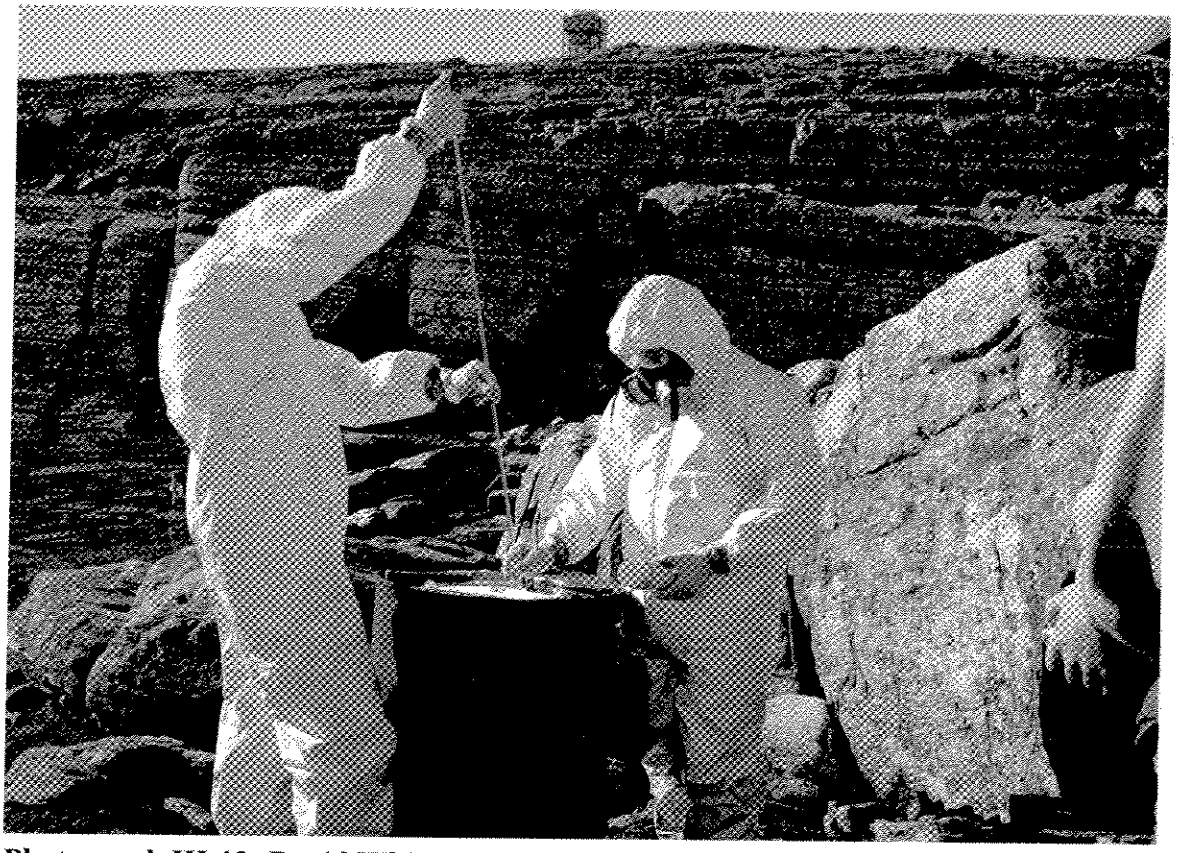


Photograph III-12: David Whitmore and Jared McKay Taking a Sample From a Barrel Containing a Liquid of Unknown Composition

