PCB Label	Description	PCBs (ppm)
PN10811	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10812	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10813	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10814	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10821	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10822	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10823	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10824	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10825	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10826	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10827	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10828	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10829	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10830	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10831	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10832	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10833	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10834	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10835	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10836	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10837	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10838	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10839	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10840	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10841	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10842	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10843	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10844	CEPA soil in a 3.1 m^3 steel conical container	50-2000

PCB Label	Description	PCBs (ppm)
PN10845	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10846	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10847	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10848	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10849	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10850	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10851	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10852	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10853	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10854	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10855	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10856	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10857	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10858	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10859	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10860	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10861	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10862	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10863	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10864	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10865	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10866	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10867	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10868	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10869	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10870	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10871	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10872	CEPA soil in a 3.1 m^3 steel conical container	50-2000

PCB Label	Description	PCBs (ppm)
PN10873	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10874	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10875	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10876	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10877	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10878	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10879	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10880	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10881	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10882	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10883	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10884	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10885	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10886	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10887	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10888	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10889	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10890	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10891	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10892	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10893	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10894	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10895	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10896	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10897	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10898	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10899	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10900	CEPA soil in a 3.1 m^3 steel conical container	50-2000

PCB Label	Description	PCBs (ppm)
PN10901	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10902	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10903	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10904	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10905	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10906	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10907	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10908	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10909	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10911	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10912	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10913	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10915	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10927	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10928	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10929	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10930	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10931	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10935	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10936	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10937	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10938	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10939	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10940	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10941	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10942	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10943	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10944	CEPA soil in a 3.1 m^3 steel conical container	50-2000

PCB Label	Description	PCBs (ppm)
PN10954	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10955	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10956	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10965	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10966	CEPA soil in a 3.1 m^3 steel conical container	50-2000
PN10967	CEPA soil in a 3.1 m^3 steel conical container	50-2000
NR 93413	CEPA soil in a 3.1 m^3 steel conical container	50-2000
WR 70564	CEPA soil in a 3.1 m^3 steel conical container	50-2000
WR 70565	CEPA soil in a 3.1 m^3 steel conical container	50-2000
WR 70566	CEPA soil in a 3.1 m^3 steel conical container	50-2000
WR 70567	CEPA soil in a 3.1 m^3 steel conical container	50-2000
WR 70568	CEPA soil in a 3.1 m^3 steel conical container	50-2000
WR 70569	CEPA soil in a 3.1 m^3 steel conical container	50-2000
WR 70570	CEPA soil in a 3.1 m^3 steel conical container	50-2000
WR 70571	CEPA soil in a 3.1 m^3 steel conical container	50-2000
WR 70572	CEPA soil in a 3.1 m^3 steel conical container	50-2000
WR 70573	CEPA soil in a 3.1 m^3 steel conical container	50-2000
WR 70574	CEPA soil in a 3.1 m^3 steel conical container	50-2000
WR 70575	CEPA soil in a 3.1 m^3 steel conical container	50-2000
WR 70576	CEPA soil in a 3.1 m^3 steel conical container	50-2000
WR 70577	CEPA soil in a 3.1 m^3 steel conical container	50-2000
WR 70578	CEPA soil in a 3.1 m^3 steel conical container	50-2000
WR 70579	CEPA soil in a 3.1 m^3 steel conical container	50-2000
WR 70580	CEPA soil in a 3.1 m^3 steel conical container	50-2000
WR 70581	CEPA soil in a 3.1 m^3 steel conical container	50-2000
WR 70582	CEPA soil in a 3.1 m^3 steel conical container	50-2000
WR 70583	CEPA soil in a 3.1 m^3 steel conical container	50-2000
WR 70588	CEPA soil in a 3.1 m^3 steel conical container	50-2000

PCB Label	Description	PCBs (ppm)
WR70589	CEPA soil in a 3.1 m^3 steel conical container	50-2000
WR 70591	CEPA soil in a 3.1 m^3 steel conical container	50-2000
WR 70595	CEPA soil in a 3.1 m^3 steel conical container	50-2000
WR 70598	CEPA soil in a 3.1 m^3 steel conical container	50-2000

V. FUEL CONTAMINATION

A. General

Further progress was made this year in remediating fuel contaminated soils at Resolution Island and research related to the remediation efforts. At the beach POL tank area, the highly contaminated soil was removed to the main landfarm. The landfarm also had soil added from beneath the imploded tank which was dismantled. The main landfarm and the experimental plots were maintained, sampled and monitored during the summer season. A set of experimental plots were constructed in the barrel cache valley with hydrocarbon contaminated soil from between the Beach POL tanks. This experiment is designed to study the prospect of employing in situ bioremediation as a cost effective and efficient clean up method. The major laboratory experiments to mimic the field studies continued this year and produced exciting and useful results. Further work was carried out at the pond and filter system constructed in the drainage pathway from the imploded tank. At the barrel cache valley more soil contaminated with oil and grease was detected and this was containerized, together with that already identified, and shipped off site.

