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To: Government of Nunavut
Department of Community and Government Services
- Petroleum Product Division

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Project #: 60658136
From: AECOM Canada Ltd.

Technical Memorandum

Subject: **Baker Lake Spill Response 2021 – Remedial Action Plan**

AECOM Canada Limited (AECOM) was retained by the Petroleum Product Division – Government of Nunavut (PPD-GoN) in response to a spill release located at the Bulk Fuel Storage Facility in Baker Lake, Nunavut, hereafter referred to as the "Site".

The following technical memo will provide a brief description of the site, the details regarding the recent spill, the spill clean up activities completed to date at the Site, and present the remedial action plan (RAP) for the Site to address the remaining contaminated soil from the spill from the Baker Lake Tank Farm in March 2021.

1. Site Setting

The Site is located within the Town of Baker Lake. The Site is partially unfenced and consists of a Bulk Fuel Storage Facility and adjacent properties, which includes a vacant piece of land located south of the fuel dispensing area of the Baker Lake Bulk Fuel Storage Facility. Baker Lake is located approximately 300 m to the south of the fuel storage area and abuts the southern extent of the Site.

The Site has operated as a bulk fuel storage facility for the town of Baker Lake and surrounding areas. The Site contains eight (8) above ground storage tanks (ASTs). An aboveground steel pipeline is located to the east of the Site, running from the fuel storage area to the shore of Baker

A total of fifteen (15) hydrocarbon releases have been documented on the Site since 1985.The release range in magnitude from approximately 60 L to over 2000 L, with some release volume still unknown. Ten (10) of the fifteen (15) releases occurred within the fuel dispensing area. The remaining five (5) releases occurred within the tank farm area.

A recent spill (2021) has occurred on Site which is described in further details below. The area where the spill occurred was within the Bulk Fuel Storage Facility, which is a fenced in area. For the purpose of this RAP, this will be the area that will be remediated and will be referred to as the Site, as shown in **Figure 1**.

1.1 Spill Release: March 2021

On March 5, 2021, a gasoline spill (currently estimated to be 10,000 litres of gasoline) was discovered at the fuel tank farm in Baker Lake. The source of the spill was identified as a ruptured drain valve on the pipeline. The leak was stopped upon discovery, and the spill was believed to be contained within the protective berm surrounding the fuel tank farm.

On March 29, 2021, gasoline was detected outside the protective berm and plans were made to remediate—or cleanup—the site. The source of this seepage has not yet been identified. Weather conditions and snow have hampered the work, but field crews are now making good progress with repairs. Investigations are ongoing to confirm the source.

1.2 Spill Response: April 2021 – On-Going

The ongoing work to clean up the site is progressing well. The environmental response team continues to: remove and securely store impacted soil, snow, ice and water in two temporary containment cells that have been built for this purpose; a cut-off wall to stop the movement of hydrocarbons is now in place; and the collection and treatment of impacted water—to remove hydrocarbons—is ongoing.

The inspection of the fuel tanks in the tank farm is ongoing.

In the past few weeks, a gravel pad has been constructed for the expanded water treatment system now in place to treat hydrocarbon-impacted meltwater and remove sediment for the effluent stream. Treated water will be released only after it meets regulated discharge criteria.

The emergency response successfully contained the spill and addressed the source of the spill. However, contaminated soil remains in place at the Baker Lake Tank Farm along the South side of the berm. The contaminated soil has been delineated and stockpiled and short-term measures have been taken to limit any further impacts to the environment from these soils, however a long term remedial action plan is required to complete the remediation of the property.

1.3 Applicable Remediation Criteria

The GoN-PPD has adopted various sets of guidelines for comparison of soil and water chemistry for contaminated sites. The standards include, the Canadian Council of Ministers of the Environment (CCME) Environmental Guidelines which have been applied for this Site.

The most stringent standard for the given media type was adopted as the Tier 1 guideline for the initial screening of contaminants of concern (COC). For the purpose of this remediation, AECOM has applied the pathway specific (Tier II) guidelines as the remedial objectives. For parameters and media where criteria do not exist, AECOM had used criteria from other provincial environmental agencies for comparison.

The Site conditions pursuant to the Canadian Council of Ministers of the Environment (CCME) Guidelines for soil and groundwater/meltwater indicates the appropriate criteria for the Site are **non-potable** / **coarse grained soils** / **residential/parkland land use**.

Soil and Sediment Criteria

- Canadian Council of Ministers of the Environment (CCME) Soil Quality Guidelines (SQG) for the Protection of Environmental and Human Health (commercial land use) (CCME 1999 (and updates)).
- Canadian Council of Ministers of the Environment (CCME 2008). Canada-Wide Standards for Petroleum Hydrocarbons (PHC) in Soil. January 2008 Revision.

Groundwater/meltwater and Surface Water Criteria

- Canadian Water Quality Guidelines for the Protection of Aquatic Life (CCME 1999 (and updates)).