Photograph III-13: Taking Barrel Samples From Behind the Old Officer's Mess

G. Air Sampling for PCBs and Chlorobenzenes

The selection of appropriate personal protective equipment for respiration when working with PCB contaminated materials at the site is important. In the Resolution Island Health and Safety Plan (HASP), Appendix 5, a dust level of 4.4 mg/m^3 is suggested as a trigger for when a dust mask should be worn. This value is calculated using a value of 10 mg/m^3 for an 8 hour day relating to particulates not otherwise classified. A direct reading dust meter is available for use at the site. In practice dust masks must be worn in dusty conditions or at any time workers may wish to do so. Half-face respirators equipped with filters and organic vapour cartridges are worn whenever the odour of chlorobenzenes is encountered. Regulations with respect to PCBs are given in the HASP and these are in the range 0.5 to 2.0 mg/m^3, that is less than the 4.4 mg/m^3 for dust suppression. However, it should also be noted that NIOSH has set a recommended exposure limit of 0.001 mg/m^3 or about one thousandth of the NWT occupational exposure limits. The situation with PCBs is also complicated by the fact that they were manufactured and sold as mixtures, often referred to as Askarels, which contained not only PCBs but also chlorobenzenes. These more volatile compounds are responsible for the characteristic PCB odour. Regulations respecting Occupational Safety and Health made under Part II of the Canada Labour Code give a ceiling value of 5 ppm or 40 mg/m^3 for chlorobenzenes: NIOSH has the same standard for their time weighted average (TWA) concentration for a 10 hour working day.

In order to determine the levels of PCBs in the air, samples were collected using NIOSH method 5503 with an air pump and ORBO-60 adsorption tubes. The pump was run at a rate of about 170 mL/min for about 3-4 hours. Twenty four air samples have been taken during the last four field seasons and all have given results below the detection limit and NIOSH level of 0.001 mg/m^3. Six samples were collected this year from the locations specified in Table III-13. Analysis of these samples all gave results of < 0.001 mg/m^3.

In order to determine the level of chlorobenzenes in the air, samples were collected and analysed using NIOSH method 5517. The XAD-2 tubes and filters were extracted with hexane and the extracts run on a gas chromatograph with a mass spectrometric detector (GC/MS). This year three samples were collected from various locations where CEPA soils were being processed. Samples were analysed for all di-, tri-, tetra-, penta- and hexa- chlorobenzenes.

Results are presented in Tables III-14 and III-15. Sample RI05-194 was from the Tier II landfill, RI05-195 was from the north slope dump during excavation, and RI05-197 was taken from beside the decontamination trailer. In previous years tri- and tetra-chlorobenzenes had been detected. This year no chlorobenzenes were detected. This probably reflects the fact that the three samples were collected from areas where Tier II soils were being handled rather than CEPA soils as in previous years.

Table III-13: PCB Concentrations in Air Samples Collected at Resolution Island

Sample	Location	PCB per tube (μg)	PCB Concentration. in air (mg/m^3)
RI05-192	Tier II landfill	<0.05	<0.001
RI05-193	North slope dump	<0.05	<0.001
RI05-196	Building B2 and decontamination trailer	<0.05	<0.001
RI05-384	Building B2	<0.05	<0.001
RI05-389	S1/S4 Beach area	<0.05	<0.001
RI05-383	Tier II landfill	<0.05	<0.001

Table III-14: Chlorobenzene Compounds Found in Air Samples Collected at Resolution Island (ug per tube plus filter)

Sample	RI05-194	RI05-195	RI05-197
1,2- dichlorobenzene	<0.01	<0.01	<0.01
1,3- dichlorobenzene	<0.01	<0.01	<0.01
1,4- dichlorobenzene	<0.01	<0.01	<0.01
1,2,3 trichlorobenzene	<0.01	<0.01	<0.01
1,2,4 trichlorobenzene	<0.01	<0.01	<0.01
1235, 1245- tetrachlorobenzene	<0.01	<0.01	<0.01
1,2,3,4 tetrachlorobenzene	<0.01	<0.01	<0.01
pentachlorobenzene	<0.01	<0.01	<0.01
hexachlorobenzene	<0.01	<0.01	<0.01

Table III-15: Chlorobenzene Concentrations in Air Samples Collected at Resolution Island (mg per m^3)

Sample	RI05-194	RI05-195	RI05-197
1,2- dichlorobenzene	<0.001	<0.001	<0.001
1,3- dichlorobenzene	<0.001	<0.001	<0.001
1,4- dichlorobenzene	<0.001	<0.001	<0.001
1,2,3 trichlorobenzene	<0.001	<0.001	<0.001
1,2,4 trichlorobenzene	<0.001	<0.001	<0.001
1235, 1245 - tetrachlorobenzene	<0.001	<0.001	<0.001
1,2,3,4 - tetrachlorobenzene	<0.001	<0.001	<0.001
pentachlorobenzene	<0.001	<0.001	<0.001
hexachlorobenzene	<0.001	<0.001	<0.001

H. Drinking Water

1. Analysis

A thorough testing of the drinking water at Resolution Island was performed three times during the summer. In addition, the new drinking water lake was sampled and analyzed to comply with the water board requirements.

