3. Sampling

Soil samples were collected using plastic scoops and placed in WhirlPak bags. Samples were collected in the vicinity of locations where previous samples had shown high contamination levels to be present. Tape measures were used to determine the relative location of sampling points. Sampling locations were marked with a six inch nail to which was attached a numbered metal disk and a piece of flagging tape. Soil sample locations were referenced to previous sampling points. Tables containing the analytical results cross reference sample numbers with the location numbers. Soil samples were generally restricted to the upper 10 cm but in order to determine the depth of contamination, test pits were also excavated (manually and by machine) and samples collected at specific depths.

Water samples were collected in 1 L Teflon bottles. Absorbent boom material was collected by cutting open a small section of boom and extracting some material by hand. The absorbent material was placed in WhirlPak bags. Care was taken to extract boom material from the center of the boom to avoid material that was in direct contact with contaminated soil.

All samples were shipped by guaranteed air freight to Queen's University for testing. In order to conform with regulations regarding sample control, a rigorous chain of custody was maintained. Chain-of-custody forms were filled out and checked for each sample before shipment from the North, and the contents of shipments were verified upon receipt in the laboratory. The relevant documentation is available on request.

4. PCB Analysis

Two methods were used to analyze for PCBs in soils namely the standard laboratory technique using gas chromatography with an electron capture detector (GC/ECD) and the field method using immunoassay test kits; for all other matrices only the GC/ECD method was employed. The field test kit method worked well for all soil samples but was not relied upon for those samples containing high levels of oil or plant material.

a) Field Test Kits (Soil Samples)

Field analyses of polychlorinated biphenyls (PCBs) were performed with Millipore EnviroGard™ PCB Test Kits. The immunoassay was carried out according to the manufacturer's instruction, but with a few minor modifications. A sub-sample was spread out on absorbent paper towels and allowed to air dry overnight. Then a 5 g portion was weighed and extracted with 5 mL methanol. The soil-methanol mixture was filtered and an aliquot of the extract used for subsequent analysis. A 25 μL aliquot was used, and the colour intensity recorded on a portable spectrometer. Results from previous studies indicated Aroclor 1260 was the principal constituent; therefore, Aroclor 1260 standards were used for calibration, rather than the Aroclor 1248 standards supplied by the manufacturer. These were prepared by dilution of a 200 ppm standard. For samples with high levels of PCBs a 1.0 g sample was taken from a well mixed soil sample, and if required the methanol extract was diluted before analysis.

b) Laboratory Analyses (GC/ECD) (Soil Samples)

The standard analytical procedure for the analysis of PCBs, namely gas chromatography with an electron capture detector (GC/ECD) was used. These analyses were performed by the Analytical Services Unit, Queen's University by the following procedure. A separate soil sample was first taken for the determination of wet weight/dry weight ratio. Soils were analyzed by using approximately 10 g (dry weight equivalent), spiking it with an internal standard solution (decachlorobiphenyl) and extracting with approximately 250 mL dichloromethane in a soxhlet extractor for four hours. The sample was concentrated to 1 mL and the solvent exchanged for hexane. This concentrate was then applied to a Florisil column (Supelco SPE tube) and the resulting eluent analyzed using an HP 5890 Series II Plus gas chromatograph equipped with electron capture detector and a 30 m SPB-1 capillary column and calibrated with Aroclor 1260 standards.

c) Laboratory Analyses (GC/ECD) (Other Matrices)

Samples of metal, tile, and barrier absorbent materials were analyzed as for soil. Water was analyzed by using approximately 800 mL of sample, spiking with internal standard and extracting three times with dichloromethane. The extract was filtered through sodium sulphate and concentrated to 1-2 mL and the solvent exchanged for hexane. This concentrate was then applied to a Florisil column for cleanup of the extract and the resulting eluent analyzed by GC/ECD. Air samples were analysed according to NIOSH Method 5503 by desorbing both the filter and absorbent with hexane and running the samples on a GC/ECD system.

C. Furniture Dump and Drainage Pathway

1. Background

It is not known when the furniture dump was created. When the detailed environmental assessment of the site was conducted in 1994, the dump was largely buried beneath a road which had been constructed, or at least improved, while the new short range radar was being built from 1989-93. The visible part of the dump consisted of mostly rusting metal furniture but electrical equipment including a large transformer was visible through cracks in the road surface. Testing over the period 1996-98 showed that there was no PCB contamination to the up-gradient side of the dump but that surface soils on the road were contaminated with PCBs. The extent of the buried material and PCB contamination arising from it within the dump could not determined at that time without the use of heavy equipment. The drainage pathway leading from the dump was delineated in 1994 and shown to be contaminated with PCBs above the 50 ppm level (Map II-4). Two interceptor barriers were installed in 1994 in order to prevent further migration of PCBs to the sea.

In 1999, an initial excavation of the dump was undertaken. Fourteen transformers were removed from the dump and these were placed in the registered PCB storage facility along with 5 containers of PCB contaminated soil which were excavated from close to where this cache of transformers were found. A large volume of metal parts was also excavated from the dump. These were tested and found to be slightly contaminated with PCBs; they were left in a pile on top of part of the dump.

2. Excavation Conducted in 2000

The first action taken in 2000 was to set up the screening plant at the edge of the dump. This initially required the removal of the metal parts which were taken and placed by the side of the road leading to S4 at the head of the S1/S4 valley; the ground in this location is contaminated with PCBs at the Tier II level (Photograph II-3). A large part of the dump was then excavated. One more large transformer was found along with several large capacitors and other electrical parts. These were taken to the beach PCB storage facility. Extremely large rocks were separated, shaken to remove soil and then placed to the clean side of the dump. The remaining soil was passed through the screener. The screened soil was taken to the main PCB storage facility where it was unloaded on to the lined area.

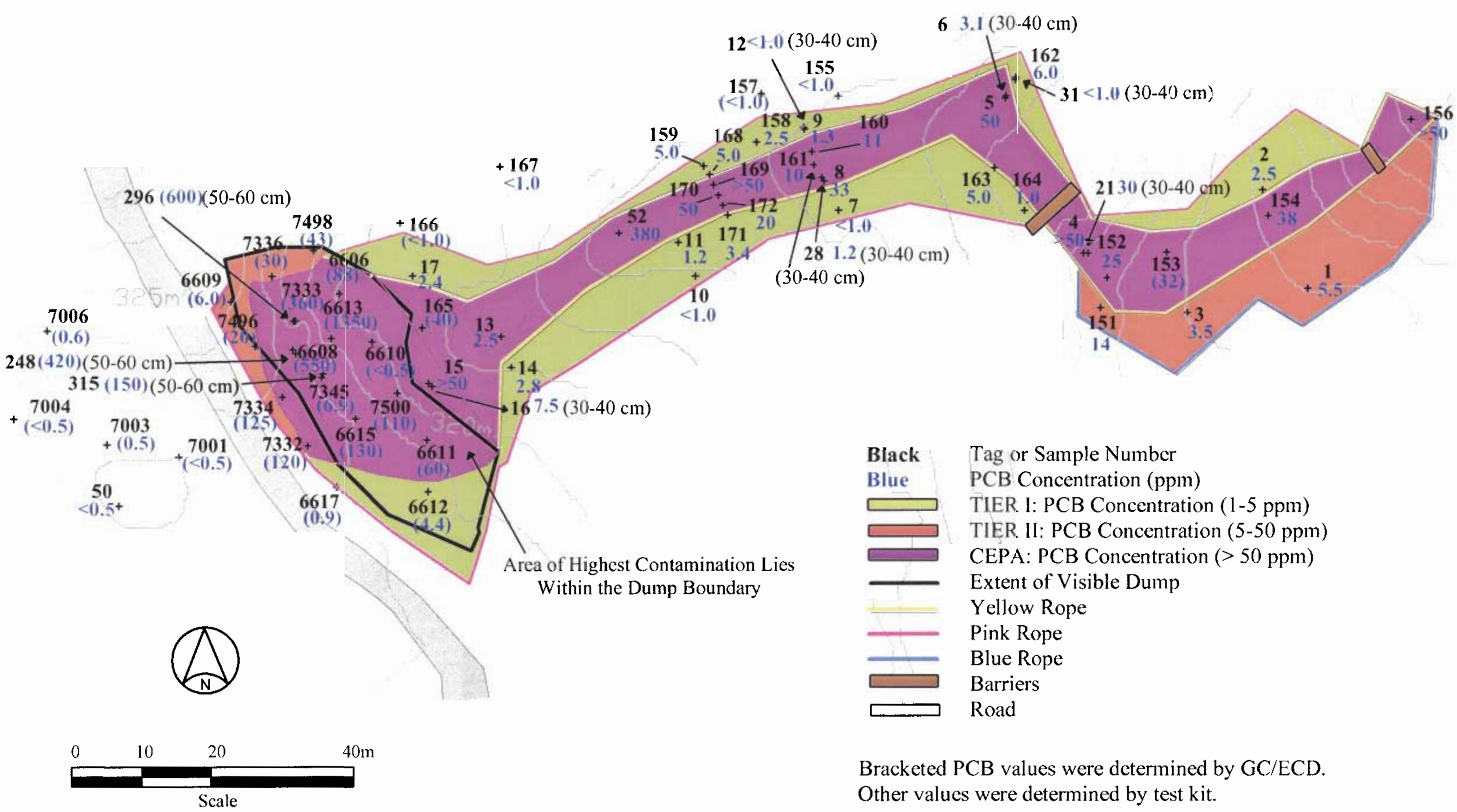
CEPA soils were then removed from the drainage pathway of the dump. The first straight section of this pathway contained much more soil than anticipated. The PCBs, which are more dense than water in the pure state appear to have traveled along the pathway in concentrated form and collected in a depression in the bedrock near the end of the first straight section. Soils in this location smelled very strongly of askarel. The bedrock sloped perpendicular to the drainage pathway and therefore the PCBs were found at depths up to about 1 meter. From this point onwards, the depth of the soils to bedrock was generally less than 30 cm and the soils were not stained with oil or PCBs. The initial excavation was generally carried out with heavy equipment, and hand shoveling and the vacuum truck were used to remove the soil left by the excavators. Water was used on the sloping bedrock with the vacuum truck sucking up this water at the end of the drainage channel. The upper interceptor barrier was removed and placed in two red steel vaults along with contaminated geotextile fabric. They were taken to the beach PCB storage facility.