Each of the topics described above is discussed in detail in separate sections below. Data from the landfarms and laboratory experiments are discussed separately in Section G and Section H respectively. Rate constants for the various field and laboratory experiments by assuming first order kinetics have been derived. These are discussed in Sections G for the experimental landfarm and then in Section I in order to compare the field and laboratory results.

In this chapter, the abbreviation TPH (total petroleum hydrocarbon) is used synonymously with petroleum hydrocarbon.

B. Remediation Criteria

This topic was covered in detail in the ASU 2003 Resolution Island report. Briefly the following matters were discussed and resolved. Until 2002, the cleanup criteria used at Resolution Island was based on the original DLCU criteria established in 1991 but hydrocarbon contamination was not part of the original DLCU investigations. The CCME Canada-Wide Standards for petroleum hydrocarbons[1] were introduced in 2001. As stated in these standards, "The Canada-Wide Standards for Petroleum Hydrocarbons in Soil (PHC CWS) is a tier framework offering the proponent the option to comply with a set of reasonably conservative risk-based standards corresponding to a number of defined land uses, exposure scenarios and site characteristics (Tier 1) or to use additional site-specific information to assess and manage the risks through a more precise knowledge of actual or potential exposures (Tiers 2 and 3)". For the Resolution Island site and the Canadian Arctic in general, Tier 2 remediation criteria were developed according to the framework. This was originally done for the F2 fraction (diesel fuel) in surface coarse grained soils but has since been expanded as shown in Table V-1 for all four fractions.

Table V-1: CCME-TPH Tier 2 Derived Remediation Criteria for Arctic Soils

CCME Fraction	Unit	Tier 2 Remediation Criteria
F1 > 55 m to water body	ppm	15000
F2 > 55 m to water body	ppm	8000
F3 > 55 m to water body	ppm	18000
F4 > 55 m to water body	ppm	25000

The use of the 8000 ppm clean up criteria for the imploded tank area was proposed in the 2003 ASU report and approved by INAC and Environment Canada; an independent risk assessment (Tier 3) had proposed a remediation criteria of 26,860 ppm. The criteria of 18000 ppm for fraction F3 was used as the cleanup criteria in the barrel cache valley this year.

[1] Canadian Council of Ministers of the Environment (CCME) 2001. Canada-Wide Standard for Petroleum Hydrocarbon (PHC) in Soil User Guidance. April 2001.

C. Analytical Methods

1. Sampling

For soil, a test pit was dug in the desired sampling area. Using a new scoopula, each sample was composed of either a designated depth composite or a specific depth profile sample. To prevent volatilization during transport, the sample containers were completely filled allowing no headspace in the 250 mL glass amber bottles and kept cold. The samples were sealed and analysed at the ASU laboratories at Queen's University. Some samples were analysed in the on-site laboratory. Water samples were transported in glass amber containers sealed with a Teflon lid.

In the field, water was sampled in two types of environments: pooled water and flowing, shallow water. In pooled water the amber jar was submerged, filled allowing no headspace and sealed. In flowing water the amber jar was placed in the flow trajectory, filled and sealed. All samples were stored in a cold room prior to analysis.

The gravel and GAC filters were removed from the barrier, placed laterally on the ground and opened on one side by removing the screws. The open filter and its contents were photographed. Three samples were taken from each of the filters at the bottom (0.0-0.1 m), middle (0.15-0.25 m) and top (0.30-0.40 m) of the filter. Each sample was taken from a 50 cm by 50 cm area to the depth of the filter. The filter and boom materials were placed in 250 mL glass amber bottles and sealed with teflon lids

2. Total TPH Analysis

Soil samples were homogenized and sub-samples dried for moisture determination. A wet sample (10 g dry equivalent weight) was mixed with anhydrous sodium sulphate and Ottawa sand in an Erlenmeyer flask. Pesticide grade hexane (40 mL) was added, and the flask ultrasonically agitated. For wet samples additional hexane and sodium sulphate was added. A 1-mL aliquot of the hexane extract was pipetted from the flask in a manner ensuring no transfer of solid material, and sealed in a gas chromatography (GC) vial.