2. Methods

Water samples were collected in one litre polyethylene bottles for general water quality parameters and inorganic elements analysis and in one litre Teflon bottles for PCB analysis. For the analysis of phenols, a bottle containing an aliquot of phosphoric acid was used, for mercury, a bottle with an aliquot of sodium dichromate solution was used and, for bacteriological measurements, a sterile bottle was employed. Upon receipt in the laboratory, all samples were stored at 4 ^{o}C. Tests were performed using standard laboratory procedures

3. Drinking Water

Analytical results are shown in Table III-16. None of the parameters measured, with the exception of the pH levels were outside of the OME guidelines. The water at Resolution Island contains no buffering capacity and is quite acidic. Addition of sodium carbonate was undertaken again this year and pH values given in Table III-17 were measured daily. The pH values ranged from 4.0 to 8.0 with a mean value of 5.7. Obviously some days the carbonate was not added.

Table III-16: Drinking Water Results and Guidelines

Parameter	Units	1-Jul-05	14-Jul-05	19-Aug-05	OME Guidelines
Alkalinity	mg/L	<3	6	8	30-500
Ammonia	mg/L	<0.1	<0.1	0.2	-
Calcium	mg/L	4.2	7.0	9.5	-
COD	mg/L	<3	<3	<3	-
Conductivity	uS/cm	143	121	155	-
Copper	mg/L	0.17	0.06	0.09	<1.0

Parameter	Units	1-Jul-05	14-Jul-05	19-Aug-05	OME Guidelines
Hardness	mg/L	25	30	38	80-100
Iron	mg/L	<0.05	<0.05	<0.05	<0.30
Lead	mg/L	<0.010	<0.010	<0.010	<0.010
Magnesium	mg/L	3.6	3.2	3.5	-
PCBs	ug/L	<3.0	<3.0	<3.0	< 3.0
pH	-	5.2	6.9	6.9	6.5-8.5
Phenols	ug/L	<1.0	<1.0	<1.0	-
Potassium	mg/L	0.5	0.3	0.5	-
Sodium	mg/L	11.2	3.4	13.6	<200
Sulphate	mg/L	65	41	53	<500
Nitrate	mg/L	<0.05	<0.05	<0.05	<10
Nitrite	mg/L	<0.05	<0.05	<0.05	<1.0
Chloride	mg/L	12.5	5.2	5.7	<250
TDS	mg/L	85	94	87	<500
TKN	mg/L	0.1	0.3	0.1	-
TSS	mg/L	3.2	3.0	<7.0	<500
Zinc	mg/L	0.11	0.04	0.06	5
Total Coliforms	Cts/100 mL	0	0	0	5
Faecal Coliforms	Cts/100 mL	0	0	0	0
Faecal Streptococci	Cts/100 mL	0	0	0	0
E coli	Cts/100 mL	0	0	0	0
Standard Plate Ct (48hrs)	Cts/1 mL	0	0	0	500
Background Count	Cts/100 mL	65	3	2	250

Table III-17: Drinking Water pH Results

Date	pH	Date	pH
28-June-05	4.9	2-August-05	6.2
29-June-05	4.6	3-August-05	6.0

Date	pH	Date	pH
30-June-05	4.3	4-August-05	5.9
2-July-05	5.2	5-August-05	5.8
4-July-05	4.9	6-August-05	5.9
5-July-05	4.6	8-August-05	6.0
6-July-05	4.1	9-August-05	4.0
7-July-05	5.5	10-August-05	4.0
8-July-05	5.5	11-August-05	4.9
10-July-05	5.9	12-August-05	4.9
11-July-05	6.6	13-August-05	4.8
12-July-05	6.1	14-August-05	5.2
13-July-05	6.3	16-August-05	6.4
14-July-05	6.1	17-August-05	7.3
15-July-05	6.7	18-August-05	6.9
16-July-05	5.3	21-August-05	6.5
17-July-05	5.3	22-August-05	6.4
18-July-05	6.5	24-August-05	6.3
19-July-05	5.6	25-August-05	6.5
20-July-05	6.0	26-August-05	6.5
21-July-05	5.4	27-August-05	6.8
23-July-05	4.8	28-August-05	7.0
24-July-05	4.7	29-August-05	6.5
25-July-05	4.8	30-August-05	6.2
26-July-05	6.6	31-August-05	5.8
27-July-05	8.0	1-September-05	5.1
28-July-05	6.2	2-September-05	5.0
29-July-05	6.3	3-September-05	4.2
30-July-05	6.8	4-September-05	4.1
31-July-05	6.8	5-September-05	4.4
1-August-05	7.1	6-September-05	4.4