When all the CEPA soil had been removed from the drainage pathway, the rocks that did not pass through the screener were in a large pile below the unit. These rocks which were contaminated at the Tier I/II level were taken to the area in the S1/S4 valley next to where the metallic debris had been placed. Tier II soils from the drainage pathway were then excavated and placed with these rocks. Finally Tier I soils from the drainage pathway were excavated and placed in a separate cell in the landfill by the core camp (Photograph II-4).

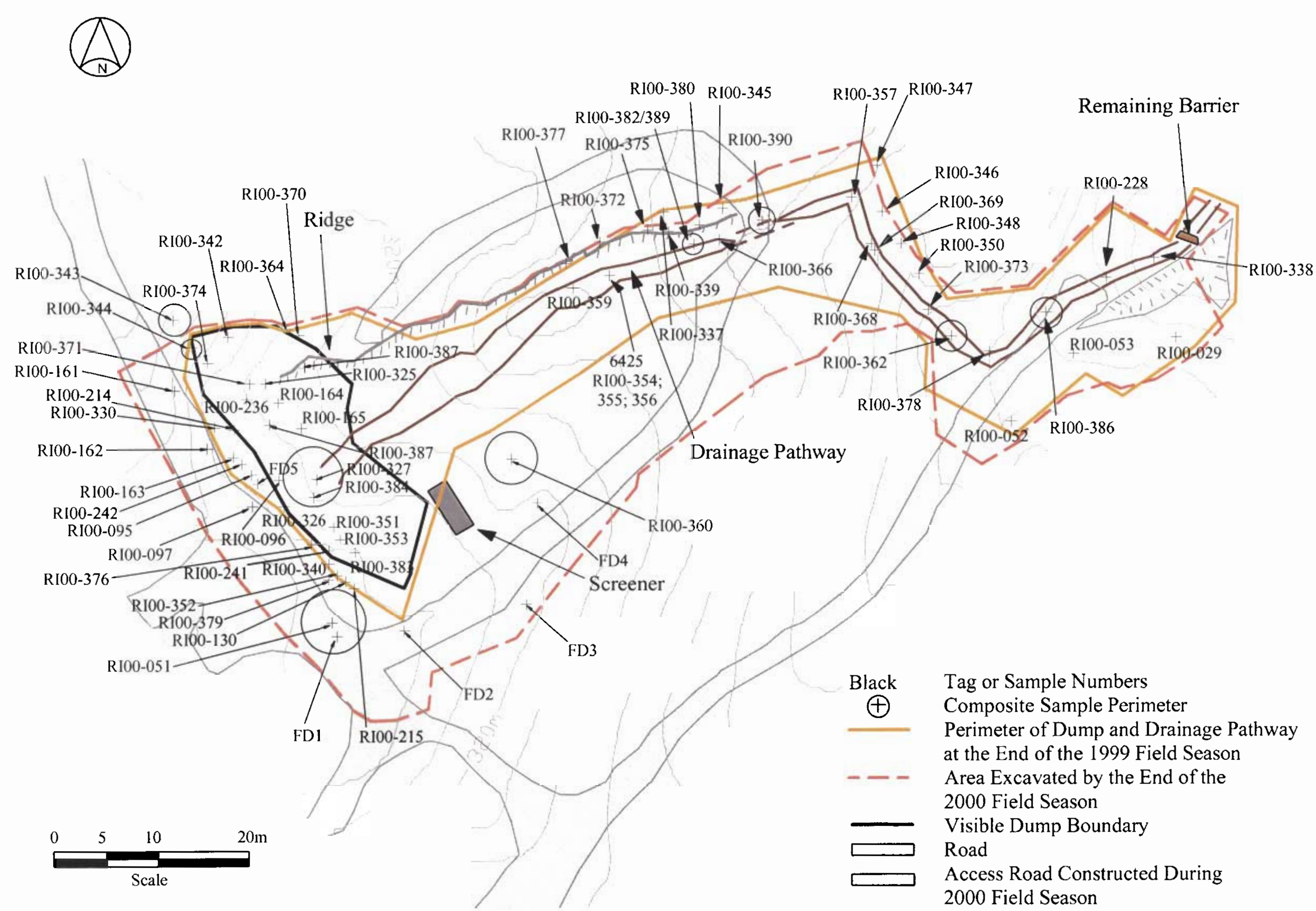
The last area to be excavated was the roadway and the area where the screener was located. The screener was decontaminated and moved to the S1/S4 area (see next section). The PCB contamination under the road was more extensive than had been anticipated. This was because the PCBs had leaked from the transformers and expanded the area of contamination in the soil beneath them in a pyramidal fashion. Unfortunately the bedrock under the road at this point had the form of a large depression and this further increased the zone of contamination.

The total volumes for soils removed from the furniture dump and drainage channel are estimated as 450 m^3 of CEPA soil, 750 m^3 of Tier II soil, and 120 m^3 of CEPA soil. Maps II-1 to II-3 show the extent of PCB contamination at the start of the work, the sampling locations during the work and the extent of the excavations at the end of the work. Table II-1 lists the samples taken this year and the PCB concentrations found. Photographs II-5 to II-12 show the work as it progressed.

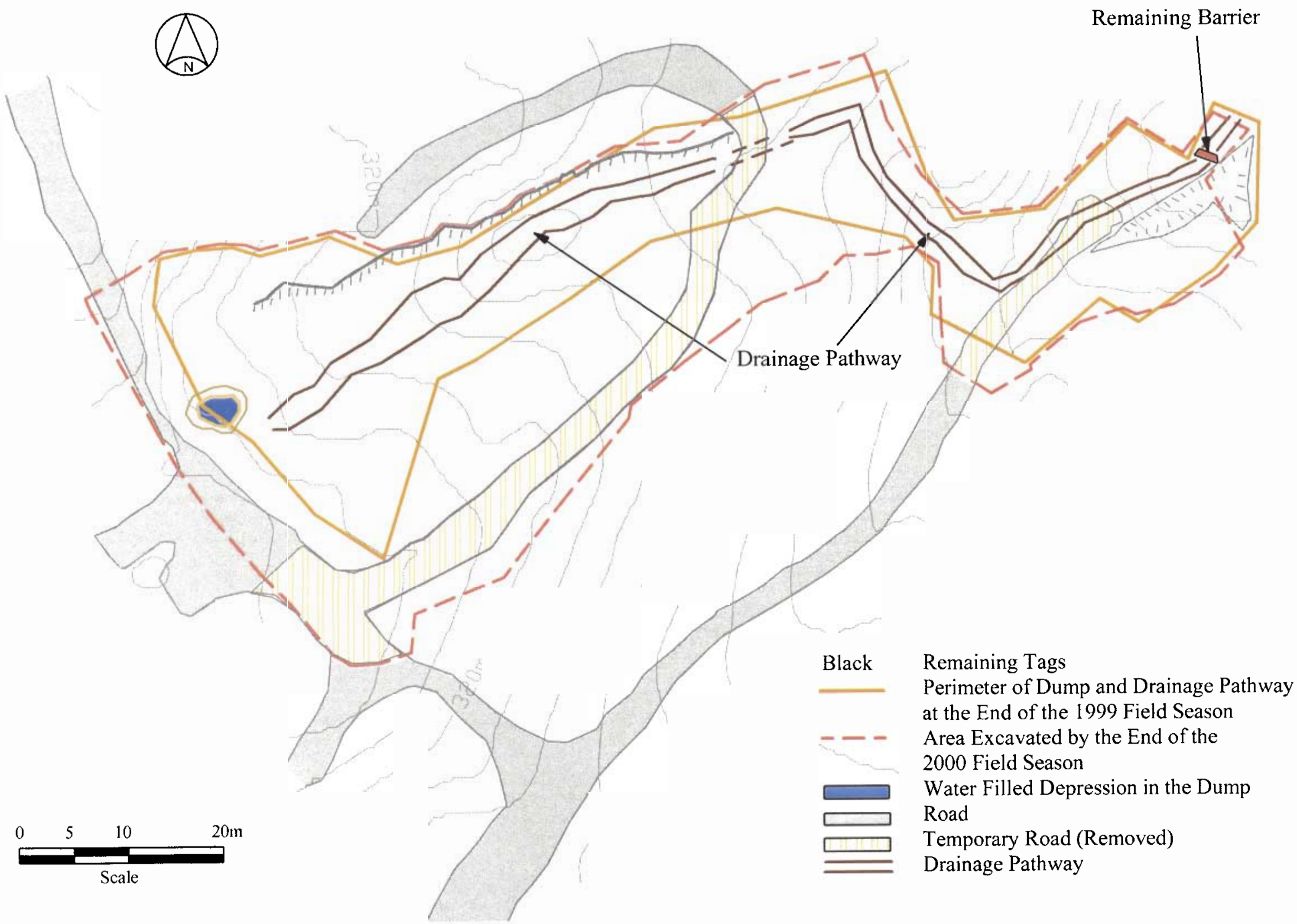
Map II-1: Sampling Locations and PCB Concentrations in the Furniture Dump and Drainage Pathway at the Start of the 2000 Field Season