For water samples, 100 mL was accurately measured and transferred to a clean, 125 mL glass separatory funnel. Hexane, 5 mL, was added and the mixture shaken vigorously and then allowed to separate. If emulsions formed, the funnel was briefly sonicated to ensure adequate phase separation. An aliquot of the hexane phase was then transferred to a GC vial. For low level detection the samples were concentrated by blowing down with nitrogen gas from 10 mL to 0.5 mL before transfer to a GC vial; the final volume was determined accurately with a syringe.

For GAC, each charcoal trap was cooled in a 5 °C refrigerator before analysis to mitigate loss of readily volatile hydrocarbons. The contents of the trap were placed in an amber jar (125 mL) and carbon disulfide (CS_2) was added for extraction (30 mL). The jar was sealed with a teflon lid, mechanically homogenised and the contents were extracted for 30 minutes. Using a pipette, CS_2 (1 mL) was transferred to a gas chromatography (GC) vial and sealed. For the barrier filters GAC samples, 15 g of GAC was taken and shaken with 30 mL of CS_2.

The hexane or CS_2 extracts were analysed by GC/FID using a Hewlett Packard gas chromatograph with flame ionization detector. TPH was quantified by comparing the chromatogram peak area of the sample with that of the standard; standards of fuel oil and lubricating oil were prepared in hexane. Compound identity was determined by comparing the sample chromatogram with those of known hydrocarbon mixtures.

3. *CCME TPH Analysis*

Analysis was carried out according to the Canada-Wide standard for petroleum hydrocarbon in soil method.

For Soil Fraction F1, accurately weighed samples of wet soil (5 g) were extracted on a shaker for 1 hour with 10 mL of methanol. The methanol layer was then transferred into a vial and refrigerated until analysis. A 1 mL aliquot of the extract made up to 5 mL with water, was directly syringed into the purge and trap apparatus. The sample was purged with high purity helium gas for 11 minutes. The trapped components were desorbed from the trap in the unit by heating to 225 °C and holding for 4 minutes. A SPB-1 fused silica capillary column (30 m, 0.25 mm ID x 0.25 µm film thickness) was used. Retention time marking was done using nC6 and nC10 hydrocarbons and calibration using toluene. A wet/dry ratio for the sample was determined using a sub-sample and the final result was calculated using the dry weight of the sample. BTEX concentrations were subtracted from the F1 fraction results, if present.

For Soil Fractions F2-F4, samples were homogenized and sub-samples dried for moisture determination. Accurately weighed samples of wet soil (10 g) were extracted by soxhlet for 4 hours at 4 - 6 cycles per hour using 250 mL of hexane/acetone (1:1). The extract was filtered through sodium sulphate and 3 mL of toluene was added. The extract was then concentrated by rotoevaporation and transferred to a 50 mL tube. Hexane/dichloromethane (1:1) was added to bring the volume up to 30 mL. Silica was added and the sample shaken for 5 minutes. Once the sample had settled, a GC vial was then filled and the sample analysed by GC/FID. Blanks, control samples and duplicates were run at a frequency of approximately 20%. Calibration and retention time marking was done using nC10, nC16 and nC34 hydrocarbons and the final result reported in ug/g for each fraction. If PAH analysis had been present in the sample, naphthalene would have been subtracted from fraction F2 and the other 15 priority pollutant PAHs would have been subtracted from fraction F3.

4. *Identification*

The nature of the petroleum product present in the contaminated soils can be determined by comparison to known hydrocarbons and mixtures. Comparison of retention times indicate whether sample peaks are in the range of hydrocarbons found in fuels such as gasoline or diesel or due to lubricating oils and greases. Closer comparison of the chromatograms allows some insight into the change in the composition of the mixture by environmental factors.