I. Lake Water

In order to comply with the water board licence, water samples were required to be collected from the water lake and runoff from the new non-hazardous landfills. However, there was no runoff from the two non-hazardous landfills so only results from the water lake are presented here. A sample of lake water was collected on 14 July 2005 and analyzed to give the results presented in Table III-18. The value of 0.113 ppm for manganese and those for other metals are consistent with the results from previous years. The manganese value is greater than the drinking water criterion but this is an aesthetic guideline.

Table III-18: Lake Water Results

Parameter	Unit	Lake Water
Copper	mg/L	0.018
Iron	mg/L	0.09
Lead	mg/L	<0.005
Manganese	mg/L	0.113
Mercury	mg/L	<0.0001
Cadmium	mg/L	<0.001
Nickel	mg/L	0.082
Chromium	mg/L	<0.005
Cobalt	mg/L	0.018
Zinc	mg/L	0.044
Phenols	ug/L	<1.0
pH	-	4.64
TSS	mg/L	<4.0
Nitrate	mg/L	<0.05
Nitrite	mg/L	<0.05
Oil and Grease	mg/L	<1.0
BOD	mg/L	<3
Faecal Coliforms	Cts/100 mL	0

J. Background Water Samples

In order to establish background data, water samples were again collected this year from several locations and analysed for PCBs, and the eight elements of the DEW Line Clean Up Criteria. Analytical procedures were used to give low detection limits; metals are for the dissolved fraction. Average results from previous years are given in Table III-19; these values exclude results from the furniture dump and S1/S4 beach stream and lake which are not representative. Results for the background samples collected this year are given in Tables III-20 and III-21. Furniture dump drainage results are presented in Chapter VI, section D.3.d.

Seven samples were collected from six locations this year (Photograph III-14). The lake near the S1/S4 beach was added to the monitoring locations and the beach stream was sampled twice.

Results for eight elements in the DLCU criteria for the four locations other than the S1/S4 beach stream and lake are all within the ranges given in Table III-19. For arsenic, cadmium, chromium and lead all are less than the method detection limits except for a lead level of 42 ppb found in the maintenance dump drainage pathway. This sample was taken prior to the removal of the cobalt contaminated pathway and may represent contamination due to the activity upgradient at the Tier II landfill. No PCBs were detected in the water at these four locations.

Photograph III-15 shows the pond and the stream that flows from it below the cliff near the S1/S4 beach area. The photograph also shows the road that was constructed across the stream in order to access the PCB contaminated soil at the S1/S4 beach area. Water was taken from the stream below the crossing point on 9 July and 25 August 2005 and from the pond. Results from the stream last year showed levels for cobalt, copper and nickel above the normal background levels. These high levels were again found this year and these were also found in the pond water. This could be due to the construction activity or the fact that the water could be described as glacial in that it flows from the old water lake over the cliff area that is covered with permanent snow to a lake whose color, on occasion, resembles that of alpine glacial lakes. PCB levels in both stream samples were elevated while the level in the pond was not. This result is undoubtedly due to the construction activity.

