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NUNAVUT WATER BOARD

NUNAVUT IMALIRIYIN

Water License Application

Supplementary Information Requirements For Hydrocarbon-Impacted Soil Storage and Landfarm Treatment Facilities

Adopted March 2005

This supplementary questionnaire has been provided by the Nunavut Water Board (“NWB”) for the purpose of assisting Applicants in the development of water licence applications (“Applications”) for the construction and operation of landfarm treatment facilities. By following this questionnaire, Applicants should be able to produce an Application that contains all the relevant information that the NWB deems necessary for a comprehensive review of a landfarm undertaking. However, according to the specific circumstances of a particular Application, the NWB may request additional information from an Applicant that goes beyond the scope of this questionnaire.

The information provided here is intended to apply to “one-off” storage or landfarm facilities and not for permanent or commercial storage or landfarm facilities. The latter will require further management and monitoring procedures to ensure the medium- to long-term landfarming activities do not impact on the environment. Under suitable conditions, landfarming is an effective bioremediation technology for reducing concentrations of nearly all of the constituents of petroleum products typically found at petroleum storage sites. In some cases, an Applicant may decide that off-site soil storage and disposal is a better option.

Landfarming is an above ground remediation technology for hydrocarbon-contaminated soil that reduces hydrocarbon concentrations through biodegradation. This technology usually involves spreading excavated contaminated soil in a thin layer on the ground surface and stimulating aerobic microbial activity within the soils through aeration and/or the addition of minerals, nutrients and moisture. The optimal rate of application of each of these parameters to achieve efficient biodegradation will depend on a number of factors, including but not limited to: the type of petroleum hydrocarbons to be remediated; the level of hydrocarbon contamination; the hydrocarbon-degrading bacteria present; and the soil matrix.

When environmental and other conditions will not be suitable for landfarming, an Applicant may apply for on-site storage licence. Information to be submitted in support of the Application is the same as for a landfarm.

I. GENERAL INFORMATION

The following general information should be included in the Application.

1. Date of Application.
2. Name and mailing address of the Applicant.
3. Contact information including phone number(s), fax number(s) and email address(es).
4. Name(s) of Facility operator(s) and alternate management personnel.
5. Number of years the Applicant is requesting for a water license.

Applicants may be required, under various legislation, to obtain land tenure approvals or other permits from local, territorial or federal regulators.

II. TECHNICAL INFORMATION REQUIRED TO PROCESS THE APPLICATION

Current Engineered Drawings, Facility Design Plans, a Facility Operations and Maintenance Plan (including, but not limited, to a Spill Contingency Plan developed in accordance with the Board's "Guidelines for Contingency Planning" (1987)) and a Site Monitoring Plan will be required to process the Application. All Engineered Drawings shall be stamped by a qualified Professional Engineer registered to practice in Nunavut.

Site Assessment Considerations

The Applicant shall provide details of the site topography, hydrology and permafrost regime, including the following:

1. Current detailed topographical site survey diagrams, map(s) and/or aerial photos, of sufficient scale to clearly show all pertinent drainage features, and which clearly illustrate the location of the following:
 - a. Soil, fuel and chemical storage locations;
 - b. Soil landfarm active treatment locations;
 - c. Site drainage patterns;
 - d. Adjacent surface water bodies that could be affected by the proposed undertaking, particularly fish-bearing waters;
 - e. Facility site access routes;
 - f. Surface and subsurface environmental monitoring sites; and
 - g. Traditional land use areas used for recreation, camping, fishing, etc.

Note: Maps, diagrams and aerial photos submitted with the Application must include an accurate scale that allows the determination of distances between the objects depicted.

2. The slope of land underlying the Facility.

See attached drawings and maps.

3. A hydrological/climatic assessment of the site that includes the following:

- a. Precipitation and temperature profiles for the area;

See attached climatic information in closest proximity to the site.

- b. Details concerning the local drainage basin;

See attached drawings and maps for topography and drainage. No concerns.

- c. Information regarding direction, path of water flow and potential seepage in area of the undertaking;

The site will be lined so the potential for seepage is minimal.