5. *Microbial Analysis*

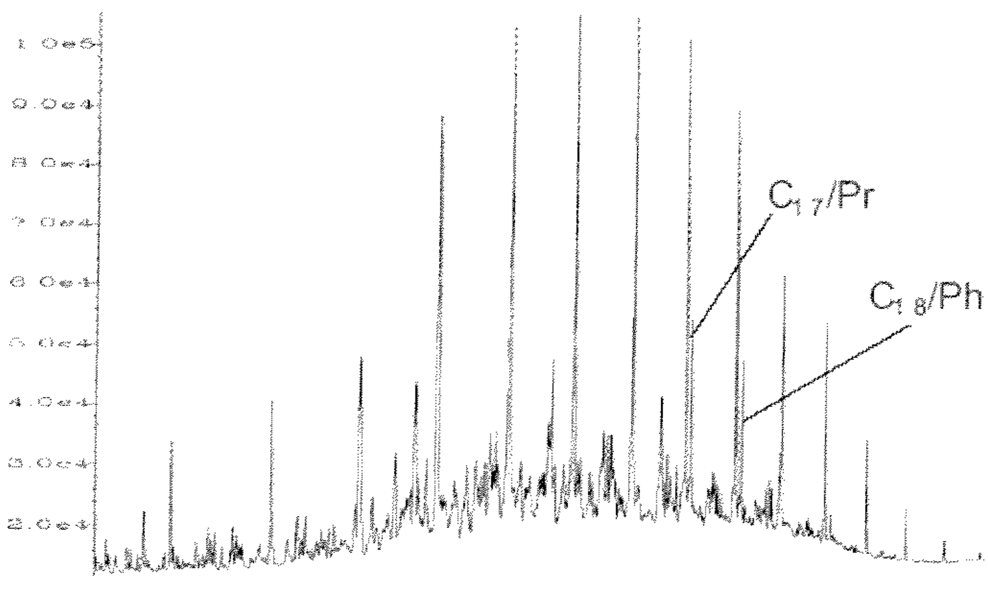
Microbial analysis of soil samples was conducted by IG Micromed Laboratories, British Columbia, Canada. The most probable number (MPN) was reported as colony-forming units (cfu) per g of dry soil.

6. C_{17}/Pristane and C_{18}/Phytane Ratios

Diesel fuel contains two pairs of compounds with very similar boiling points but for each pair, one is a straight chain alkane while the other is branched. Because the straight chain alkane is volatilized at the same rate as its branched counterpart but the straight chain hydrocarbon is bioremediated faster than the branched counterpart, these two pairs of compounds can be used to discriminate between the two remediation pathways of volatilization and bioremediation. The four compounds are the two straight chain alkanes, heptadecane ($C_{17}H_{36}$; C_{17}) and octadecane ($C_{18}H_{38}$; C_{18}), and the two branched alkanes 2,6,10,14 tetramethylpentadecane ($C_{19}H_{40}$; pristane Pr) and 2,6,10,14-tetramethylhexadecane ($C_{20}H_{42}$; phytane Ph). These branched alkanes are sometimes referred to as isoprenoids. The ratio of the masses of each pair in the hydrocarbon mixtures (equivalent to the ratio of the peak areas) are given as the mass of the straight chain alkane divided by the mass of the branched alkane; these are abbreviated as C_{17}/Pr and C_{18}/Ph in this report. Figure V-1 below shows the two pairs of peaks in a diesel standard.

Figure V-1

Chromatogram of a Diesel Standard



D. Barrel Cache Valley

Samples were taken from stains in the barrel cache valley and analysed by the CCME TPH method to give the results given in Table V-2.

The values for the F3 fraction exceeded the criterion of 18,000 ppm TPH in four of the five samples. As a result the stains were excavated and the contaminated soil placed in small (1.5 m^3) brown steel conical containers along with other soil already identified. Much of this soil was, in reality, oil and grease mixed with soil from direct spills found adjacent to barrels. Twenty six containers were filled and these were shipped off site for southern disposal at Horizon Environnement, Quebec. It was felt that, at Resolution Island, it was unwise to place this material in any landfill because of the preponderance of PCB contaminated soils and the possibility that the PCBs might be mobilized by the oil and grease.