Table III-19: Summary of Analytical Results Obtained from Background Water Samples Over the Period 2001 – 2004*

	Cobalt	Copper	Nickel	Zinc
Surface Runoff	ppm	ppm	ppm	ppm
Mean	0.016	0.019	0.059	0.059
Standard Deviation	0.004	0.007	0.022	0.026
Range	0.010-0.023	0.007-0.036	0.021-0.084	0.031-0.122
Lake Water				
Mean	0.014	0.015	0.059	0.032
Standard Deviation	0.004	0.004	0.023	0.007
Range	0.010-0.022	0.011-0.022	0.033-0.095	0.023-0.040

*Excluding the furniture dump drainage area and the S1/S4 beach stream

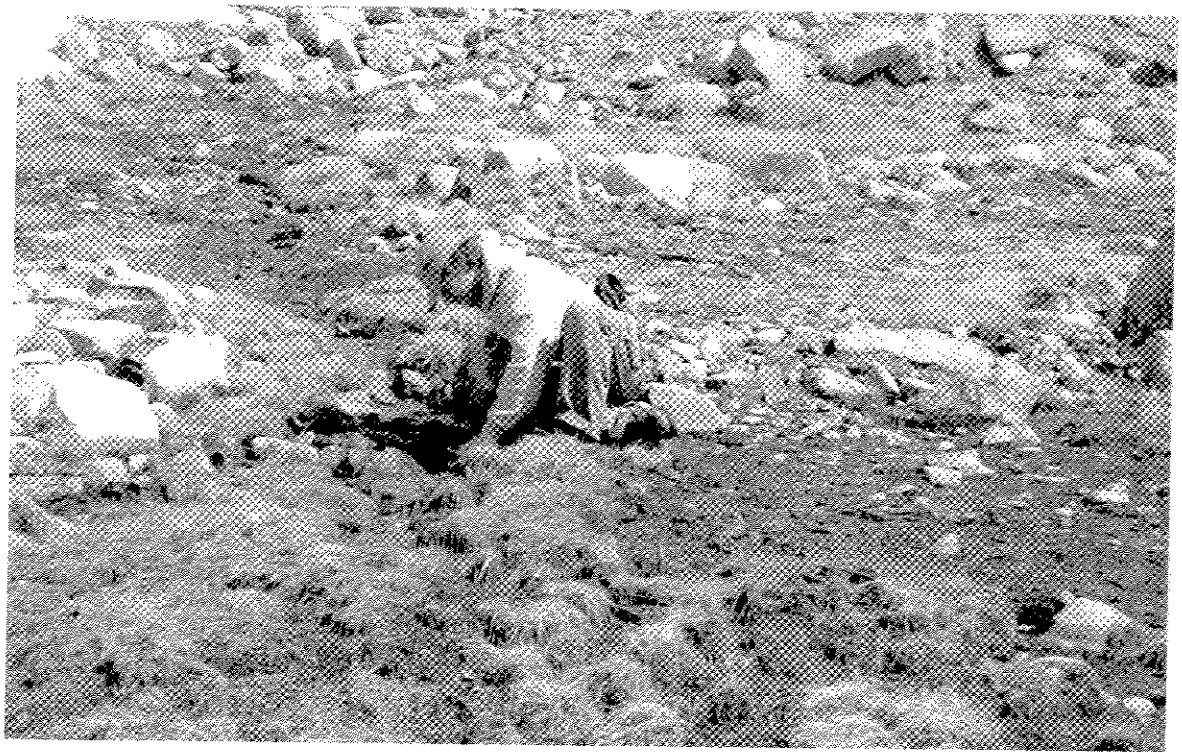
Table III-20: Sampling Locations and Collection Dates of Background Water Samples

Sample Number	Sample Description and Location	Date Collected
RI05-W010	Water flowing in stream below the S1/S4 Beach, now crossed by Road	9-July-05
RI05-W014	Water flowing by the old officer's mess	11-July-05
RI05-W020	Water flowing behind imploded tank	11-July-05
RI05-W021	Water flowing from the maintenance dump	11-July-05
RI05-W022	Water flowing in the beach dump stream	11-July-05
RI05-W035	Water in Lake above stream below the S1/S4 Beach, now crossed by Road	9-August-05
RI05-W058	Water flowing in stream below the S1/S4 Beach, now crossed by Road	25-August-05