Map II-2: Sampling Locations at the Furniture Dump During the 2000 Field Season



Map II-3: Furniture Dump at the End of the 2000 Field Season



Photograph II-3: Metallic Debris and Tier II Soils from the Furniture Dump were Stockpiled on Tier II Soils in the S1/S4 Valley by the Road to S4.

Photograph II-4: Tier I Soils from the Furniture Dump and Drainage Pathway Were Placed in a Separate Cell in the Landfill by the Core Camp

Photograph II-5: Excavation of the Furniture Dump at the Start of the Year

Photograph II-6: The Furniture Dump After Removing Most of the Buried Material: Note the Pile of Tier II Rocks Which Did Not Pass Through the Screener

Photograph II-7: Excavation of the Furniture Dump Drainage Pathway: Note the Sloping Bedrock and Posts in the Bank Marking Sampling Points

Photograph II-8: Washing the Fine Material From the Rocks to the Vacuum Truck

Photograph II-9: The Cleaned Area on the Lower Part of the Drainage Pathway

Photograph II-10: The Furniture Dump After Excavation: the Road Which is Now Mostly Excavated Was Constructed to the Right of the Original Road

Photograph II-11: The Furniture Dump in 1994

Photograph II-12: The Same View of the Cleaned Area on the Upper Part of the Drainage Pathway at the End of the Work

Table II-1: PCB Concentrations in Samples Collected During the Excavation of the Furniture Dump and its Drainage Pathway

Sample prefix RI00-	Description	Sampling Date	PCB Concentration by Test Kit (ppm)
029	45 – 50 cm depth near tag 6334	23-Aug-00	<0.5
052	85 – 90 cm depth near tag 6336	23-Aug-00	<0.5
053	85 – 90 cm depth near tag 6333	23-Aug-00	<0.5
161	near tag 6340	31-Aug-00	<5
162	near tag 6355	31-Aug-00	<5
163	near tag 6528	31-Aug-00	9
164	tag 6331; close to bedrock	31-Aug-00	<5
165	tag 6521; close to bedrock	31-Aug-00	<5
215	1.2 m depth	31-Aug-00	<5
228	near tag 6335	23-Aug-00	<0.5
236	90 cm from bedrock near tag 6563	31-Aug-00	20
242	near tag 6560	31-Aug-00	7.5
325	50 cm from bedrock near tag 6565	31-Aug-00	>50
326	near tag 6567	31-Aug-00	7.5
327	near tag 6561 composite sample	31-Aug-00	>50
330	near tag 6560	31-Aug-00	44
337	close to bedrock	16-Aug-00	5
339	close to bedrock	16-Aug-00	<5
342	close to bedrock	16-Aug-00	30
343	composite sample	16-Aug-00	<5
344	120 cm depth	15-Aug-00	40
345	40 cm depth	15-Aug-00	>50
346	30 – 40 cm from bedrock	15-Aug-00	<5
347	30 – 40 cm from bedrock	15-Aug-00	5
348	30 – 40 cm from bedrock	15-Aug-00	<5
350	30 – 40 cm from bedrock	15-Aug-00	25
354	test pit sample, 30 cm depth; tag 6425	09-Aug-00	>50

355	test pit sample, 50 cm depth; tag 6430	09-Aug-00	<5
356	test pit sample, 60 cm depth; tag 6425	09-Aug-00	>50
357	50 – 60 cm depth	11-Aug-00	<5
359	close to bedrock, area vacuumed to bedrock; tag 6429	09-Aug-00	>50
362	composite sample of area	14-Aug-00	25
364	30 cm depth (halfway to bedrock)	12-Aug-00	10
366	close to bedrock, area vacuumed to bedrock	11-Aug-00	>50
368	close to bedrock	12-Aug-00	<5
369	30 – 40 cm depth	11-Aug-00	<5
370	30 cm depth (halfway to bedrock)	12-Aug-00	6
371	close to bedrock	12-Aug-00	
372	50 – 60 cm depth	12-Aug-00	<5
373	test pit sample close to bedrock	14-Aug-00	<5
374	close to bedrock	12-Aug-00	<5
375	50 – 60 cm depth	12-Aug-00	<5
376	near tag 7333	22-Aug-00	7.5
377	50 – 60 cm depth	12-Aug-00	6
378	test pit sample close to bedrock	14-Aug-00	<5
380	50 –60 cm depth	12-Aug-00	<5
382	50 cm depth	11-Aug-00	>50
383	near tag 6588	22-Aug-00	>50
384	near tag 6581	22-Aug-00	>50
386	composite sample	14-Aug-00	
387	close to bed rock	12-Aug-00	>50
388	test pit sample, close to bedrock	14-Aug-00	
389	50 cm depth	11-Aug-00	>50
390	composite sample, area vacuumed to bedrock	14-Aug-00	25

214	near tag 6583	22-Aug-00	<5
340	near tag 6580	22-Aug-00	14
352	near tag 6587	22-Aug-00	21
379	near tag 6586	22-Aug-00	7
351	near tag 6590	22-Aug-00	800
353	near tag 6589	22-Aug-00	191
241	near tag 6585	22-Aug-00	141
130	near tag 6584	22-Aug-00	13
051	on road adjacent to screener	24-Aug-00	13
360	composite sample	24-Aug-00	37
096	near tag 6546	1-Sep-00	4
095	near tag 6424	1-Sep-00	6
097	near tag 6523	1-Sep-00	<1
FD1	on road adjacent to screener	24-Aug-00	<5
FD2	beside screener near road	24-Aug-00	<5
FD3	beside screener near road	24-Aug-00	12
FD4	beside screener near road	24-Aug-00	8
FD5	near tag 6562	24-Aug-00	7.5

D. S1/S4 Buildings Area

This work was carried out in two stages. Initially, three buildings were demolished. The excavation work was conducted later when the equipment, which had been used at the furniture dump, was available.

1. Building Demolition

It had originally been planned to demolish two buildings in June when the snow was on the ground to provide a layer between the heavy equipment and the contaminated soils. However, since the work did not commence until early July, this plan was abandoned. Instead, the road which was built to behind S3 in 1999, was extended to an area between S1, S2 and S3 by clearing away the Tier II soils in the path of the road to a stockpile and adding clean fill. Building S2 was added to the demolition list in order to gain access to soil beneath it and to provide more space for equipment to work. Prior to building demolition, all the barrels containing PCB-contaminated floor tiles were taken to the beach PCB storage facility. Barrels containing paint products and batteries were taken to the hazardous materials storage building. Other waste material in and around the building was taken to the landfill by the core camp. There were no tiles beneath the electrical racks in S3. The lower portions of two racks from where transformers had been previously removed were oily and stained with a clear resin in some areas. Testing showed that the oil was PCB contaminated (Table II-2). These two parts were placed in a steel vault which was taken to the beach PCB storage facility.

Table II-2: PCB Levels From Transformer Racks

Sample Number	Description	PCB Concentration by GC/ECD (ppm)
RI-00-D108	resinous material taken from transformer rack	>10,000
RI-00-D109	resinous material taken from transformer rack	227

The buildings S1 and S3 were first dismantled to the floor level (Photograph II-13). Building S2 and all adjoining corridors were completely demolished. Floor tiles which could not be previously removed were placed in a Tier II stockpile. All non-hazardous material was placed in a new landfill in the area previously occupied by the old accommodation buildings. Most of the material was shredded into the landfill

(Photograph II-14). There were some areas under buildings S1 and S3 which were highly contaminated (> 2000 ppm) with PCBs. During demolition, some of these areas were covered with tarps to minimize contamination of the non-hazardous debris. Other areas were excavated and the soil placed in steel "flower pots". In order to allow the heavy equipment to reach the buildings and still remain on clean ground, CEPA soil had to be cleared. It was in these areas that the protocol for removing the soil using the excavator followed by shoveling and vacuuming was developed (Photograph II-15). Much of the floors of S1 and S3 were highly contaminated with PCBs (Photograph II-16). The affected sections were carefully removed using the clam attachment on the excavator and placed directly into steel containers. Tar paper was also added. Fourteen steel containers were filled and taken to the beach PCB storage facility. The remainder of the floors were taken and placed in a pile by the road on Tier II soil as they are slightly contaminated with PCBs.

