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E. Gruben's Transport
P.O. Box 177
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Dear Mr. Newmark:

RE: PIN-D, ROSS POINT AND PIN-E, CAPE PEEL HYDROCARBON SOIL TREATMENT PLAN

1. INTRODUCTION

This Hydrocarbon Soil Treatment Plan has been prepared on behalf of E. Gruben's Transport (EGT) for the treatment of petroleum hydrocarbon (PHC) contaminated soil at PIN-D, Ross Point NU and PIN-E, Cape Peel NU for Public Works and Government Services Canada (PWGSC). EGT was awarded a contract to remediate the former DEW Line sites at PIN-D and PIN-E by PWGSC in 2011. Remediation activities at the sites will commence in September 2011 and are planned to be completed by October 2012.

The areas of contaminated soil at the sites were defined by AECOM during environmental site assessments completed in 2009 and remedial action plans completed in 2010. The remediation specifications and revisions require 510 m^3 of PHC contaminated soil to be treated from PIN-D and 2300 m^3 of PHC contaminated soil to be treated from PIN-E.

Remediation criteria for acceptable remaining hydrocarbon concentrations in soil were provided in the contract specifications, Design Revision No. 2 of the EGT-PWGSC remediation contract and are summarized in Table A.

Table A PIN-D and PIN-E Hydrocarbon Soil Remediation Criteria

	Near Shore Criteria (<30 m from water body) in mg/kg	Far Shore Criteria (>30 m from water body) in mg/kg
Type A PHC contaminated soil	N/A	N/A
Type B PHC contaminated soil	F1 – 1290 F2 – 330	TPH (F1, F2 and F3) – 2500

The intention of the soil remediation program at the former PIN-D and PIN-E DEW Line sites is to excavate and treat the identified PHC contaminated soil to below the far shore criteria and to dispose of the treated soil on-site more than 30 m from a surface water body.

The purpose of this Hydrocarbon Soil Treatment Plan is to outline the treatment methodology for Type B contaminated soils at the sites and includes a description of the treatment methodology, required equipment, labour, materials and supplies, surface water management, laboratory testing program and, the final placement of treated soils at the sites.

2. EQUIPMENT, MATERIALS, SUPPLIES AND LABOUR

The anticipated equipment, materials, supplies and labour required to conduct this PHC soil remediation program are outlined in Table B.

Table B Equipment, Materials and Supplies Required for PHC Soil Treatment

Site	Item	Quantity
PIN-D	D-6 bull dozer	1
	D-3 bull dozer	1
	Hitachi 300 Excavator with Allu attachment, frost and clean-up buckets, & Operator	1
	Rock Truck	1
	Surveyor	1
	Type-2 fill for berm construction	Up to 65 m^3
	Hydrocarbon Resistant Liner 25 m x 40 m	1 if required
	Hydrocarbon Specialist	1
PIN-E	D-6 bull dozer	1
	D-3 bull dozer	1
	Hitachi 300 Excavator with Allu attachment, frost and clean-up buckets with Operator	1
	Rock Truck	1
	Surveyor	1
	Type-2 fill for berm construction	Up to 140 m^3
	Hydrocarbon Resistant Liner 40 m x 100 m	1 if required
	Hydrocarbon Specialist	1

In addition to the items listed above, approximately 10-12 people and a loader may be required to layout the liners on the treatment areas.

If used, the soil liners will be stored in place within the treatment cells and all heavy equipment will be winterized before operations at the site shut down for the 2011-2012 winter. If unused, the liners will be stored outside in their original packaged state (rolled or folded).

Once the treatment cells have been decommissioned, the used hydrocarbon liners would either be disposed of at the PIN-D on-site non-hazardous landfill or will be secured for shipment to a licenced off-site disposal facility. Unused liners will be transported from the site during demobilization.

3. TREATMENT METHODOLOGY

3.1 Treatment Cell Construction

3.1.1 Size and Location

The locations of the treatment area at each site have been provided in the contract specifications or will be decided in consultation with the Departmental Representative (DR) on-site. At the time that this plan was produced, EGT intends to place approximately 510 m^3 (insitu) of contaminated soil into the on-site treatment area located on the secondary airstrip at PIN-D and approximately 2300 m^3 of contaminated soil into the on-site treatment area at PIN-E. It is expected that this material will bulk by approximately 15-20% during excavation and the treatment cell areas will be designed to hold 600 m^3 of soil at PIN-D and 2800 m^3 of soil at PIN-E with sufficient space to allow for treatment operations. The initial placement of soils will be in windrows which are approximately 6 m wide and 2 m high and if space is adequate the soil may be laid out in a 0.3 to 0.5 m lift.

The treatment cell at PIN-D will be approximately 22 m x 37 m and the treatment cell at PIN-E will be approximately 35 m x 95 m.