- d. A discussion concerning the likelihood of flood events that could disrupt operations or threaten water quality, and whether the local landforms may encourage or discourage such events (i.e. a Facility situated in an active flood plain).

The is not in a flood plain. The site is in such a location that it is highly unlikely to influence or be influenced by any potential flooding activity should any exist in the area.

A description of the soil underlying the site that includes:

- a. The physical and chemical characteristics of the material underlying Facility;

Surficial sand and gravel over bedrock is anticipated.

- b. The depth of the permafrost active layer;

Approximately 1 meter.

- c. A discussion of any permafrost characteristics that may impact on the construction and operation of the Facility (i.e. frost heaving, presence of ice lenses, evidence of permafrost degradation).

There is nothing to suggest potential permafrost impact, regardless, the facility will be designed to keep the base material below the liner high and dry to act as insurance against permafrost impact.

6. Information regarding the conformity of the undertaking with any applicable Municipal zoning or land use planning ordinances.

The site was selected in consultation with the Hamlet and will conform to applicable zoning and by-laws.

Soil Storage and Landfarm Treatment Design Considerations

The Applicant shall provide details of design and construction of all components of the Soil Storage and Landfarm Treatment Facility prior to its construction, including the following:

1. Comprehensive design details, including the dimensions, materials of construction and installation/construction procedures of all Facility components are required as part of the Application. Drawings of the design, stamped by an engineer licensed to practice in Nunavut, are also required. The design details should depict and describe the following components:
 - a. Retaining structures (dimensions, materials of construction, etc.);
 - b. Geo-synthetic liners (properties, installation details, etc);
 - c. Sumps, pumps, storage ponds/tanks and any other devices used to manage excess runoff water and/or leachate;
 - d. Existing and any proposed drainage modifications, such as berms (natural or constructed) and diversion ditches; and
 - e. Water quality and environmental monitoring stations and associated equipment (design, placement, etc).

See attached drawings and maps.

2. Information regarding the installation of barriers to prevent access to the site.

The site will be fenced as shown on the drawings.

3. A discussion considering the placement of the Facility in relation to water bodies.

Shallow tundra ponds exist 100 meters from the proposed landfarm site adjacent to the existing solid waste site.

4. A discussion considering flood risks/maximum probable precipitation events in regards to the Facility placement and design.

There are no flood risks. All precipitation will be contained within the facility.

5. The consideration of alternative methods of soil storage or remediation, in the event that circumstances are not suitable, for example because of environmental constraints, available human resources, etc

Other areas were considered for this project such as near the existing fuel facility. This is the site preferred by the Hamlet and the GN.

Operations and Maintenance Considerations

The Applicant shall provide details of the Operations and Maintenance Plan to be implemented at the Facility regarding the acceptance of material at the Facility, the procedures to be utilized in the treatment, or storage, of the hydrocarbon-impacted soil, the criteria to be attained prior to soil being deemed remediated, and the ultimate deposition of any treated soils. This shall include the following:

1. The procedures to determine if soils may be accepted at the Facility, including but not limited to:
 - a. Chemical, physical and biological characterization of the soils and the associated hydrocarbon and metal contaminant concentrations;

Contaminated soils will be identified by field test methods and confirmed using laboratory analysis.

- b. Treatability studies, to determine the viability of landfarm treatment; and

Treatability studies will not be undertaken. The use of landfarms in the arctic is a common and proven technology in spite of the harsh climate.

- c. Sampling frequency and number of samples *per* volume of soil accepted

This project deals with the materials from a particular site. It is not for general use. Contaminated soils will be identified as per 1a.

2. The procedures to be utilized during active landfarming operations in the active treatment cells, including but not limited to:
 - a. Treatment cell development and material placement therein;

There is one treatment cell as shown in the drawing. Materials will be placed by equipment.

- b. Contaminated soil thickness in treatment cells;

Soils will not generally exceed 1 metre.

- c. Method of mechanical aeration in treatment cells;

Soils will be turned with a loader.

- d. Oversize material management;

Oversized material deemed to be contaminated will be set aside in the landfarm.