Some of the supports for the buildings were thought to be contaminated with PCBs and these were placed in a Tier I/II debris pile on Tier II ground previously below and next to building S2. Other large pieces of wood and metal collected from around the buildings or items which had become contaminated with soil during demolition were also added to this pile. Other smaller pieces of wood, metal and other debris, which littered the ground below where the buildings had been (Photograph II-17), were picked up and placed in five steel containers. The contents of these containers where analysed and the results shown in Table II-3 indicate that this material is contaminated at the CEPA level. The vaults should have PCB labels affixed to them and then be taken to the Beach PCB storage facility.

Table II-3: PCB Concentrations in Samples Collected From Small Pieces of Debris Collected From Below the Building Demolition Areas

Sample Number	Description	PCB Concentration by GC/ECD (ppm)
RI00-311	wood pieces from S1/S4 buildings area	440
RI00-313	wood pieces from S1/S4 buildings area	480
RI00-314	wood pieces from S1/S4 buildings area	160
RI00-315	wood pieces from S1/S4 buildings area	160
RI00-316	wood pieces from S1/S4 buildings area	<2.0

2. *Soil Excavation*

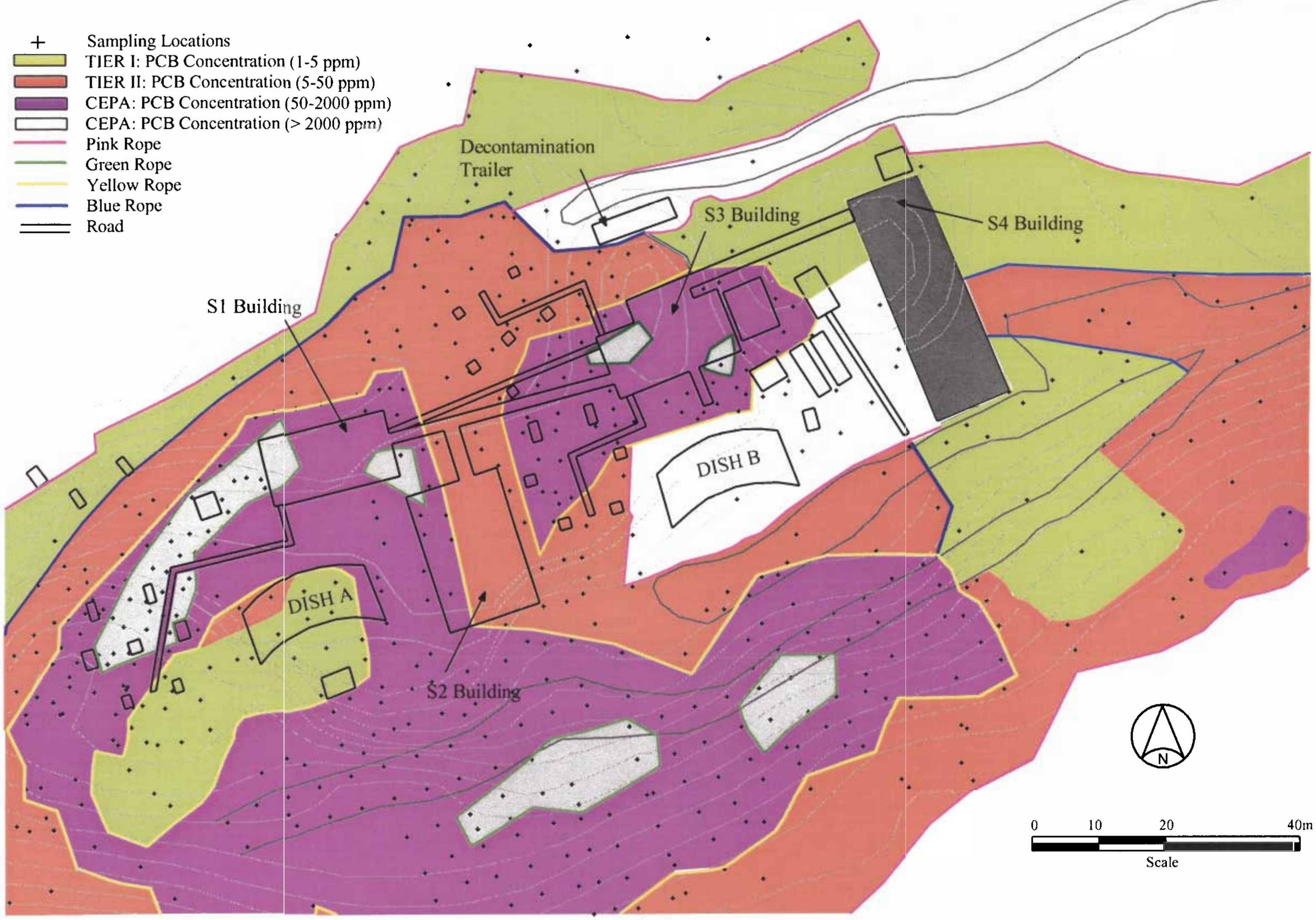
Once the furniture dump excavation was completed, the soil below where building S3 had stood was excavated (Photograph II-18). This soil was taken to the screening plant which was set up on the road below S4 (Photograph II-19). This location for the screener was chosen for several reasons. Firstly, the Tier II rocks and boulders that did not pass through the screen would fall naturally on to Tier II ground at the edge of the S1/S4 valley and therefore not require further handling. In addition by using this location, the CEPA soil could be taken to and from the screener without passing by the core camp. The road from beside the windsock to the screener was contaminated at the low Tier II level. This road was covered with a layer of clean soil to permit a clean path to the screener; it was decided that it was too difficult to remove the Tier II material from this road prior to adding the clean fill. Soil was also excavated from some of the areas around S3 and S2 (Photographs II-20 to II-22). Also some of the excavated areas were vacuumed. Map II-4 shows the contamination levels in the S1/S4 buildings area at the start of the season and Map II-5 shows the progress made by the end of the work this year. Table II-4 lists the analytical results. A total of 180 m^3 of CEPA soil were taken to the main PCB storage facility from this location by the end of the year.