3.1.2 Design

Differences in elevation across the treatment cell areas will be decreased using a bull dozer to level the sites. Soil that is removed from high locations may be used as material to build the berms and additional berm material may be brought in from a remote borrow source. Berms surrounding the treatment cell will be approximately 0.5 m high. A small depression will be constructed along the down gradient side of the treatment area to provide a collection point for any surface water.

Baseline soil samples from the treatment area will be collected as described in Section 4 to characterize the pre-treatment concentrations of TPH in the native soils.

The treatment cell will be situated adjacent to the final disposal area for the treated soil and typically will not use a liner. However, a liner will be available on-site if EGT elects to use it. The liner material is designed for cold climates and can retain flexibility in sub-zero temperatures. If required, the liner will be placed over the entire treatment cell area and overlap the crest of the berms. Large or sharp rocks and debris that could puncture the liner should be removed from the treatment area base prior to

placement of the liner. If the base area contains rocks that may damage the liner from below, a 0.1 m thick or greater layer of fine fill with no angular gravel and no gravel or rock larger than 50 mm in diameter should be placed on the treatment area base under the liner. An approximately 0.2 m thick layer of protective fill would be placed over the liner to mitigate possible damage by heavy equipment or sharp objects. The protective fill should consist of fine soil with no angular gravel and no gravel or rock larger than 50 mm in diameter.

3.2 Surface Water Management

Significant accumulations of surface water within the treatment cells at PIN-D and PIN-E during the summer working season are not anticipated due to low rainfall in the region. Climate normals between 1971 and 2000 presented by Environment Canada for nearby Cambridge Bay indicate that average daily temperatures in the region are above minus five degrees for June, July, August and September and that for these months the average monthly precipitation ranges from 12.5 mm to 26.7 mm. The extreme daily rainfall for the same time period was 35.8 mm.

The largest likely source of surface water in the treatment cells is melting snow in the spring of 2012. Windrows of soil undergoing treatment in the cells will be flattened with depressions filled at the end of the 2011 treatment season to mitigate the accumulation of snowdrifts within the cells.

It is anticipated that the planned berms around the treatment cells will prevent accumulation of run-on water.

In the unlikely event that surface water does accumulate within the cells, it is anticipated that the designed water collection points as described in Section 3.1.2 will provide sufficient holding capacity for ponded water without affecting treatment activities. The ponded water would be sampled and sent for analysis to determine if it meets discharge criteria outlined in the water licence. Where laboratory results indicate that the ponded water does meet discharge criteria, DR authorization will be sought prior to discharge to the environment. A 2” trash pump would be used to remove ponded water from the treatment cells and the outlet hose would be placed on a durable surface to dissipate the water’s energy and avoid significant surficial erosion.

If water quality results do not meet the discharge criteria, a granular activated carbon treatment system or an aeration system may be brought to site as required to treat hydrocarbon affected water prior to re-sampling and discharging to the environment. If free product is encountered it will be collected using sorbent pads or booms that are available on-site.

3.3 Soil Management

3.3.1 Soil Treatment Strategy

Following construction of the soil treatment cells, soil from the predetermined PHC contaminated areas will be excavated with a track hoe and placed in a Terex dump truck for transportation directly to the treatment areas. EGT does not intend to store PHC contaminated soil at any locations other than the treatment areas. Efforts will be made at each stage of the treatment process to avoid damage to the treatment cell liner, if it is used.

The primary method that EGT will use to treat the soil is by aeration using an Allu Bucket attached to an excavator. Soil aeration involves repeatedly turning over and screening the contaminated soil. This technique essentially aerates and dries the soil, whereby hydrocarbons are volatilized. While there may also be some biological activity to reduce concentrations using this technique, it has been observed (e.g., bench scale studies) that the majority of the hydrocarbon reduction is due to volatilization through exposure to heat and/or the evaporative energies of the air and sun.

The Allu bucket is attached to an excavator and operated hydraulically by the excavator. The Allu bucket is configured with rotating drums that are controlled by the excavator operator. The drums break up and aerate the excavated PHC contaminated soil. The PHC soils will initially be placed in the treatment areas in windrows from which the excavator with its Allu bucket will scope and then aerate the PHC soil depositing these aerated soils in a trailing treated windrow. The excavator with Allu bucket will continue treating the PHC soils cycling the length of the windrow(s).

2011 Treatment

EGT intends to begin aerating the excavated soil with an Allu bucket in 2011 and will continue to treat the soil for as long as weather conditions at the sites allow. Larger gravel material, approximately > 150 mm, will be removed from the soils during the aeration process and placed to the sides of the treatment area.

At the end of the treatment season, the windrows will be flattened to remove the peaks and fill the valleys in the treatment cell. This regrading of the stockpiled soil is intended to reduce the volume of snow and future melt water that may accumulate within the treatment cell.