- e. Surface water management, leachate containment and/or treatment, and site grade planning;

Surface waters, if any, will be routed around the site with the use of the berm and swales if necessary. There will be

no leachate from the lined facility. The site will be graded to provide positive drainage as necessary.

- f. Process water management, and treatment prior to discharge;

Water will be collected in the internal sump. As necessary, water will be pumped over the surface of the landfarm. The site is in an area where evaporation exceeds precipitation. Effluent discharges are not expected.

- g. Site volume and operational monitoring programs;

The site is designed to accept 170 cubic metres. Field testing will be undertaken monthly during warm weather months. Once field testing suggests the soil is remediated, confirmation samples will be taken,

- h. Dust control programs; and

If the site becomes dusty, water from the Community can be used to control the dust.

- i. Staff operational training programs.

Construction contractor has qualified personnel with internal health and safety plans / programs. After the construction and placement of the contaminated soils, management of the site will be contracted to qualified contractors.

- 3. The Applicant must provide a soil quality remedial objective, as defined by the Canadian Council of Ministers of the Environment ("CCME") or by other applicable agency, to which the Applicant is intending to achieve.

The soils will be remediated to meet CCME/GN Commercial/Industrial Standards.

- 4. A conceptual decommissioning and reclamation plan is required with the Application, which should contain the following information:

- a. Details regarding the ultimate deposition of any treated soils; and

Once remediated, the soils could be used for cover at the landfill.

- b. A disposal plan for soils contaminated with bioremediation-unsuitable compounds, or for soils that do not respond well to the proposed landfarming treatment.

All the soils should be treatable by volatilization and natural bacteria consumption. If treatment is slower than desired, fertilizer could be added to increase bacterial action.

Surface and Groundwater Monitoring Programs

A comprehensive Surface and Groundwater Monitoring Plan to be implemented at the Facility is required with the Application. This Plan shall include the following:

- 1) Locations (including GPS coordinates) of all proposed Monitoring Stations;

Shown on the drawings.

- 2) Chemical, physical and biological parameters to be monitored;

TPH, CCME F1 to F4 plus BTEX

- 3) Sampling frequency;

Annually during warm weather.

- 4) Baseline monitoring programs currently in progress, or contemplated during the term of the license under consideration; and

None

- 5) QA/QC Programs to be implemented as part of the Monitoring Program.

Standard field protocol.

Table VII: Summary Information on Monitoring Program Sites

Monitoring Location	GPS Coordinates	Type of Monitoring Carried Out	Monitoring Frequency
001	To Be Determined In Field	<input checked="" type="checkbox"/> Surface <input type="checkbox"/> Subsurface	<input type="checkbox"/> Monthly <input checked="" type="checkbox"/> Annually
002	To Be Determined In Field	<input checked="" type="checkbox"/> Surface <input type="checkbox"/> Subsurface	<input type="checkbox"/> Monthly <input checked="" type="checkbox"/> Annually
003	To Be Determined In Field	<input checked="" type="checkbox"/> Surface <input type="checkbox"/> Subsurface	<input type="checkbox"/> Monthly <input checked="" type="checkbox"/> Annually

References:

“Bioremediation of Petroleum Hydrocarbons in Soil and Groundwater Under Cold Climate Conditions: A Review, Implications for Applications in Canada”, Dale Van Stempvoort and Pamela Grande, National Water Research Institute, P.O. Box 5050, Burlington, Ontario, Canada L7R 4A6, December 2005;

“Federal Guidelines for Landfarming Petroleum Hydrocarbon Contaminated Soils”, Science Applications International Corporation (SAIC Canada) Environmental Technologies Program December 2005.

“Guidelines on the Ex-situ Bioremediation of Petroleum Hydrocarbon Contaminated Soils on Federal Crown Land”, Conservation and Protection, Environment Canada (1993)

“Phase III Environmental Assessment, Bulk Fuel Storage Facility and Pipeline Distribution System, Rankin Inlet, Nunavut, Draft Report, January 17, 2001.” Dillon Consulting Limited.

James, P. A., “The Soils of the Rankin Inlet Area, Keewatin, N.W.T., Canada”, Arctic and Alpine Research, Vol. 2, No. 4 (Autumn, 1970), pp. 293-302