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NUNATTA ENVIRONMENTAL SERVICES INC.

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PROTECTING OUR ARCTIC ENVIRONMENT

Remediated Soil/Rock Reject Usage Plan

Hydrocarbon-Impacted Soil Landfarm Facility
1575 Federal Road.
City of Iqaluit, Nunavut

Water Licence Number - NWB4NUN0511-Type "B"

Prepared for:

Nunavut Water Board
P.O. Box 119
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Prepared by:

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Dated: October, 2011

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NUNATTA ENVIRONMENTAL SERVICES INC.

1.0 Introduction

Nunatta Environmental Services Inc. (Nunatta) owns and operates a Hydrocarbon-Impacted Soil Landfarm Facility within the City of Iqaluit, Nunavut.
On August 4, 2004, an application for a water license was filed with the Nunavut Water Board by Nunatta for water use and waste disposal activities at Nunatta's Hydrocarbon-Impacted Soil Landfarm Facility located at 1575 Federal Road, Industrial Park, within the City of Iqaluit, Nunavut (City of Iqaluit Lot 1, Block 229)
The NWB License number for the Hydrocarbon-Impacted Soil Landfarm Facility is NWB4NUN0511 "B"

This treatment facility is commonly referred to as the 'landfarm'. Nunatta's operations consist of accepting soils impacted with petroleum products at various concentrations at the landfarm's geosynthetic lined platform (Cells) and with addition of fertilizers, aeration, and moisture control, allow indigenous soil microorganisms to degrade petroleum products to breaking them down into compounds such as water, carbon dioxide and hydrogen sulfide. Soils accepted at the landfarm are contaminated with diesel, gasoline and various automotive and construction/mining oils.
The site where the land farm is located is at the western limits of the industrial part of Iqaluit, adjacent the old metal dump where old equipment and cars and trucks were junked. Many rotting barrels of unknown products are still visible on adjacent properties around the landfarm and through out the dump site to the west. Records show the landfarm site was used as crushing grounds for any old waste barrels and storage of unclaimed or rejected freight.
One water test well located in the north east corner of the lot has always tested high in hydro carbons it is believed this is contamination from previous operation conducted at this site.

If contaminants are encountered that do not respond to our remediation process, these soils will be containerized and shipped to an approved disposal facility.

2.0 Rock Disposal Plan

Impacted soils enter the landfarm into Cell #1 where cobbles and rocks are screened out.

Rocks and cobbles are screened down to lass than ¾ inch or 18mm.

These rocks are piled into cell #2 to weather off any soils or hydrocarbons that might be adhered. The freezing, thawing and wetting, drying action as well as movement of air through the aggregate pile will expel hydrocarbons and release contaminated soils stuck to the stones. These stones will be screened again at a later date to remove all rocks larger than 2 inches.

Large rocks will be tested and when confirmed clean will go to local crushers to be used in gravel for road construction. Excavation Companies have expressed interest in getting these clean stones for use in making clear gravel products.

The smaller stones will require additional time to expel contaminates and will be rescreened to further reduce soil. When results confirm absence of hydrocarbon they will be used around the land farm for levelling, road building, and backfilling excavated work sites.

The screened soil removed from the rock piles will be spread in one of the remediation cells to expel hydrocarbons. The natural process of freezing and thawing which occurs over the fall, winter and spring removes sand and dirt clinging to the cobbles and stones and leaves them clean and free of hydrocarbons.

This procedure was developed following consultations with Dr. Steve Siciliano, Professor of Soil Toxicology, and University of Saskatchewan. (see page 6)

Since 2009 approximately 800 $m^{3\ of}$ rock rejects have been extracted from the Cells.

3.0 Treated Soil Disposal Plan

- Nunatta anticipates that the contaminated soil treatment will require 5-6 summer seasons to lower TPH concentrations to CCME's levels. Once treated, if acceptable by the applicable legislation, the remediated soil will be disposed of as follows:
- Sent to the municipal landfill for daily cover.
- Foundation material for road construction.
- Used to back fill excavation sites where spills have occurred and are being cleaned up by Nunatta.
- ****** Used as innoculants for incoming soils.