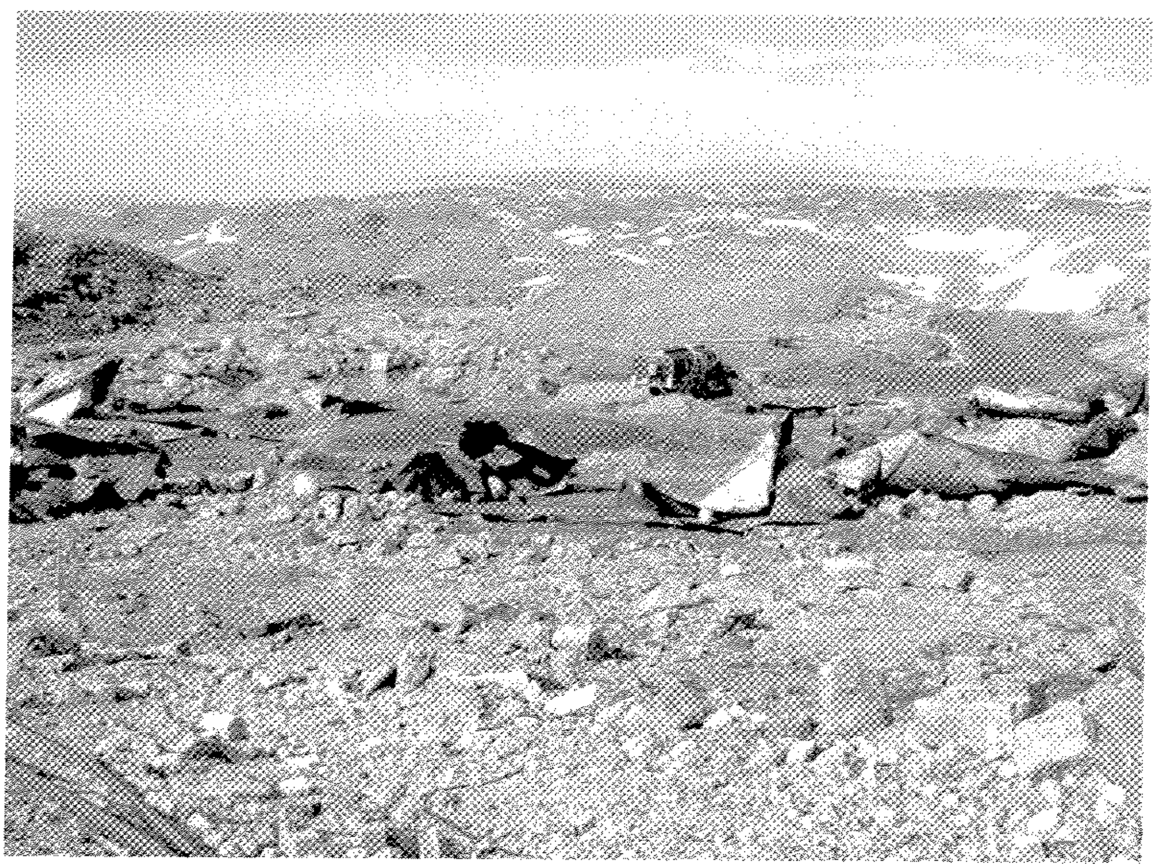
Table V-2: Results of Analyses of Delineation Samples for CCME-TPH at the Beach POL Area Obtained in 2003 (ppm)

Samples	F1 (C6-C10)	F2 (C10-C16)	F3 (C16-C34)	F4 (C34-C50)
RI05-1010	<10	750	31000	3400
RI05-1013	<10	2900	36000	7700
RI05-1014	<10	3200	42000	2100
RI05-1015	<10	1100	42000	4700
RI05-1017	21	4000	1300	<500

E. Imploded Tank Area

The imploded tank was dismantled this year (Photograph V-1). Stained soil at the resulting footprint was sampled and analyzed. Analysis of the two composite samples taken gave results of 15000 ppm (RI05-1018) and 11000 ppm (RI05-1019) as diesel fuel. Because these results were above the F2 criterion of 8000 pm, the top layer of soil was excavated and added the large landfarm.

This year further research work was conducted on the pond and barrier system constructed in 2004 as described below. The landfarm created in 2004 was maintained as described in section G.3.



Photograph V-1: The Remains of the Imploded Tank After its Demolition: Note the Hydrocarbon Contaminated Pad and the Main Landfarm Beyond

1. Ponding and Barrier Research

A pond and barrier system was constructed in 2004 as shown schematically in Figure V-2. This novel system was installed to examine its effectiveness in removing TPH from a drainage pathway under Arctic conditions. It was reasoned that a pond would help in the removal of volatile TPH by adding a larger surface area for evaporation and the use of an oil absorbent boom on the surface of the pond would remove any hydrocarbon on the water surface. Additionally, the placement of a barrier system incorporating materials to absorb TPH from water would remove any TPH from the water or entrapped particles.

