg)	3x3 m grid (all tested) + perimeter (all tested 4 to 5 tested
6	Main Station Building East of East Wing	1 m^3 exceeds DCC II	Metals (Pb 290 mg/kg, Zn 4,500 mg/kg)	3x3 m grid (all tested) + perimeter (all tested) 4 to 5 tested
7	Main Station Building East of East Wing	41 m^3 exceeds DCC I	Metals (Cd 7.4 mg/kg, Zn 7,350 mg/kg)	3x3 m grid (all tested) + perimeter (all tested) 6 to 10 tested
8	Main Station Area Maintenance Garage	126 m^3 exceeds DCC II	Metals (Cd 5.9 mg/kg)	6x6 m grid (40% tested) + perimeter (50% tested) 8 to 12 tested
9	Main Station Area Maintenance Garage	160 m^3 exceeds INAC PHC	PHC F3 41,100 mg/kg)	6x6 m grid (40% tested) + perimeter (50% tested) 15 to 20 tested
10	Main Station Area Disaster Hut	1 m^3 exceeds DCC II	Metals (Cd 5.9 mg/kg)	3x3 m grid (all tested) + perimeter (all tested 4 to 5 tested
11	Beach Area Outfall	207 m^3 exceeds DCC II	Metals (Cu 273 mg/kg)	6x6 m grid (40% tested) + perimeter (50% tested) 8 to 12 tested
12	Beach Area, Worked Area	871 m^3 exceeds INAC PHC	PHC (F2 8,450 mg/kg)	6x6 m grid (40% tested) + perimeter (50% tested) 60 to 100 tested
13	Landfarm	Treating 1,700 m^3 of soil that exceeds INAC PHC	PHC	100 to 150 tests

2.2 ESTIMATED SAMPLE NUMBERS FOR CONFIRMATORY TESTING

- PHCs: 230 to 360 samples
- Metals: 38 to 54 samples
- PCBs: 5 to 6 samples
- Duplicates: 10%

2.3 SAMPLE CODING

- Prefix by AEC and Suffix by northing, easting, and depth (i.e., AEC 1-6-6-1.5)

2.4 FIELD SCREENING

- PID for PHC impacted areas

2.5 EQUIPMENT

- Sample jars supplied by laboratory
- Hand auger, scoop or similar device
- Latex gloves
- Alconox and water or similar for decontamination of samples
- Cooler and ice packs, chain of custody
- Notebook, pen or pencil
- PID
- Sample bags for vapour testing
- Munsell colour chart
- Measuring wheel or tape and pins
- Camera

2.6 METHODOLOGY – CONFIRMATORY SOIL TESTING

For each area requiring sampling, when approximate boundaries are reached, inspect first to determine whether there is evidence that further excavation is required (i.e., signs of odours, staining, etc.). Sample the soil on grid using scoop or similar device, decontaminating between sample points. Place soil in both jars and bags. Describe soil using Unified Soil Classification system and Munsell Colour Charts and other descriptors and record. Place soil in cooler and if air temperatures are greater than 5ºC ensure ice packs are used for PHC soils. Measure the headspace of the soil in the bag after 15 minutes using PID and record. Take pictures of excavation area. Fill out chain of custody and ship to laboratory as soon as possible. Follow up with laboratory within two days of shipping to ensure the shipment has been received.

3.0 BASELINE SAMPLING

3.1 AREAS REQUIRING BASELINE TESTING

Areas requiring baseline testing will include:

Baseline No.	Location Description	Tests Required – Soil	Tests Required – Water
1	Landfill	6-12 + 4-8 wells PHC: F1 to F4, metals, PCBs	4 to 8 wells, PHC F1 to F2, total and dissolved metals, routine water, PCBs
2	Landfarm	12-24 PHC: F1 to F4	
3	Barrel Processing Area	6-12 F1 to F4, metals, PCBs	Liquids 10-15 F1 to F4, metals, PCBs
4	Metal Processing Area	6-12 F1 to F4, metals, PCBs	
5	Site Roads	10-15 F1 to F4, metals, PCBs	
6	Temp Waste Storage Area	3-5 metals, PCBs	
7	Camp	3-5 F1 to F4, metals	
8	Borrow Sources	10-15 metals	