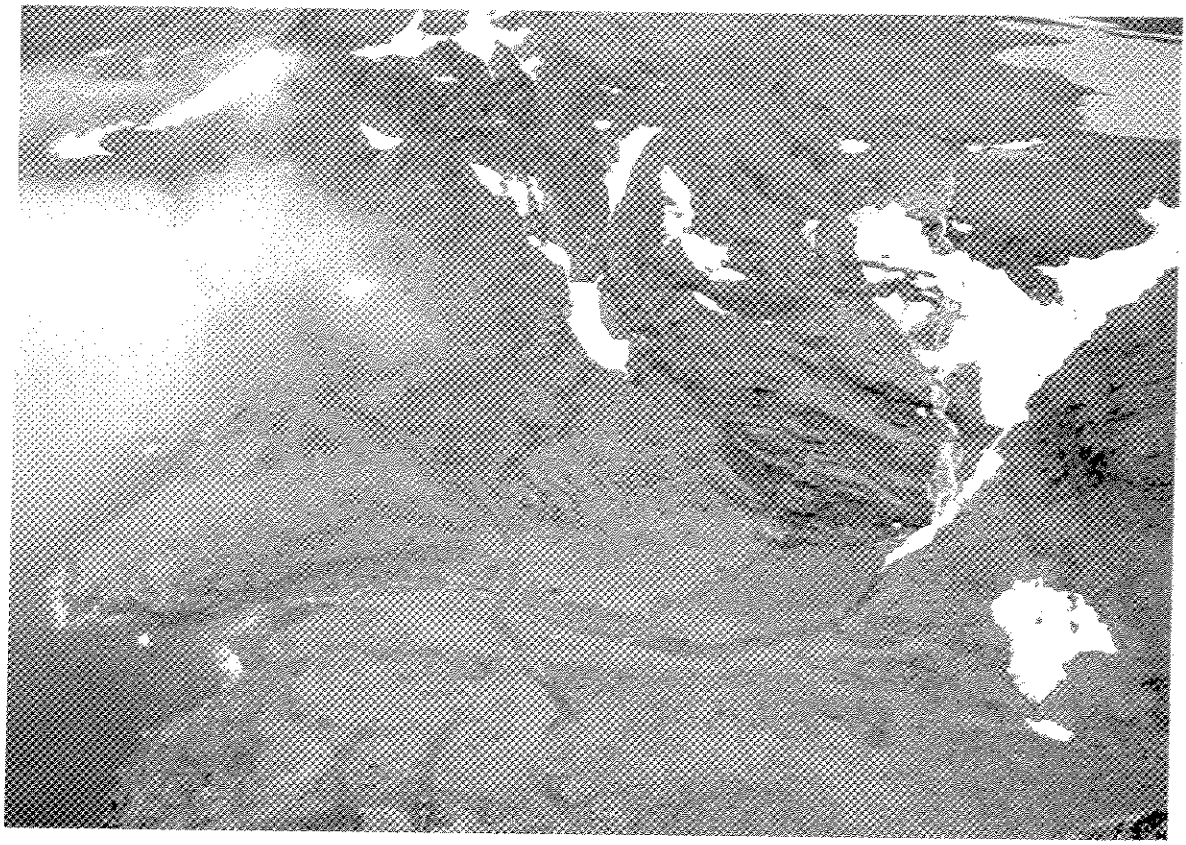
Table III-21: Analytical Results Obtained from Background Water Samples

Element	Unit	RI05-W010	RI05-W014	RI05-W020
		Stream by S1/S4 beach	Officer's mess	Imploded tank
PCBs	ppb	0.053	<0.020	<0.020
As	ppm	<0.003	<0.003	<0.003
Cd	ppm	<0.001	<0.001	<0.001
Cr	ppm	<0.005	<0.005	<0.005
Co	ppm	0.029	0.013	0.022
Cu	ppm	0.059	0.025	0.032
Pb	ppm	<0.010	<0.010	<0.010
Ni	ppm	0.133	0.084	0.051
Zn	ppm	0.082	0.113	0.077

Element	Unit	RI05-W021	RI05-W022	RI05-W035	RI05-W058
		Maint. dump	Beach dump	S1/S4 beach lake	Stream by S1/S4 beach
PCBs	ppb	<0.020	<0.020	<0.020	0.27
As	ppm	<0.003	<0.003	<0.003	<0.003
Cd	ppm	<0.001	<0.001	<0.001	<0.001
Cr	ppm	<0.005	<0.005	0.006	<0.005
Co	ppm	0.005	0.018	0.030	0.034
Cu	ppm	0.034	0.021	0.049	0.047
Pb	ppm	0.042	<0.010	<0.010	0.021
Ni	ppm	0.013	0.062	0.140	0.161
Zn	ppm	0.060	0.042	0.081	0.092