Vapour Criteria

- Health Canada (2010) Federal Contaminated Site Risk Assessment in Canada, Part VII: Guidance for Soil Vapour Intrusion Assessment at Contaminated Sites.

2. Recently Completed Work by AECOM

AECOM completed a recent assessment at the Site which included the delineation and excavation of visually impacted soil based on visual observations of the soil and Photo Ionization Detector (PID) readings to detect Volatile Organic Compounds (VOCs) concentrations in soil. Preliminary test pits were also collected during this assessment. Impacted soil was excavated and placed in Containment Cell #1 and the remaining soil was stockpiled on-site, as shown on **Figure 2**.

Additional assessments are required for the Site, which are described in **Section 5.0** below.

3. Estimated Quantity of Impacted Soil

Table 1 below summarizes the estimated areas of impacted soils and the intervals of impacted soils. The table also includes the volume of impacted soil currently stored in Containment Cell 1, as well as the stockpiled soil location on-site. In addition, it also includes the volume of additional bags of impacted soil. These estimates are used to calculate the volume of impacted soil at the Site to be approximately 1,975 m3 (minimum) and 2,775 m3 (maximum).

Table 1: Impacted Soil Volume Estimate

Areas of Environmental Concern (AEC)	Estimated Areas of Impacted Soil (m2)	Analytical Parameter Exceeding Criteria	Estimated PHC Impacted Soil Depth (m)	Estimated PHC Impacted Volume (m3)
MINIMUM SOIL VOLUME ESTIMATE				
Area 1	200	To be confirmed in field	1.0	200
Containment Cell 1	N/A	BTEX/MTPH	N/A	750
Stockpiled Soil	N/A	BTEX/MTPH	N/A	750
Additional bags of soil	N/A	BTEX/MTPH	N/A	275
			TOTAL MIN VOLUME	1,975

MAXIMUM SOIL VOLUME ESTIMATE				
Area 1	1,000	To be confirmed in field	1.0	1,000
Containment Cell 1	N/A	BTEX/MTPH	N/A	750
Stockpiled Soil	N/A	BTEX/MTPH	N/A	750
Additional bags of soil	N/A	BTEX/MTPH	N/A	275
			TOTAL MAX VOLUME	2,775

4. Conceptual Site Model

WorleyParsons completed a Conceptual Site Model (CSM) in 2013 which was presented in the 2013 Environmental Site Assessment Report (WorleyParsons, 2013).

AECOM completed an updated CSM based on our understanding of nature of the historical hydrocarbon releases and the distribution of contamination in all media including soil, groundwater/meltwater, surface water and soil vapour. This CSM was presented in the Environmental Site Assessment and Human Health Risk Assessment Report (AECOM, 2021).

The potential human health exposure pathways considered at the Site include the following:

- Soil contact / ingestion;
- Leaching to potable groundwater / potable groundwater drinking pathway;
- Inhalation of indoor air / vapour migration from groundwater to indoor air; and
- Outdoor air.

4.1 Soil Contact / Ingestion

The ground surface at the Site is mainly grass covered and bare soil in some areas. Therefore, the soil contact / ingestion pathway is considered operable for the Site.

4.2 Leaching to Potable Water

Since the Site is located in a potable area, the leaching to potable groundwater pathway (for soil) and the potable groundwater drinking water pathway (for groundwater) are operable.

4.3 Inhalation of Indoor Air

Residential properties are located to the west and east of the Site. Homes are built on piles because of the permafrost conditions; there are no slab-on-grade residential homes or homes with basements adjacent to the Site. Therefore, infiltration of soil vapours into homes and subsequent inhalation exposure considered non-functional and presents a negligible risk to nearby residents.

4.4 Inhalation of Outdoor Air

Volatile concentrations identified in soil at the Site are generally low at the site and are considered to be not active; therefore, the outdoor air inhalation exposure pathway would be considered to be not active on Site. However;

volatile concentrations in air should be monitored during on-site remedial activities and health and safety planning should be adjusted accordingly if volatile hazards are identified during the remedial work progress.

The ground surface is mainly grass covered with some bare soil in some areas. Therefore, exposure to dust particles would be considered to be active on Site. Dust in air should be monitored during on-site remedial activities and health and safety planning should be adjusted accordingly if volatile hazards are identified during the remedial work progress.

4.5 Ecological Exposure Pathways

The Site is an industrial area and is fenced; therefore, it is not a significant habitat for ecological receptors.

5. Remedial Action Plan

5.1 Construction of On-Site Land Farm

As part of the remedial options analysis, GN-PPD, after consulting with the Community and Hamlet of Baker Lake, decided on the preferred option to construct a new land farm cell on-site to address the contaminated soil remaining from the spill at the tank farm. Details of the proposed land farm are as follows:

On-Site – New Cell
- Construct a new land farm to the east of the Baker Lake tank farm (as shown in **Figure 4**)
- Land farm could be built in 2021.
- Move contaminated soil into newly constructed cell.
- 2-4 years of land farm management (i.e aerating, mechanical excavation, etc.)
- Confirmatory sampling to confirm soil has been remediated, and
- Placement of remediated soil back to original locations.