3. *Depth Sampling*

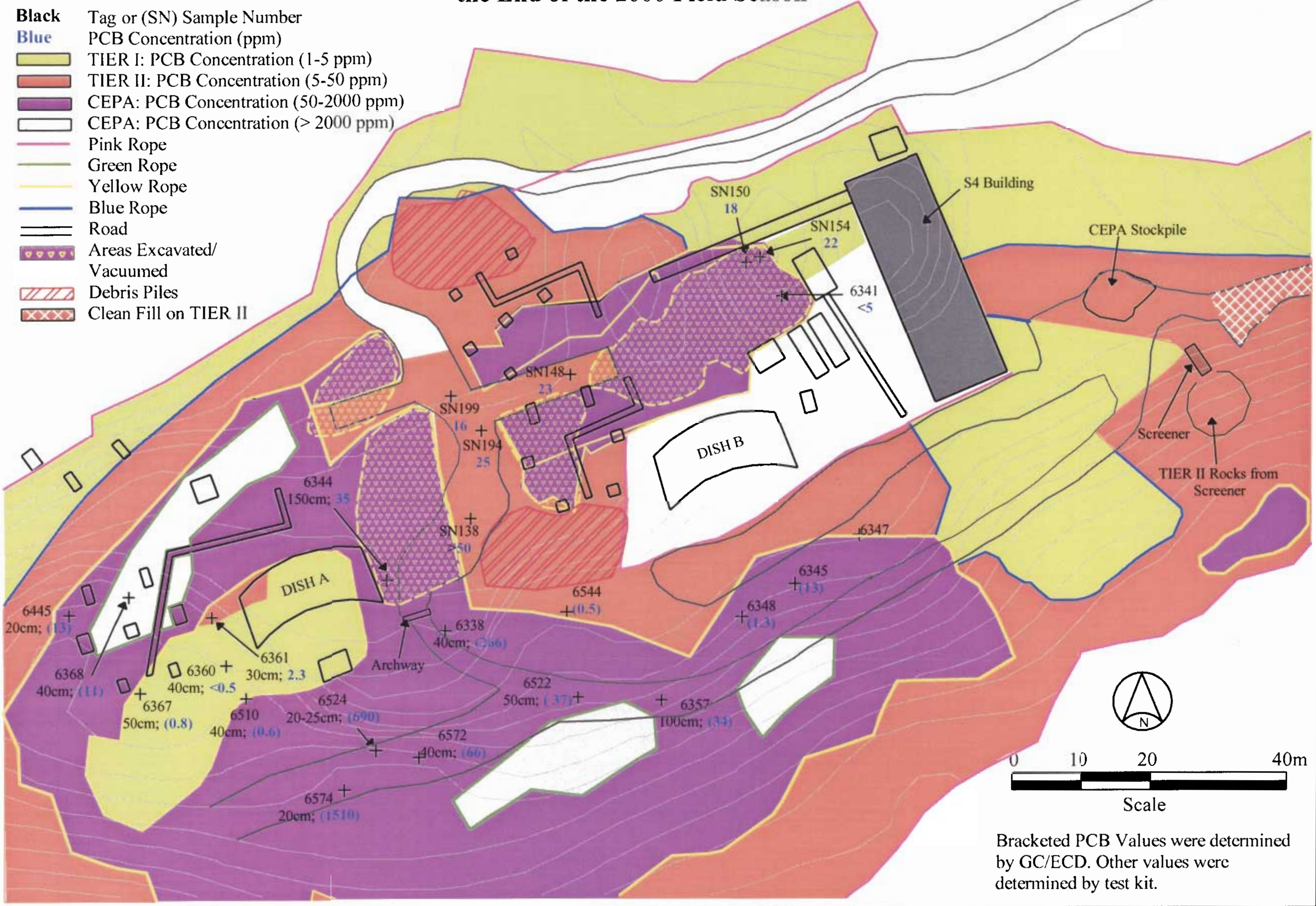
Several test excavations were conducted and several test pits dug in the S1/S4 buildings area at the end of the season in order to aid the start of work next year and to obtain a better idea of the depths of excavation required to remove the CEPA soil. Map II-5 and Table II-5 show the sampling locations, sample numbers and their PCB concentrations. Two samples (tags 6345 and 6348) were taken along the steep slope between the road and the troposphere dish B. The excavator was used to remove some large boulders to permit a sampling depth of 0-30 cm. The low results of 13 and 1.3 ppm show that the CEPA contamination here is only in the surface layer (0-15 cm). A similar result (0.5 ppm) was obtained from tag number 6544 at a depth of 0-30 cm on the steep slope further along the road. Samples taken from pits dug along the roadway indicate that the depth of the CEPA layer is between 0.5 to 1.0 meter. Samples taken from test pits in the Tier I area near to troposphere dish A were at the Tier I level; it is planned to put a road through this area at the start of the work next year in order to access the CEPA areas in the S1 building drainage pathway. The sample at tag 6368 in the >2000 ppm area below S1 gave a result of 11 ppm at a depth of 40 cm indicating that excavation to a depth of 30 cm may be adequate to remove all the CEPA soil in the area. A sample taken from the nearby CEPA area at tag 6445 gave a result of 13 ppm at a depth of 20 cm showing that only the top 10 cm need be taken from this area. Two samples taken from along the pathway originally taken by the sewage line showed only low levels of contamination (2.7 and 0.6 ppm).

The analytical results for all the soil samples from these investigations are given in Table II-5.

Map II-4: Contaminated Areas in the S1/S4 Valley and Buildings Vicinity at the Start of the 2000 Field Season



Map II-5: Contaminated Areas in the S1/S4 Valley and Buildings Vicinity at the End of the 2000 Field Season



Photograph II-13: Demolishing Building S1; Note the Steel "Flower Pot" Used for Containerising > 2000 ppm PCB Soils

Photograph II-14:Shredding Non-Hazardous Demolition Debris Directly into the Landfill

Photograph II-15: Excavating the > 2000 ppm PCB Area by S3

Photograph II-16: The PCB Contaminated Floor and Tar Paper; Note The Highly Contaminated Top Layer Which is Clearly Separated from the Lesser Contaminated Lower Layer of the Floor

Photograph II-17: The Area Previously Occupied by S3 After Demolition

Photograph II-18: The Same Area After Excavation of the Contaminated Soil; The Clean Bedrock in the Foreground has been Vacuumed

Photograph II-19: The Screening Plant on the Road Below S4 in Operation

Photograph II-20: The Area Previously Occupied by S1; The Soil Pile to the Right Contained CEPA Soil Which Was Removed to the Screening Plant

Photograph II-21: Excavating Contaminated Soil From the Area Between S1 and S2

Photograph II-22: The Area Previously Occupied by S2 at the End of the Season; Note the Tier I/II Debris Pile Behind the Excavator

Table II-4: PCB Concentrations in Samples Collected During the Excavation in the S1/S4 Buildings Area

Tag Number	Sample Number (prefix RI00-)	Description	PCB Concentration (ppm) by GC/ECD	by Test Kit
6357	050	Test pit – 1 m depth; in centre of road north of geotextile	34	-
-	138	In the middle of the road leading to the arch	-	>50
-	148	In the middle of the access road leading to S3 area	-	23
-	150	Few metres northeast of hole dug; close to the S4 building	-	18
-	154	1 meter northeast of hole dug; close to the S4 building	-	22
-	194	In the middle of the access road; 10 m south of decontamination area	-	25
-	199	In the middle of the access road; in front of decontamination area	-	16
6341	200	Inside hole (close to S4) – 1 m depth	-	<5
6338	234	Test pit – 40 cm depth; side of road below archway	266	-
6344	301	Inside hole east of tropo dish – 1.5 m depth	-	35
6522	331	Test pit – 50 cm depth; west of tag 6357	37	-

Table II-5: PCB Concentrations in Samples Collected During Investigations in the S1/S4 Buildings Area

Tag Number	Sample Number (prefix RI00-)	Description	PCB Concentration by GC/ECD (ppm)
6510	S1S4-H1	Test pit – 40 cm depth; 4 m southwest of tropo dish	0.6
6360	S1S4-H2	Test pit – 40 cm depth; in TIER I area, west of tropo dish	<0.5
6361	S1S4-H3	Test pit – 30 cm depth; 4 m northwest of tag 6360	2.3
6367	S1S4-H4	Test pit – 50 cm depth; 10 m southwest of tropo dish, beside concrete pillar.	0.8
6445	S1S4-H5	Test pit – 20 cm depth to bedrock; taken between yellow and green rope.	13
6368	S1S4-H6	Test pit – 40 cm depth; high CEPA area.	11
6364	S1S4-SS1	50 m south from start of pipe at broken pipe joint.	2.7
6362	S1S4-SS2	50 m further south at a second broken section	0.6
6524	235	Test pit – 20-25 cm to bedrock; between tropo dish and old fuel tank	690
6544	277	On rocky steep slope, south of TIER II debris pile	0.5
6572	278	Test pit – 40 cm to bedrock; 2-3 m southeast of tag 6524	66
6348	279	On rocky steep slope south of tropo dish	1.3
6345	280	On rocky steep slope southeast of tropo dish	13
6574	282	Test pit – 20 cm to bedrock; few meters northwest of fuel tank	1510

III. PCB SITE INVESTIGATIONS

A. PCB Storage Facilities

In 1999, all the PCB liquids, transformers and capacitors held in the PCB storage facility (B2) were shipped south and have been destroyed. However, further liquids and electrical equipment containing PCBs were found in 1999 and these were stored in the PCB storage facility (B2) along with PCB contaminated soil and concrete in barrels (originally from Iqaluit) and mercury and lead contaminated soils excavated in 1999. Since only PCB containing materials should be stored in a PCB registered storage facility, Environment Canada required that the storage be reorganized to comply with regulations.

Three sea-cans equipped with steel liners were purchased and brought to the site on the sea-lift this year. These 3 sea-cans have been placed on wooden beams and together with several steel containers form a new PCB storage facility called the Beach PCB Storage Facility (Photograph III-1). This facility is situated between B2 and the POL pumphouse. All the transformers, PCB contaminated floor tiles and PCB containing liquids have been removed from B2 and placed in these sea-cans (Photographs III-2 and III-3). In addition, more PCB containing electrical equipment which was found during the excavation of the furniture dump (Photographs III-4 and III-5) has been added to the sea-cans. Steel vaults containing sections of the floors of buildings S1 and S3 that were contaminated with PCBs above the 50 ppm level have been placed alongside the sea-cans together with 3 steel flower pots containing soil contaminated with PCBs above the 2000 ppm level; this soil was not screened.

In addition the maintenance buildings were joined in 1999 and now forms another new PCB storage facility called the Main PCB Storage Facility (Photograph III-6). A liner system comprising two layers of geotextile with a plastic 30 mil liner between was placed on the floor of one half of the Main PCB Storage Facility. Six hundred and thirty (630) cubic meters of excavated PCB contaminated CEPA soils which was screened to two inches have been placed on this liner. In addition all the other containerized soils from B2 have been placed on the concrete floor at the other end of the building. These comprise the 156 barrels of PCB contaminated soil and concrete from Iqaluit and nine containers of soil from the site.