3.2 ESTIMATED SAMPLE NUMBERS FOR BASELINE TESTING

- PHCs: 43 to 80 samples soil; 14 to 23 water/liquid
- Metals: 44 to 76 samples soil; 14 to 23 water/liquid
- PCBs: 31 to 56 samples soil; 14 to 23 water/liquid
- Routine Water: 4 to 8 samples water
- Duplicates: 10%

3.3 SAMPLE CODING

- Prefix by AEC and Suffix by northing and easting if applicable (i.e., for landfill: BL-1-10-20) or suffix sequentially or appropriately if grid is not appropriate

3.4 EQUIPMENT

- Sample jars supplied by laboratory
- Hand auger, scoop or similar device
- Latex gloves
- Alconox and water or similar for decontamination of samples
- Cooler and ice packs, chain of custody
- Notebook, pen or pencil
- PID
- Sample bags for vapour testing

- Munsell colour chart
- Measuring wheel or tape and pins
- Camera
- Water level meter, pH and conductivity meter, metal filters, preservatives, bailers and rope for groundwater sampling.

3.5 METHODOLOGY

Soils

For each area requiring baseline sampling, sample the soil on grid (if applicable) using scoop or similar device, decontaminating between sample points. Place soil in both jars and bags. Label jars using proper coding. Describe soil using Unified Soil Classification system and Munsell Colour Charts and other descriptors and record. Place soil in cooler and if air temperatures are greater than 5ºC ensure ice packs are used for PHC soils. Measure the headspace of the soil in the bag after 15 minutes using PID and record. Take pictures of excavation area. Fill out chain of custody and ship to laboratory as soon as possible. Follow up with laboratory within two days of shipping to ensure the shipment has been received.

Groundwater

Install wells as per specification and log soil (include depth and description of permafrost and soil moisture conditions) and well construction details (screen and solid length, stickup, depth, bentonite and screen sand intervals, etc.) to ensure proper placement of well. Record soil stratigraphy and construction details in notebook. Take soil samples at regular intervals and treat as per soil section methodology. Survey wells as per location and elevation and record. Measure the depth to groundwater as well as total depth and record. Purge of minimum three well volumes or until dry. When recharged conduct field tests and record and then sample groundwater and preserve appropriately as per laboratory instructions. Label jars and place in cooler with ice for shipping. Fill out chain of custody and ship to laboratory. Follow up with laboratory within two days of shipping to ensure the shipment has been received.

4.0 WORKED AREAS WITH BARRELS (NOT INCLUDING WORKED AREA 1)

4.1 AREAS REQUIRING INVESTIGATION

The following areas of concern require remediation and should be investigated as early as possible to allow for further remedial planning.

Worked Area No.	Location Description	Comments on Delineation	Contaminants of Potential Concern	Minimum Test Pits Recommended
2	Southeast of Air Terminal Building	No sampling conducted previously	PHC, metals, PCBs, barrels with unknown contents	6 to 10
3	East of Air Terminal Building	No sampling conducted previously	PHC, metals, PCBs, barrels with unknown contents	4 to 8
4	Southeast of Air Terminal Building	No sampling conducted previously	PHC, metals, PCBs, barrels with unknown contents	4 to 6
5	Beach Area North	No sampling conducted previously	PHC, metals, PCBs, barrels with unknown contents	4 to 6
6	Beach Area North	No sampling conducted previously	PHC, metals, PCBs, barrels with unknown contents	10 to 20
7	Beach Area South	No sampling conducted previously	PHC, metals, PCBs, barrels with unknown contents	10 to 20
8	Beach Area South	No sampling conducted previously	PHC, metals, PCBs, barrels with unknown contents	4 to 8

4.2 ESTIMATED NUMBER OF TESTPITS AND SAMPLES FOR WORKED AREAS

- PHCs: 42 to 78
- Metals: 42 to 78
- PCBs: 42 to 78
- Testpits: 42 to 78
- Duplicates 10%

4.3 SAMPLE CODING

- Prefix by WA and suffix by northing, easting and depth. (i.e., WA-2-10-20)

4.4 EQUIPMENT

- Sample jars supplied by laboratory
- Latex gloves
- Hand auger, scoop or similar device
- Alconox and water or similar for decontamination of samples