Additional details of this land farm, including the soil remediation and land farm management plan, are provided in the technical memo titled Baker Lake – Proposed Land Farm Options, completed by AECOM in July 2021.

5.2 Movement of Stockpiled Soils to Land Farm

Contaminated soil that is currently contained or stockpiled on-site will be placed directly on a dump truck and transferred over to the newly constructed land farm on-site. Analytical data that was collected during the additional work completed by AECOM confirmed that this soil was impacted; therefore, no additional samples needed to be collected from this contained and stockpiled soil.

5.3 Soil Remediation Plan – Excavation / Placement of Soil in Land Farm

The excavation process will include the following general steps:

1. Test pit program to achieve delineation of soil impacted areas;
2. Excavation of soils above applicable criteria and transfer of impacted soil to on-site land farm;
3. De-watering of the excavation and managing the contact water on-site with treatment and discharge to approved location;

4. Confirmatory sampling of the sidewalls and floors of the excavation to ensure the impacted area has been successfully remediated; and
5. Final grading of the Site.

The on-site contractor shall provide, install and maintain all necessary erosion and sediment control measures, and provide dust control and ensure the work does not impact the adjacent environment. The contractor will also be responsible for installation of erosion and sedimentation controls at the perimeter of all work areas, etc., sufficient to ensure there are no deleterious materials leaving the work areas. Control measures will be put in place to ensure there are no impacts from their work on the immediate environment, watercourses or habitats. In addition, the contractor is required to take the necessary actions to prevent loss of contaminated soil during transportation, as applicable, including the possibility of contaminated soil from tires.

Excavated soil to be placed at the on-site land farm will be placed directly on a dump truck for transport. If the excavated soil is to be disposed elsewhere on the Site, it first will be stock piled in secondary containment to prevent leaching to the underlying soils, wind transport or washout of the excavated soil. Soil to be stock piled will be segregated based on physical observations (i.e. the visual/olfactory condition of the soil), as well as field screening measurements (i.e. PID). If the excavated soil is to be disposed elsewhere on the Site, it first will be stock piled on plastic tarps or in containers. The soil is then covered with tarps to prevent wind and rain from blowing or washing it away and to keep workers from coming into contact with the impacted soil material. Necessary precautions and preventative measures will be taken to prevent water (ground and surface) contamination.

The excavation will be completed, and confirmatory sampling of side wall and excavation floors will be completed based on the CCME Guidance Manual for Environmental Site Characterization in Support of Environmental and Human Health Risk Assessment (2016).

Compaction of the excavated area will be completed using the excavation equipment to ensure the Site is properly graded and does not result in settling and ponding of surface water following completion of the excavation.

The approximate area of the remedial excavation is shown on **Figure 3**.

5.4 Land Farm Operation

Land farm operations, including the placement of soil, soil sampling, bioremediation product addition and additional management plants, are provided in the technical memo titled Baker Lake – Proposed Land Farm Options, completed by AECOM in July 2021.

5.5 Management of Contact Water / Groundwater Entering Excavations

It is anticipated that the excavated area will be infiltrated with groundwater and will require de-watering of the excavation during the remedial activities. The physical management of water will include containment structures to ensure surface runoff that comes in contact with excavated soils will be retained on Site. The removal of groundwater infiltrating the excavations will be removed using dedicated pumps stored on-site prior to treatment or disposal. The water removed from the excavations will be pumped into Containment Cell 2 on-site. Water will be treated on-site to meet CCME Fresh Water Aquatic Life (FWAL) guidelines will be tested before discharge to the area previously approved by GoN.

There is additional water currently stored in totes on-site that will also be pumped into Containment Cell 2 for treatment, sampling and discharge to the GoN approved location.

5.6 Soil Vapour Assessment

The quality of the air will be monitored during remedial activities between the land farm as the residential houses nearby. Air quality will also be monitored post remediation by the installation and sampling of ambient air SUMMA™ stainless steel-canisters along the Site boundary, as shown in **Figure 3**.

5.7 Groundwater Assessment

The quality of groundwater post remediation will be evaluated by the installation of monitoring wells within the excavation footprints as well as downgradient from the Site. Groundwater monitoring of existing wells and the newly installed wells will be used to inform if there is any additional remediation required for the Site. Proposed locations of the groundwater monitoring wells are shown on **Figure 3**.

6. Closing

Should you have any questions or concerns, please contact me at 902.717.5440.

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Attachments:
Attachment 1 – Figures

- *Figure 1: Current Site Conditions*
- *Figure 2: Contaminated Soil Areas*
- *Figure 3: Additional Site Assessment*
- *Figure 4: Proposed Land Farm Location*