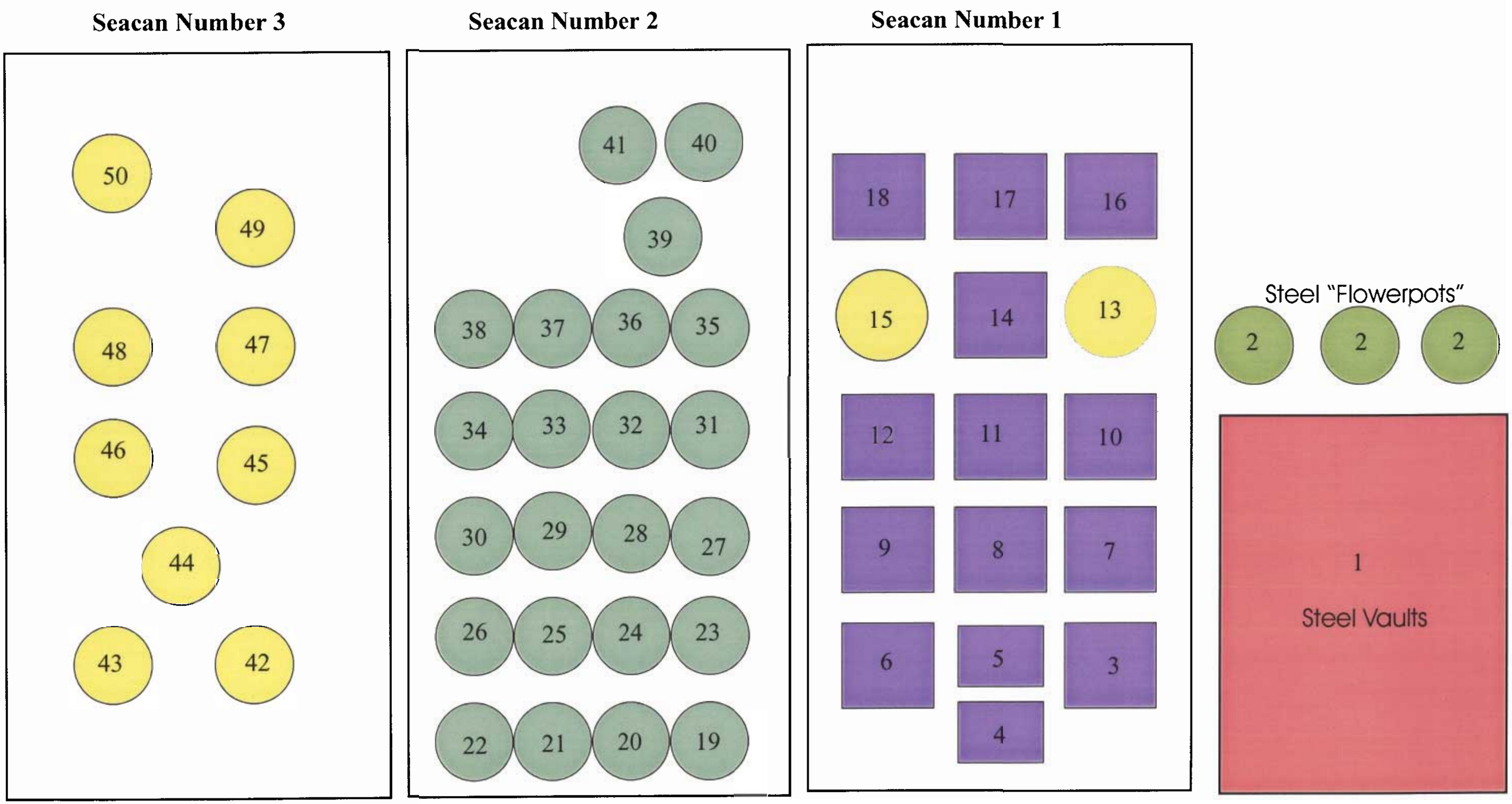
Maps III-1 and III-2 show the contents of the two new PCB storage facilities. Tables III-1 and III-2 list the contents of the facilities. Map III-3 and Table III-3 show the contents of the former PCB storage building (B2) which is now a storage facility for non-PCB hazardous or contaminated materials.

Details of the actions taken are given below:

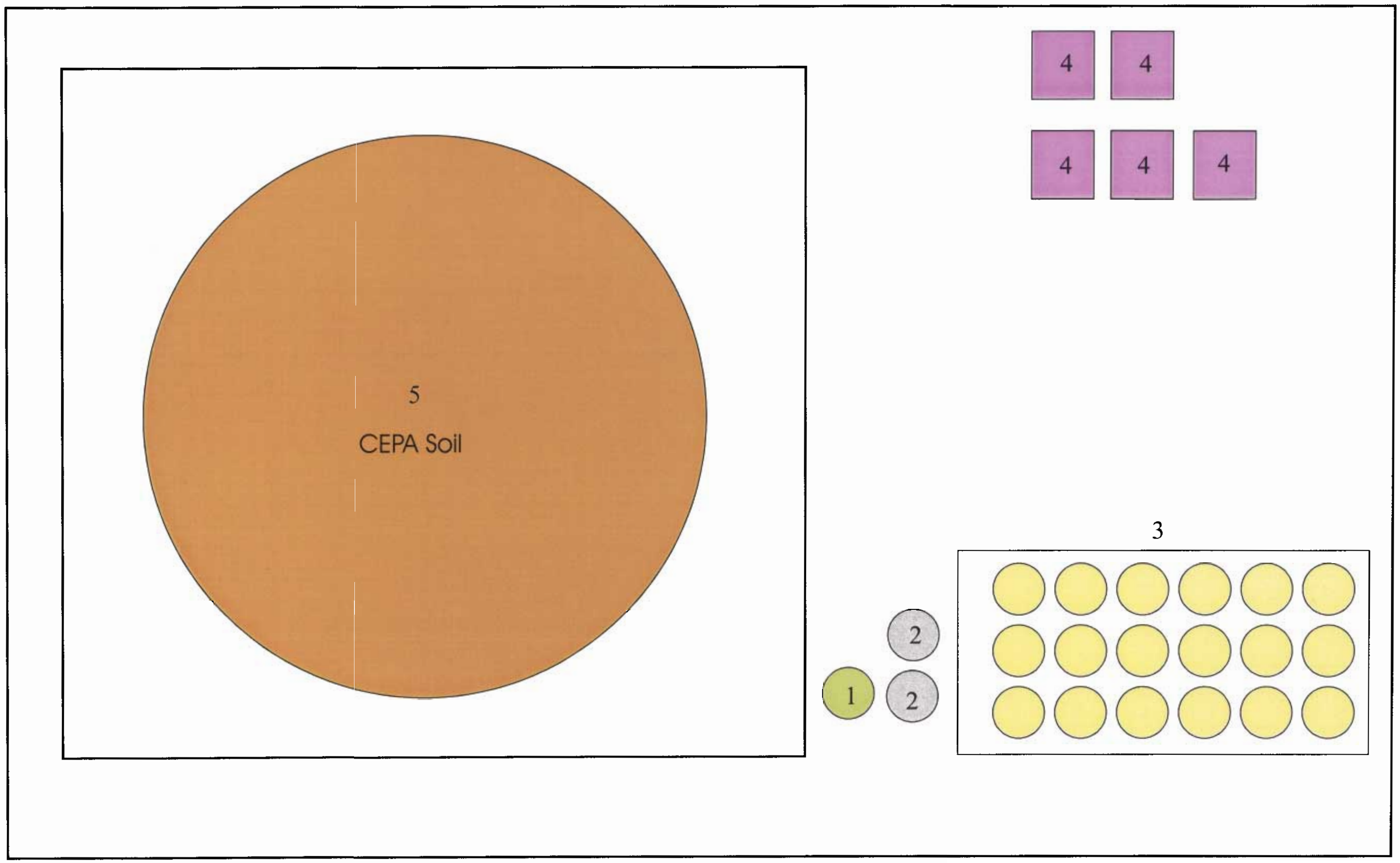
- Three special sea-cans were moved into position.
- Six red vaults containing contaminated wood were moved from the side of B2 to next to the 3 sea-cans.
- Eight red vaults containing contaminated wood were moved from the maintenance area to next to the 3 sea-cans.
- Two red vaults containing the furniture dump barrier were moved to next to the 3 sea-cans.
- Three flower pots containing highly contaminated soil (>2000 ppm) were moved to next to the 3 sea-cans.
- Eight metal barrels containing oil were moved from B2 to sea-can #3
- The plastic barrels that were just outside B2 were inspected and those that contain PCB-contaminated floor tiles were placed in sea-can #2. Missing PCB labels were replaced and a record kept of which labels were still present and which ones were added. These barrels included one containing paint cans and one containing Nicad batteries. These two barrels were placed in B2 next to the boxes containing mercury contaminated soil.
- Other barrels of capacitors in B2 were located and placed in sea-can #2. In addition the capacitors that were found during the excavation of the furniture dump (Photograph III-4) were placed in new plastic drums and PCB labels affixed to them. Small capacitors were removed from electrical racks (Photograph III-5) and added also.
- The barrel labeled PN00137 contained ballasts. Some of the fluorescent fixtures in S4 were removed and were placed in this drum.