This year the barrier was initially inspected to determine how well it had stood up to the winter and spring run off. As shown in Photograph V-2 the systems were in good condition and required no repair. The boom on the pond was replaced with a new one in early July 2005 and the sand and GAC filters were regenerated and replaced in the filter box.

In order to gauge the performance and effectiveness of the pond and barrier system, a monitoring system was established. This required the testing of soil, water and components of the system to determine whether TPH was indeed being removed. The monitoring activities are described below.

In 2004, soil and water monitoring points were established at locations upstream, downstream and within the system reservoirs as shown on Map V-1.

Results of analyses of the soil samples are shown in Table V-3 for both 2004 and 2005. The soil results show the established trend of a decrease in TPH levels as the distance from the source at the imploded tank increases. The value at SP2 in 2005 is anomalously low. Now that the activity at the site has ceased it will be interesting to see if the TPH soil levels change with time, particularly at SP3 just beyond the barrier system.

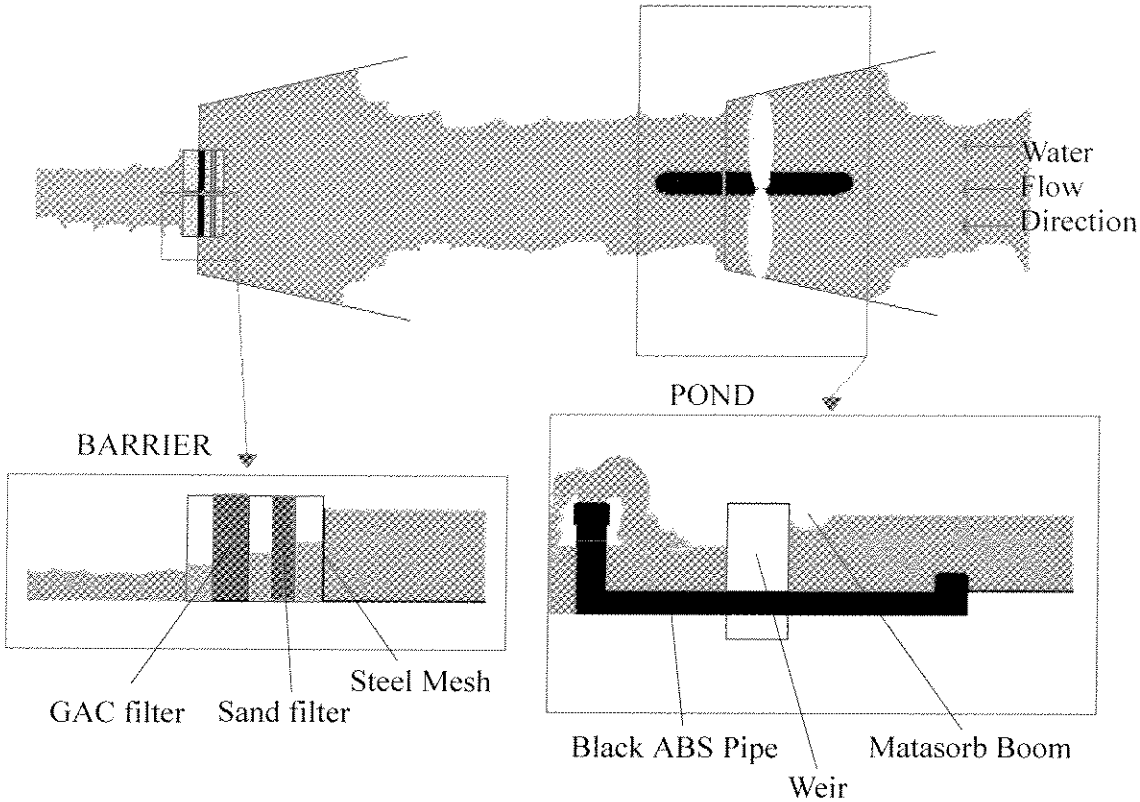


Figure V-2: Schematic of the Pond and Barrier System

Photograph V-2: The Drainage Pathway From the Imploded Tank and Main Landfarm With the Pond and Barrier System at the Start of the 2005 Season

Ma[ ] [ ]: Monitoring Points at the Pond and Barrier System in [ ]rainage Pathway Leading from the Imploded Tank