Photograph III-14: Collecting a Background Water Sample From the Maintenance Dump Drainage Channel Prior to its Excavation



Photograph III-15: The Pond Below the Old Water Lake and the Stream to the Sea That is Crossed by the Road to the S1/S4 Beach Area. Background Water Samples Were Collected from the Stream and the Pond

K. Background Plant Samples

Background plant samples were collected and analysed for PCBs again this year. The locations as shown on Map III-4 (RI05 numbers) were sampled this year on 24 July 2005 (P001-P015) and 30 August 2005 (P017-P023). All plants are *Salix Polaris* unless otherwise stated in Table III-22.

1. Analytical Method

Plant samples were wrapped in foil and placed in ziplock bags. Samples were not washed and were kept frozen prior to analysis. Samples were dried overnight in a vented oven at 25 °C. Once dried 1.0 g of dried sample was accurately weighed and then ground in a mortar and pestle with sodium sulphate and Ottawa sand. The ground sample was transferred to a thimble, spiked with DCBP, and extracted by soxhlet for 4 hours at 4 - 6 cycles per hour using 250 mL of dichloromethane. The extract was then concentrated to approximately 10 mL. This extract was applied to a GPC column to separate the PCBs from the lipids. The PCB fraction was rotoevaporated, the solvent exchanged to hexane and the extract applied to a Florisil column for cleanup. This final extract was concentrated to 0.5 mL and run by GC/ECD. Values are reported on a dry weight basis.

2. Plant Analysis Results

Plants are thought to be a good biological indicator of airborne PCBs. Results obtained over the past three seasons therefore represent the scenario during the active remediation of the site. PCB levels are expected to be higher at present than in future years when the cleanup is over. At that time nearly all the PCBs will have been removed from the site or buried and therefore much less airborne PCBs are expected to be present.

The results are presented in Table III-22 and on Map III-4. Map III-4 also shows the ten designated plant sampling points (PMPs) to be monitored in future years as part of the long term monitoring plan. All PCBs showed the Aroclor 1260 pattern. Results indicate that the level of PCBs in the plants in the areas removed from remediation action has already dropped. This is due to the removal of the high level CEPA soil. For instance, at monitoring point PMP3 near the airstrip the level has dropped from 11000 ppb in 2002 to 4.3 ppb (the average of the two results, 2.5 and 6.1 ppb). In contrast the level at PMP2 near the Tier II landfill has increased from <3 ppb in 2004 to 250 this year due to major activity involving Tier II soils nearby. The results are particularly gratifying in that they

indicate that the removal of the PCB contaminated soils has already reduced the airborne transport of PCBs.

Table III-22: Results of Analyses of Background Plant Samples

Sample	Tag	PCBs (ng/g)	Location
RI05-001P	6421	530	Old officer's mess
RI05-002P	6568	250	NE of Tier II landfill
RI05-003P	6904	42	Imploded tank (TPH drainage pathway)
RI05-004P	6741	2.5	Airstrip dump drainage pathway
RI05-006P	6739	5.0	100 m N of airstrip dump drainage pathway
RI05-008P*	6746	18	S1/S4 beach
RI05-009P	6889	5.4	1000 m S of barrel cache valley
RI05-011P	6887	8.6	1000 m NE of airstrip
RI05-012P	6783	5.3	Radio hill
RI05-017P	6742	3.9	Radio hill
RI05-018P	6888	5.8	Radio hill
RI05-019P#	6758	34	TPH Drainage Pathway, 20 m upstream from #6758
RI05-020P	6984	4.5	New water lake
RI05-021P	6887	14	1000 m NE of airstrip
RI05-022P	6741	6.1	Airstrip dump drainage pathway
RI05-023P	6739	7.3	100 m N of airstrip dump drainage pathway

* *Salix Arctica*; # Crowberry

Map III-4: Locations and PCB Concentrations of Background Plant Samples Collected in 2005 and Designated Plant Monitoring Points