- All the transformers stored in B2 were placed in sea-can #1.
- There are 11 waste wrangler boxes of cleanup waste from activities at the beach dump in 1999. These have been tested and contain <0.5 ppm PCBs and low level lead (Table III-4). These were placed in a special cell of the landfill next to the core camp and covered.
- The 5 wooden boxes and three barrels of CEPA soil excavated from the furniture dump in 1994 and 1999 were taken to the Main PCB storage facility.
- The 156 blue barrels brought to the island in 1997 from Iqaluit were taken to the Main PCB storage facility.
- There were several waste wrangler containers against the side of B2 marked Tier II metal. These contained metal parts from the furniture dump which have now had capacitors removed. As such these were taken to the S1/S4 Tier I/II debris pile.
- There were two green overpack drums next to the covered stairway opposite the current vehicle maintenance building. Since these contained batteries collected from around the site they were taken and placed in B2.
- Several empty plastic CEPA barrels, overpack drums and waste wranglers in B2 were piled to one side.
- The three sea-cans were labeled and padlocks attached.

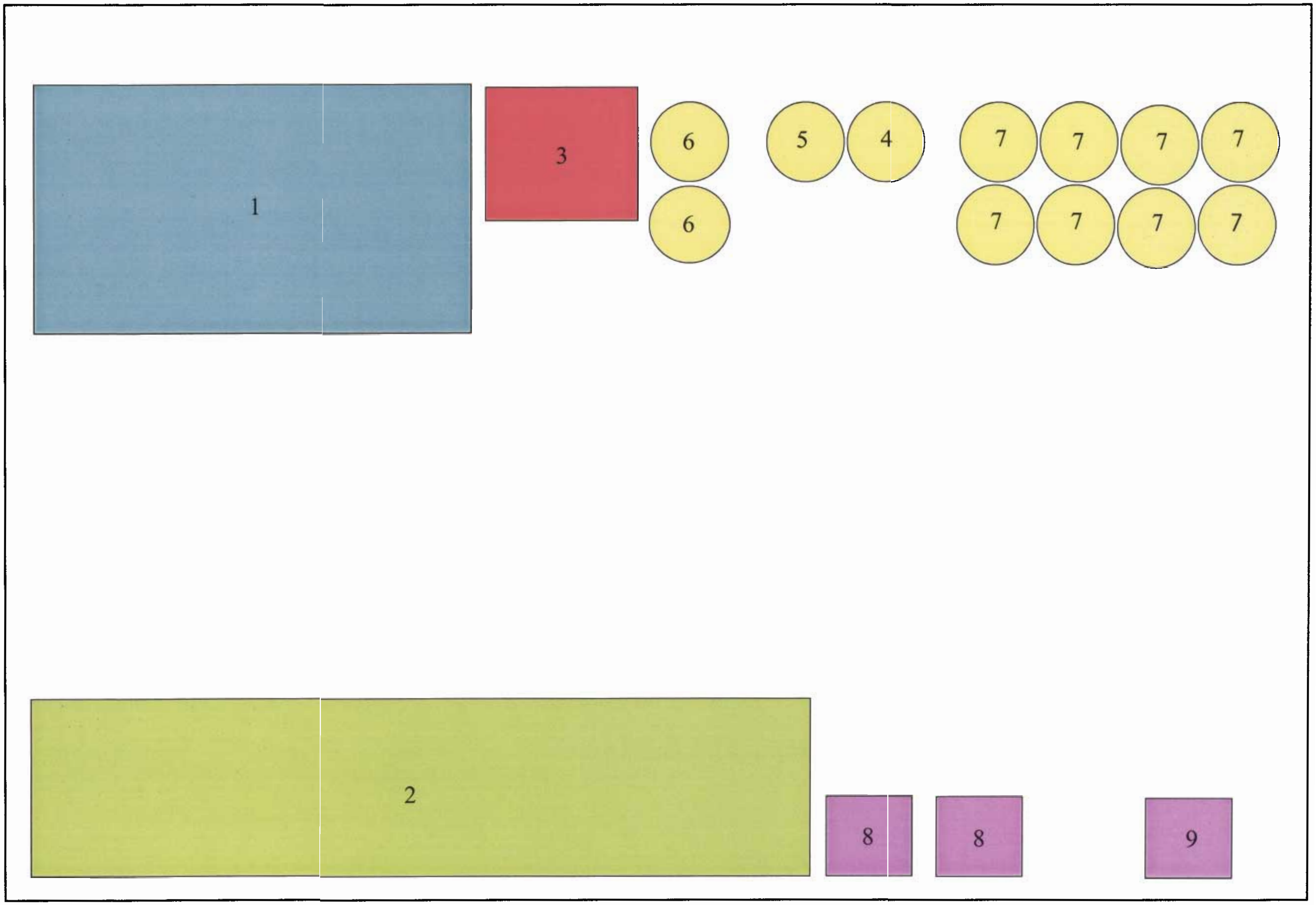
Map III-1: Plan of the New Beach PCB Storage Facility (see Table III-1 for Key to Contents)



Map III-2: Plan of the New Main PCB Storage Facility (see Table III-2 for Key to Contents)



Map III-3: Plan of the Hazardous Waste Storage Facility (B2) for Non-PCB Hazardous Wastes andContaminated Materials (see Table III-3 for Key to Contents)



Photograph III-1: The New Beach PCB Storage Facility.

Photograph III-2: Transformers Inside Sea-Can #1.

Photograph III-3: Blue Barrels Containing PCB-Contaminated Floor Tiles and Capacitors Inside Sea-Can #2.

Photograph III-4: The Capacitors and Other Electrical Equipment Excavated From the Furniture Dump in 2000.

Photograph III-5: Removing Small Capacitors From Electrical Racks Taken From the Furniture Dump in 2000.

Photograph III-6: The New Main PCB Storage Facility.

Table III-1: List of Contents of the New Beach PCB Storage Facility

Location on Map III-1	Container	Description	PCB Concentration
1	WN10461	Steel Vault – wood from S1	50 – 25000 ppm
1	PN 00233	Steel Vault – wood from S1	50 – 25000 ppm
1	PN00271	Steel Vault – wood from S3	50 – 60000 ppm
1	PN00272	Steel Vault – wood from S1	50 – 25000 ppm
1	PN00278	Steel Vault – wood from S1	50 – 25000 ppm
1	PN00279	Steel Vault – wood from S1	50 – 25000 ppm
1	PN00277	Steel Vault – wood from S1	50 – 25000 ppm
1	PN00280	Steel Vault – wood from S3	50 – 60000 ppm
1	PN00281	Steel Vault – wood from S3	50 – 60000 ppm
1	PN00282	Steel Vault – wood from S3	50 – 60000 ppm
1	PN00283	Steel Vault – wood from S3	50 – 60000 ppm
1	PN00285	Steel Vault – wood from S3	50 – 60000 ppm
1	PN00286	Steel Vault – wood from S3	50 – 60000 ppm
1	WN01461	Steel Vault – wood from S3	50 – 60000 ppm
1	PN00019	Steel Vault – barriers from furniture dump	50 - 200 ppm
1	PN00020	Steel Vault – barriers from furniture dump	50 - 200 ppm
2	WN10460	Steel Flowerpot – soil plus debris	2000 - 5000 ppm
2	WN10462	Steel Flowerpot – soil plus debris	2000 – 5000 ppm
2	PN00270	Steel Flowerpot – soil plus debris	2000 – 5000 ppm
Seacan Number 1			
3	PN00258 (RI99-C183)	Drained Unit rectifier 22 gal – drained transformer	-
4	PN00300 (RI99-C099)	Drained Filter choke 11 gal – small drained transformer	52 %
5	PN00250 (RI99-C201)	Drained Filter choke 11 gal – small drained transformer	32 %

Location on Map III-1	Container	Description	PCB Concentration
6	PN00255 (RI99-C096)	Drained Unit rectifier 60 gal – drained transformer	59 %
7	PN00292	Drained transformer	-
8	PN00293	Capacitor bank (telecommunications capacitor)	-
9	PN00296	Drained transformer	-
10	PN00253 (RI99-C200)	Drained Filter choke 11 gal – small drained transformer	52 %
11	PN00254 (RI99-C181)	Drained Unit rectifier 22 gal – small drained transformer	-
12	PN00294	Small drained transformer	-
13	PN00259 (RI99-C101)	Drained Askarel retard coil 18 gal – small drained transformer	65 %
13	PN00022	Barrel containing transformer PN00259, bank of capacitors, and a transformer core	-
14	PN00261 (RI99-C182)	Drained Unit rectifier 22 gal – small drained transformer	-
15	In Barrel PN00021 (PN00256) (RI99-C093)	Drained Filament transformer 4 gal – small drained transformer	62 %
15	In Barrel PN00021 (PN00260) (RI99-C102)	Drained Filament transformer 10 gal – small drained transformer	73 %
15	PN00021	Barrel containing two transformer PN00256 and PN00260	-
16	PN00291	Drained transformer	-