2012 Treatment

Aeration with the Allu bucket will commence once the camps have been commissioned and the stockpiled soil is thawed in the spring. The stockpiled soil will be placed back into windrows during the aeration process. Each windrow will be given a unique identifier and will be kept separate from other windrows during the 2012 treatment process. The volume of each windrow will be estimated by multiplying its length by the estimated cross-sectional area.

The windrows will continue to be aerated as weather and equipment availability permit and will be periodically sampled to determine the progress of the treatment.

3.3.2 Soil Tracking and Record Keeping

Once the windrows have been re-established and given identifier numbers in 2012, the number of aeration passes and sample ID numbers associated with each windrow will be tracked in field notes and an excel spreadsheet. Weather conditions for each day will also be recorded. Records will be available for DR review if required.

It is proposed that each windrow at a site will be given a sequential number (example - WR1, WR2, WR3, etc.) and retain that number throughout its treatment process. In the event that a windrow is divided, the new windrows should retain the same root number and be differentiated from one another

by a letter designation (example - WR3a, WR3b, WR3c, etc.). Windrows that are combined should retain both original root numbers (example – WR1/WR2).

The recommended sampling numbering system is described in Section 4.

3.3.3 Decommissioning

Once laboratory results indicate that concentrations of TPH within the soil in the treatment cell meet the far shore criteria, the on-site DR will be notified and provided the results of the testing. Once DR approval is received, the soil will be placed adjacent to the treatment cell in lifts not thicker than 0.5 m and track packed with a D6 bull dozer a minimum of three times. The placed soil will be landscaped to a similar feature as the surrounding topography.

Once all of the treated PHC soil has been removed from the treatment cell the liner would be removed and disposed of in the on-site non-hazardous landfill or an off-site licenced facility.

Confirmatory samples will be taken from the treatment cell areas following cell decommissioning and removal of the liner to compare with the 2011 baseline samples to determine if the underlying soil was adversely affected by the treatment operations. Confirmatory samples will be collected from similar locations as the baseline samples.

Subsequent to receiving confirmatory results that indicate soils underlaying the treatment areas are below the site guidelines, the berms will be flattened in place with a bull dozer and graded to blend in with the surrounding topography.

4. SAMPLING PROGRAM AND METHODOLOGY

The soil samples collected for this sampling program will be analysed for F1 to F3 hydrocarbons at Maxxam Analytics. Maxxam is a CALA accredited laboratory for this analysis. The sum of each of these hydrocarbon fractions will be used to determine a result for total petroleum hydrocarbons (TPH).

Sample shipments will be packed with ice and contain standard laboratory chain of custody forms.

It is recommended that the sample ID numbers be sequential, continuing from the previous year's numbers and include the source windrow number (example WR1-001, WR1-002, WR1-003, WR2-001, WR2-002, etc.).

Sample results will be tabulated and provided to the DR as required.

Sampling of Pad Material

To provide a baseline of existing site conditions, soil samples will be collected from the base of each treatment cell prior to construction. One sample will be collected for every 500 m^2 of the treatment cell base at PIN-E and one sample for every 150 m^2 of the treatment cell base will be collected at PIN-D. The sample locations will be spread evenly over the treatment cell area and/or at obviously stained locations. Treatment cell baseline and confirmatory samples will be collected from the upper 0.3 m of soil at each location.

Upon decommissioning of the treatment cells, confirmatory soil samples will be collected from similar locations as the baseline samples using the same methodology.

Windrow Characterization

To characterize TPH concentrations in the treatment cell soils, composite samples for each 100 m^3 of windrow material will be collected to monitor the progress of the treatment and establish when the soils are below criteria. The schedule of windrow sample submissions will be determined based field measurements and observations.

Each soil sample from soil undergoing treatment will be collected from approximately 0.5 m below the surface of the windrow using a dutch auger. The samplers will wear new nitrile gloves and decontaminate the dutch auger between composite sampling locations to avoid cross contamination of the samples.

Five sub-samples will be taken for each 100 m^3 of soil undergoing treatment and be blended to form one composite sample. The composite samples will be placed in new, laboratory supplied ziplock bags and glass jars with Teflon lined lids and minimum headspace. Soil from within the bags will be used to field screen volatile organic compounds using a photo ionization detector (PID) or organic vapour analyzer (OVA). The sample will be labeled with a unique ID and its collection location will be recorded in field notes. Twenty percent of windrow characterization samples will be duplicated for submission to a laboratory by the DR.

Following field screening, the jarred composite samples will be sent to Maxxam Analytics for laboratory analysis of F1 to F3 hydrocarbons.

5. CLOSURE

If you have any questions regarding this treatment plan please contact Sam Bird at 403-999-7781 or Sam.Bird@WorleyParsons.com.

Regards,

Sam Bird, B.Sc.
Environmental Scientist

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