DYE-M, Cape Dyer Post Construction Monitoring Program

INTRODUCTION

The following summary is being provided for the post-construction landfill monitoring program as described in the DND-NTI Environmental Cooperation Agreement for the former DYE-M, Cape Dyer DEW Line site. There are thirteen landfill areas at the DYE-M site that are included in this landfill monitoring program:

- Lower Site NWS
- Lower Site Tier II Disposal Facility
- Lower Site Crossroads and Foundations Landfill
- Lower Site Powerhouse Landfill
- Lower Site NHWL
- Upper Site Tier II Disposal Facility
- West Landfill West Lobe
- West Landfill Centre Lobe – A and East
- Pallet Line Landfill
- Upper Site – NHWL
- Helipad Area
- Upper Site NWS Landfill
- South Landfill West

BACKGROUND

The Department of National Defence (DND), in cooperation with Nunavut Tunngavik Incorporated (NTI), developed a landfill monitoring plan to address post closure monitoring requirements for the landfills at the DEW Line Sites. Defence Construction Canada (DCC) is managing the cleanup and monitoring programs on behalf of DND.

The objective of the landfill monitoring program is to collect sufficient information to assess the performance of the landfills from a geotechnical and environmental perspective. The landfill monitoring plan specifies the requirements for visual inspection, and chemical and thermal monitoring of landfills at the DEW Line sites under DND's jurisdiction.

PROGRAM COMPONENTS

The post-construction landfill monitoring program consists of four main components to measure the performance of the landfills, depending on the remediation plan for each landfill. These components are visual, soil, groundwater and thermal monitoring. Details on each of the monitoring components are provided below.

Visual Monitoring: The physical integrity of the landfill is inspected and reported using hand- drawn sketches. Documented observations include:

- ❖ Evidence of settlement, ponding, frost action, erosion, and lateral movement.
- ❖ Sloughing of berms/covering layers, thermal contraction cracks, etc.

Photographic records are to be provided to document the general condition of the landfill and to substantiate all recorded observations.

Soil and Groundwater Monitoring: The soil and groundwater monitoring program consists of baseline/background assessment and contaminant evaluation. Background conditions represent soil and water quality from an area not impacted by the landfill. Background (naturally occurring) values are obtained from samples collected from areas that were not directly influenced by activities at the DEW Line site, but are indicative of the prevailing geochemistry. These samples are taken hydraulically up-gradient and at some distance from the landfill.

Soil and groundwater samples (where required) are collected prior to construction/closure of a landfill, to represent background as well as baseline conditions. The results of subsequent landfill monitoring events are compared to these baseline and background values to evaluate any potential changes in environmental conditions. Samples are to be analyzed for the following constituents:

- ❖ PCBs (polychlorinated biphenyls – Total Aroclor analysis);
- ❖ Total Petroleum Hydrocarbons (TPH; and
- ❖ Inorganic elements: arsenic, cadmium, chromium, cobalt, copper, lead, nickel, zinc, and mercury.

In general, at least one monitoring well was installed up-gradient and two to three wells were installed down-gradient of the landfill during the construction phase. Review of analytical data from water samples collected from wells up and down gradient allows evaluation of potential impacts associated with the landfill. Soil samples are collected from the toe of the landfill, generally from the same locations as the monitoring wells. Contamination in soil samples at the toe of the landfill reflects chronic input from water that may have infiltrated the landfill, and is an important factor of contaminated leachate. Prior to collection of samples from a monitoring well, the well is purged and allowed to reach equilibrium. Physical measurements are collected prior to and after purging and are referenced to the top of the monitoring well pipe.

Thermal Monitoring: Geothermal analyses were carried out as part of the design to predict the length of time required for permafrost aggradation through landfills requiring leachate containment, including the Tier II Soil Disposal Facility. These analyses also provided information on the long and short term thermal regime in the ground, and the depth of the active layer in the cover material.

A thermal monitoring system provides measurement of sub-surface ground temperatures, which allows comparison to and verification of the predicted ground temperatures. The thermal monitoring system consists of installation of thermistor strings, with thermistor beads at selected intervals to provide

ground temperature profiles at various locations within the landfill. The thermistor strings are attached to automated data-loggers that allow for remote data collection. In general, a minimum of three thermistors are installed at each landfill where permafrost aggradation through the landfill contents is an integral part of the design.

FREQUENCY

The landfill monitoring program consists of three phases, as described in detail below.

Phase I: Phase I involves monitoring of conditions to confirm that equilibrium is achieved. The frequency of monitoring events during Phase I monitoring is dependent on the closure or remediation design at specific landfills. The landfills will be monitored on an annual basis for the first five years in Phase I monitoring. The five-year term was selected on the basis that ground• temperature thermal regimes at these specific landfills will require three to five years to reach equilibrium.

An evaluation of all Phase I data will be carried out at the end of five years to confirm that thermal and chemical equilibrium is achieved, and that no stability issues had been identified. The landfill monitoring events are carried out by independent contractors, who successfully win the competitive tender.

Phase II: Phase II monitoring is the verification of equilibrium conditions established in Phase I. The monitoring frequency in Phase II is downgraded from Phase I and will be carried out according to the following schedule, year 7, year 10, year 15 and year 25. Year 25 marks the end of Phase II monitoring.

Phase III: Phase III involves the monitoring for long-term issues such as liner integrity, permafrost stability, and significant storm events. At the end of the Phase II program, 25 years after construction, a re-evaluation of the landfill monitoring program will be carried out prior to initiating any Phase III program. The scope of the Phase III monitoring program is not included here, but is anticipated to be based on a 10 year monitoring interval.

REVIEW AND EVALUATION PROCESS

An Environmental Working Group (EWG) was established to provide a technical report and to support the DLCU Steering Committee. This working group is comprised of qualified engineering and environmental scientists with expertise in environmental remediation and clean-up in northern climates. The EWG has four designated representatives, two from each of the Owner (DND) and the Inuit (through the NTI), respectively.

During the monitoring program, the EWG reviews the results of the monitoring program in accordance with the methodology as described previously. The results of the review and any recommendations

regarding changes to the monitoring plan and/or remediation requirements are reported to the DND/NTI Steering Committee.

The requirement for further monitoring after 25 years is evaluated. Monitoring may be terminated if the performance of the landfill was satisfactory over the period of monitoring from an environmental, geotechnical and thermal perspective, as appropriate. The assessment of satisfactory performance is carried out jointly by the NTI and DND.