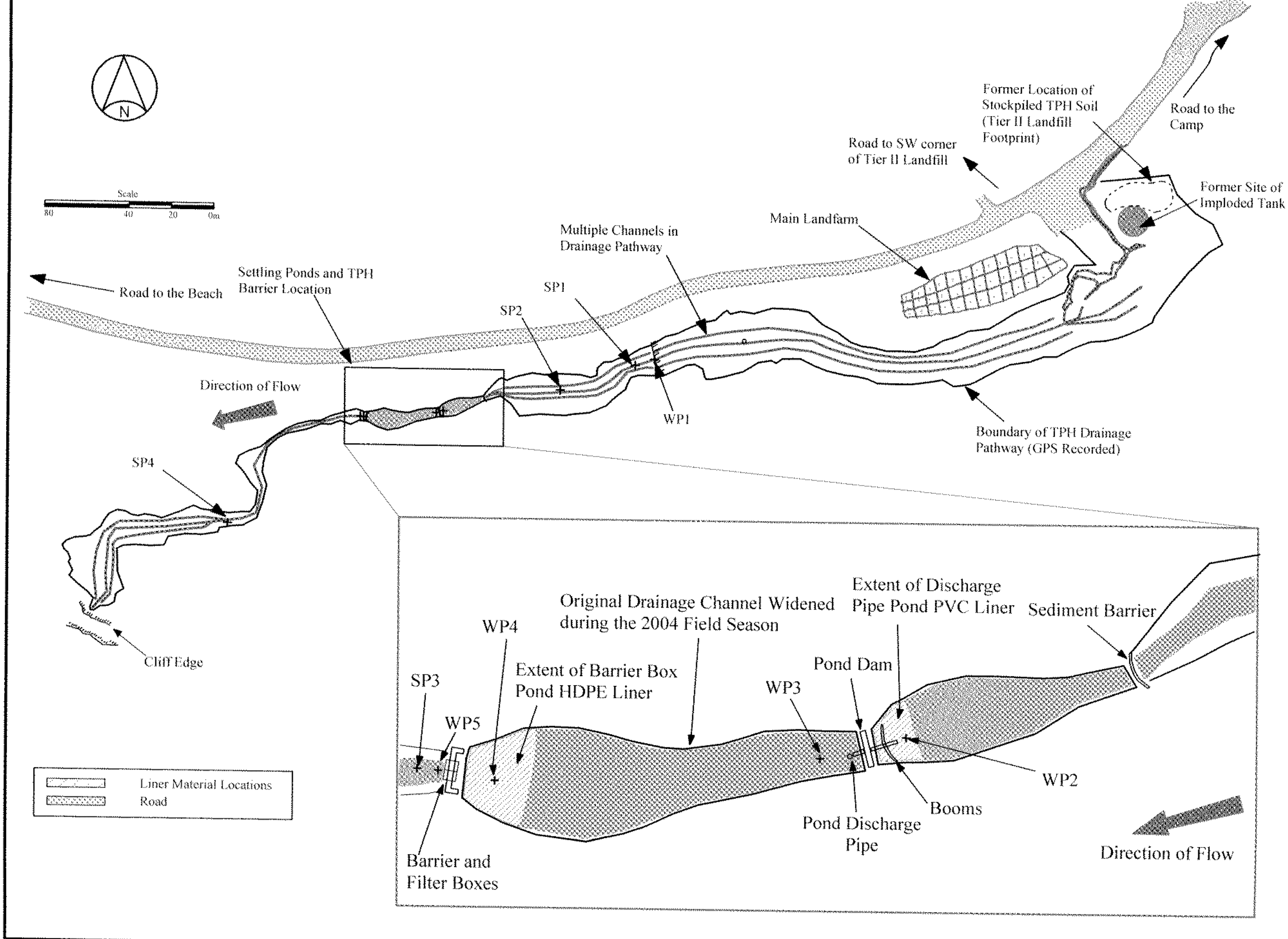


Table V-3: Results of Soil Analyses for TPH at the Imploded Tank Drainage Area Ponds and Barriers

Soil Monitoring Point	Location	TPH (ppm)	
		2004	2005
SP1	Below waterfall	954	710
SP2	Between waterfall and barrier	1190	<40
SP3	Just beyond barrier	288	604
SP4	Between barrier and cliff	157	103

Water samples taken in the imploded tank drainage channel during the assessment phase all gave results of <1.0 mg/L TPH. Water samples were collected in 2004 from four points within the barrier system to determine low-level concentrations of TPH in water. Results given in Table V-4 show that TPH levels were in the range from 0.09 - 0.11 ppm. In 2005 one additional monitoring point was added (Photograph V-3). Results of the analysis for TPH in water from these five points gave values in the range 0.16 – 0.31 ppm TPH. In both 2004 and 2005 there was considerable disturbance of the surface soil and water interface in and around the imploded tank area. The results in Table V-4 therefore represent elevated background levels associated with this activity.