******Proper hydrocarbon breakdown is difficult to achieve without the proper microorganisms. Once these microorganisms have become established in the soil it is faster to innoculate incoming soil.

This will speed up the breakdown of hydrocarbons and allow soil to be removed from Landfarm much quicker than waiting for these organisms to develop on their own each time new soil is added to the pile.

******To date no soils have been removed from the landfarm**

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4.0 Standard Operating Procedure for Soil Sampling

There are two common methods of soil sampling: grab samples and composite samples. A grab sample is a sample taken from one specific location, at one time. A composite sample is a combination of smaller samples taken at different locations or at different times. For the identification of hydrocarbon contamination, grab samples should be taken.

The sampling proceed**s** from the least contaminated to the most contaminated site.

The number of field samples that are required, as well as the type and size of the sample vial, is dependent upon the type of contaminant that is being sampled

To prevent loss of volatiles, samples are gathered from freshly exposed soil and preserved as soon as possible, after the excavation.

- Clean gloves are worn and are changed before each new sample is collected.
- Each sample vial is filled so that no headspace exists. Aeration and air contact is minimized.
- Threads of jars are thoroughly cleaned.
- Vials are capped.
- Vials are labeled.
- Vials are placed on ice in a covered cooler or refrigerated not frozen(do not freeze)
- The necessary documentation is completed

5.0 Soil Sampling

All soils have been impacted with fuel oil typically from residential or commercial fuel spills (i.e. heating oils and diesel fuels.)
Most of the soils brought to land farm are from spill sites Nunatta is cleaning up and tests are taken at the site, results of these tests confirm the hydrocarbon content. Chemical testing is done on all soils where contamination is not a known source. These soils are kept separate until lab results confirm contamination.

Additional testing is done in the spring and fall of each year on all soils at the landfarm to determine degradation rate and fertilizer requirements. Sample results are used to determine the correct measures to be taken in the remediation process and if changes are required to make process more effective.

In order to document the chemical characteristics of the soil samples will be analyzed for the following parameters twice yearly. The samples will be sent to an approved Laboratory for analysis and results kept on file at landfarm.

- Total Petroleum Hydrocarbons (CCME PHC- F1 to F4 fractions)
- Heavy metals (6)
- Mercury
- PCB
- PAH
- Microbial type and count
- Nitrogen, Phosphorus, Potassium

6.0 Paracell Laboratory Accreditation

Canadian Association
for Laboratory Accreditation Inc.

CALA

Certificate of Accreditation

Paracel Laboratories Ltd.
Unit 300
2319 St. Laurent Blvd
Ottawa, Ontario

This laboratory is accredited in accordance with the recognised International Standard ISO/ IEC 17025:2005.
This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer joint ISO-ILAC-IAF Communiqué dated 18 June 2005).

Accreditation No.: A 1262
Issued on: September 9, 2009
Accreditation Date: January 3, 2005
Expiry Date: September 9, 2012

Chief Executive Officer

CALA

This certificate is the property of the Canadian Association for Laboratory Accreditation Inc. and must be returned on request. Reproduction must be in
guidelines in place at date of issue. For the specific tests to which this accreditation applies, please refer to the laboratory's scope of accreditation at www.cala.ca

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NUNATTA ENVIRONMENTAL SERVICES INC.

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Website: http://soiltox.com/
Department: Soil Science
Expertise: Arctic Soils, microbial ecology, toxicology
Bio:

Education: B.Sc. Biochemistry (Concordia), Ph.D. Toxicology (Saskatchewan)

Research:

We have four key initiatives in the Poles devoted to exploring how soil and human health are linked.

- Exploring how soil ecosystems communicate with one another.
- Understanding how the amount of liquid water in frozen affects pollutants and biogeochemistry.
- Working with the citizens of the City of Iqaluit in the Lower Base Region to investigate what sort of and how many pollutants are in the soil around their homes.
- Archiving polar soil samples for future generations.

Selected Publications:

Siciliano SD, AN Schafer, MAM Forgeron, I Snape. 2008. Hydrocarbon contamination increases the liquid water content of frozen Antarctic soils. Environmental Science and Technology 42:8324-8329.