- Cooler and ice packs, chain of custody
- Notebook, pen or pencil
- PID
- Sample bags for vapour testing
- Munsell colour chart
- Measuring wheel or tape and pins
- Camera
- Water level meter, pH and conductivity meter, metal filters, preservatives, bailers, and rope for groundwater sampling
- Barrel thieves, if encountered
- Emergency spill kit if barrels accidentally punctured

4.5 METHODOLOGY

For each worked area requiring sampling, sample the soil with backhoe and using scoop or similar device for sampling soil, decontaminating between sample points. Place soil in both jars and bags. Label jars using proper coding. Describe soil using Unified Soil Classification system and Munsell Colour Charts and other descriptors and record in testpit log. Describe debris encountered and estimate the proportion of debris to soil. If barrels are encountered determine contents, and if safe to do so, recover barrel and sample. Take photograph of testpit. Place soil (and barrel sample if found) in cooler and if air temperatures are greater than 5ºC ensure ice packs are used for PHC soils. Measure the headspace of the soil in the bag after 15 minutes using PID and record. Take pictures of excavation area. Fill out chain of custody and ship to laboratory as soon as possible. Follow up with laboratory within two days of shipping to ensure the shipment has been received.

5.0 BARRELS, POTENTIAL DISCHARGES, ETC.

5.1 SPECIALIZED TESTING FOR BARRELS AND DISCHARGES

The following specialized testing may be required.

Item of Environmental Concern	Description	Testing Requirements	Comments
1	Barrels (partial of full) discovered in worked areas or at other parts of the site	30 (estimated) DEW Line Barrel Protocol (flashpoint, glycols, alcohols, PCBs, chlorine cadmium, chromium and lead)	Follow Barrel Protocol and Waste Tracking Protocol-Cape Christian
2	Miscellaneous Water	20 (estimated) Discharge Criteria	

Item of Environmental Concern	Description	Testing Requirements	Comments
	Discharges to Environment	parameters (pH, phenols, PCBs, cadmium (dissolved), chromium (total), cobalt (dissolved), copper (dissolved), lead (dissolved), mercury (total), nickel (dissolved), PCBs, Zinc (total)	
4	Sewage Discharges	15 (estimated) Sewage Discharge Criteria (pH, Oil and Grease, TSS, BOD and Fecal Coliforms)	
5	Incinerator Residuals	5 (estimated) metals	
6	Hazmat	5 samples each ACM, , lead in paint, PCBs in paint	

5.2 ESTIMATED NUMBER OF TESTPITS AND ANALYTICAL SAMPLES

- DEW Line Barrel Protocol Parameters (flashpoint, glycols, alcohols, PCBs chlorine cadmium, chromium and lead): 30
  - Note that for this package flashpoint will be conducted first and then the other parameters as per the Waste Tracking Protocol-Cape Christian.
- Discharge Criteria Parameters: 20
- Sewage Discharge Criteria Parameters (pH, oil and grease, TSS, BOD and Fecal Coliforms): 15
- Metals: 5
- Hazmat (ACM, lead, and PCB in paint): 5 each
- Duplicates: 10%

5.3 SAMPLE CODING

- Prefix by IEC and Suffix sequentially (i.e., IEC-1-5)

5.4 EQUIPMENT

- Sample jars supplied by laboratory
- Latex gloves
- Bung wrench
- Drum thieves
- Alconox and water or similar for decontamination of samples
- Cooler and ice packs, chain of custody

- Notebook, pen, or pencil
- Camera
- Emergency spill kit if barrels accidentally punctured

5.5 METHODOLOGY

Follow protocol in Appendix B of INAC's abandoned military site protocol for safely sampling drums. Determine approximate contents of drums by labelling, etc. Sample drums with sieves and determine whether aqueous or oil. Place samples in jars and label jar and drum with same sample coding. Record information in notebook. Place barrel sample in cooler and if air temperatures are greater than 5ºC ensure ice packs are used. Take pictures of drum. Fill out chain of custody and ship to laboratory as soon as possible. Follow up with laboratory within two days of shipping to ensure the shipment has been received.

For discharge water and sewage water, sample water and place in laboratory supplied jars with preservatives, label, and then place in cooler with ice. Fill out chain of custody and ship to laboratory as soon as possible. Follow up with laboratory within two days of shipping to ensure the shipment has been received.