Table V-4: Results of Water Analyses for TPH at the Imploded Tank Drainage Area Ponds and Barriers

Water Monitoring Point	Location	TPH (ppm)	
		2004	2005
WP1	Small Waterfall Area Upstream of Pond	0.09	0.19
WP2	Pond #1	0.11	0.31
WP3	Pond #1 Discharge Pipe	-	0.16
WP4	Pond #2	0.09	0.29
WP5	Filter System Discharge	0.09	0.23

Sand and GAC filter materials from the barrier filter systems were sampled in 2005 and analysed to give the results shown in Table V-6. Two filters were placed side by side in the slots in the barrier box. For each side there was a gravel filter (11/2 inch thick) placed in front of a GAC filter (3 inch thick). The gravel was sized between 2 and 10 mm while the GAC was between 1.68 and 3.36 mm (sieve sizes 6 and 12). Three samples were collected from each filter from the bottom, middle and top sections (Photograph V-4). Results presented in Table V-5 show that for the gravel filters all were below the detection limit of 20 ppm TPH. Measurable levels of TPH was found in two sections of the GAC filters as reported in Table V-5. Using a value of half the detection limit, the maximum amount of TPH collected by the GAC filters was calculated to be 0.75 g TPH.

Table V-5: Results of Sand/GAC Analyses for TPH at the Imploded Tank Drainage Area Ponds and Barriers

Filter	Location	TPH (ppm)
Gravel	Bottom left filter	<20
Gravel	Middle left filter	<20
Gravel	Top left filter	<20
Gravel	Bottom right filter	<20
Gravel	Middle right filter	<20
Gravel	Top right filter	<20
GAC	Bottom left filter	59
GAC	Middle left filter	<20
GAC	Top left filter	88
GAC	Bottom right filter	<20
GAC	Middle right filter	<20
GAC	Top right filter	<20

Samples from the Matasorb boom were collected at the end of the 2004 field season at which time the boom was replaced with a new one. Samples were also collected this year from the Matasorb boom which was again replaced. The boom material is currently stored at 4 °C awaiting analysis and the development of an analytical method.

Nitrogen and phosphorus levels were determined in soil samples from three monitoring points in 2004 and 2005 as reported in Table V-6. The TKN and Total P values are generally lower than those reported from other locations at the site. This suggests that currently there has been little or no leaching of fertilizer from the main landfarm.

Table V-6: Soil Nitrogen and Phosphorus Levels (ppm) in the Drainage Pathway

Sample	Year	Monitoring Point	TKN	Ext. Ammonia	Ext. Nitrate	Ext. Nitrite	Total P	Ext P
RI04-730	2004	SP1	197	<0.25	<4	<2	93	3
RI04-727	2004	SP2	290	<0.25	<4	<2	260	3
RI04-729	2004	SP4	205	<0.25	<4	<2	140	4
RI05-1016	2005	SP1	157	<0.25	<4	<2	160	4
RI05-1049	2005	SP2	79	<0.25	<4	<2	130	3
RI05-1021	2005	SP4	181	<0.25	<4	<2	160	2

In 2005, both the PVC and HDPE liners were inspected for deterioration. There was no visual evidence of tearing or tension in either of the liners. The GCL below the HDPE liner in the filter system was found to be intact at the GCL-filter box jointure and remained to provide a satisfactory seal between liner and filter box. The sand bags that were placed on the liner in 2004 were intact and the PVC liner had reformed to indicate the ground contour. The upstream edge of each liner had been toed into the ground with large boulders in 2004. In 2005 these were intact and water did not appear to be leaking from the system under the liners. The berm edges that had been partially covered with sandbags and fully covered with soil material were intact. The ABS pipe in the ponding area was intact and operational. In both the pond and the filter system pond the liners were covered with about 5 cm of sediment which should protect them from deterioration due to ultra-violet light.