Location on Map III-1	Container	Description	PCB Concentration
17	PN00263	Drained Unit rectifier 28 gal	-
18	PN00251 (RI99-C098)	Drained Askarel retard coil 18 gal – small drained transformer	70 %
18	PN00292 replaced PN00257 (RI99-C097)	Drained Unit rectifier 60 gal – drained transformer	40 %
18	PN00296 replaced PN00262 (RI99-100)	Filament transformer – small drained transformers	-
Seacan Number 2			
19	PN00297	Blue plastic barrel – floor tiles	50 – 1100 ppm
20	PN00240	Blue plastic barrel – floor tiles	50 – 1100 ppm
21	PN00015	Blue plastic barrel – floor tiles	50 – 1100 ppm
22	PN00225	Blue plastic barrel – floor tiles	50 – 1100 ppm
23	PN00298	Blue plastic barrel – floor tiles	50 – 1100 ppm
24	PN00147	Blue plastic barrel – floor tiles	50 – 1100 ppm
25	PN00224	Blue plastic barrel – floor tiles	50 – 1100 ppm
26	PN00219	Blue plastic barrel – floor tiles	50 – 1100 ppm
27	WN10787	Blue plastic barrel – floor tiles	50 – 1100 ppm
28	PN00227	Blue plastic barrel – floor tiles	50 – 1100 ppm
29	PN00299	Blue plastic barrel – floor tiles	50 – 1100 ppm
30	PN00269	Barrel in overpack – PCB oil from draining transformers	40 %
31	PN00290	Blue plastic barrel – capacitors	-
32	PN00229	Blue plastic barrel – floor tiles	50 – 1100 ppm
33	PN00221	Blue plastic barrel – floor tiles	50 – 1100 ppm
34	PN00288	Blue plastic barrel – capacitors	-
35	PN00289	Blue plastic barrel – capacitors	-

Location on Map III-1	Container	Description	PCB Concentration
36	PN00223	Blue plastic barrel – floor tiles	50 – 1100 ppm
37	PN00222	Blue plastic barrel – floor tiles	50 – 1100 ppm
38	PN00017	Blue plastic barrel – ballasts	-
39	PN00029	Blue plastic barrel – floor tiles	50 – 1100 ppm
40	PN00248	Blue plastic barrel – capacitors	-
41	PN00030	Blue plastic barrel - sphagsorb	-
Seacan Number 3			
42	Barrel RI99-C070	Waste oil	6.1 ppm
43	Barrel RI99-C071	Waste oil	4.5 ppm
44	Barrel RI99-C065	Waste oil	4.3 ppm
45	Barrel RI99-C151	Waste oil	2.0 ppm
46	Barrel RI99-C136	Waste oil	3.0 ppm
47	Barrel RI99-C063	Waste oil	5.5 ppm
48	Barrel RI99-C090	Waste oil	14.6 ppm
49	Barrel RI99-C148	Waste oil	2.5 ppm
50	Barrel RI99-B077	Ethanol	< 0.5 ppm

Table III-2: List of Contents of the New Main PCB Storage Facility

Location on Map III-2	PCB Label	Container	Description	Concentration PCBs (ppm)
1	PN00287	Overpack drum	Soil from Furniture Dump	75
2	WR70430	Black Plastic Barrel	Soil from Furniture Dump 100 L	50-100
2	WR70563	Black Plastic Barrel	Soil from Furniture Dump 100L	50-100
3	Multiple Table III-2A	156 Plastic Barrels	Soil and concrete from Iqaluit cleanup	50-200
4	PN00264	Wooden box	Soil from Furniture Dump	35
4	PN00265	Wooden box	Soil from Furniture Dump	420
4	PN00268	Wooden box	Soil from Furniture Dump	510
4	PN00266	Wooden box	Soil from Furniture Dump	340
4	PN00267	Wooden box	Soil from Furniture Dump	520
5	-	Lined Building	Approximately 630 m^3 screened soil from Furniture Dump and S1/S4 buildings area	50-2000

Table III-2A: PCB Labels on Barrels Containing CEPA Material from Iqaluit

PN00105	PN00176	WN10495	PN00132	WN10422	WN12654
PN00106	PN00177	WN10496	PN00133	WN10423	WN12656
PN00107	PN00178	WN10497	PN00143	WN10465	WN12657
PN00108	PN00179	WN12324	PN00151	WN10466	WN12658
PN00109	PN00180	WN12326	PN00152	WN10469	WN12660
PN00110	PN00181	WN12327	PN00153	WN10471	WN12661
PN00111	PN00182	WN12328	PN00155	WN10472	WN12662
PN00112	PN00183	WN12329	PN00156	WN10478	WN12663
PN00113	PN00184	WN12331	PN00157	WN10480	WN12664
PN00114	PN00185	WN12332	PN00160	WN10481	WN12665
PN00115	PN00186	WN12333	PN00161	WN10482	WN12666
PN00116	PN00187	WN12334	PN00162	WN10483	WN12667
PN00117	PN00188	WN12340	PN00163	WN10484	WN12669
PN00118	PN00189	WN12341	PN00164	WN10485	WN12670
PN00119	PN00190	WN12345	PN00165	WN10486	WN12671
PN00120	PN00191	WN12346	PN00166	WN10487	WN12672
PN00121	PN00192	WN12347	PN00167	WN10488	WN12673
PN00122	PN00193	WN12348	PN00168	WN10489	WN12674
PN00123	PN00196	WN12349	PN00170	WN10490	WN12675
PN00124	PN00198	WN12350	PN00171	WN10491	WN12677
PN00125	WN00411	WN12351	PN00172	WN10492	WN12679
PN00126	WN00412	WN12353	PN00173	WN10493	WN12680
PN00127	WN00413	WN12354	PN00174	WN10624	
PN00128	WN00414	WN12355	PN00175	WN10627	
PN00129	WN00415	WN12356	WN10417	WN10642	
PN00130	WN00416	PN00131	WN10419	WN10644	

Table III-3: List of Contents of the Hazardous Waste Storage Facility (B2) for Non-PCB Hazardous Wastes and Contaminated Materials

Location on Map III-3	Container	Description	Comment
1	30 Wooden boxes	Mercury contaminated soil	Mercury concentration max 18.4 ppm
2	29 Wooden boxes	Metal contaminated soil	Metals in the range: Cu max 500 ppm Pb max 10000 ppm Zn max 3000 ppm
3	Red metal vault labelled airport batteries	Batteries from airstrip	In waste wrangler in vault
4	Blue barrel labels RI99-S1 Paint	Paint products and thermometers	Mercury in thermometers
5	Barrel	Batteries from S3	NiCd batteries
6	2 Overpack drums	Batteries	Moved from opposite garage
7	Empty CEPA barrels and overpacks	Empty	-
8	Waste wranglers	Clean booms	-
9	Waste wrangler	Empty	-

Table III-4: Results of Analyses for Lead and PCBs in Cleanup Materials Used in the Beach Dump Cleanup in 1999

Sample	Unit	Lead	PCBs
RI00-206	ppm	18	<0.5
RI00-207	ppm	81	<0.5
RI00-208	ppm	18	<0.5
RI00-209	ppm	<10	<0.5
RI00-210	ppm	235	<1.0
RI00-211	ppm	95	<0.5
RI00-212	ppm	149	<0.5
RI00-213	ppm	27	<0.5
RI00-216	ppm	<10	<0.5
RI00-217	ppm	10	<0.5
RI00-218	ppm	220	<0.5

B. Airstrip Dump

The airstrip dump is probably the largest dump at Resolution Island in terms of volume. It contains a vast amount of debris and garbage including kitchen, food, and pharmaceutical waste. The top of the dump has been leveled and covered with soil in some places and is characterized by rusting food cans. The toe of the dump is totally exposed and is largely composed of barrels and metallic debris (Photograph III-7). Some of these barrels contain unknown product. Furthermore, evidence shows that burning of waste materials had occurred at the dump.

As part of the preparation of the site for the new Short Range Radar station, the airstrip dump was inspected in 1990. This work consisted of sampling on the surface of the debris and in the runoff from the dump. The investigation found PCBs in the soil at the surface of the dump. Two of the samples were found to contain PCBs at concentrations of greater than 50 ppm (179 ppm Aroclor 1254 and 112 ppm Aroclor 1260)[1]. However, the samples that were taken from the runoff showed no signs of PCB contamination.

As part of the 1993 environmental assessment conducted by Royal Roads Military College[2], six samples were taken along the toe of the dump. All were analysed for PCBs and found to contain much less than 1.0 ppm. The report also reviewed the previous studies and discussed the problems of false positives with the test kits used and also the lack of QA/QC data in the report. Since no PCBs were found to be leaching from the dump, the 1993 cleanup recommendation was to remove and sort exposed debris at the toe of the dump and then to cover the whole dump with 1 meter of clean fill. In 1994, two large PCB-containing rectifiers were removed from the surface of the dump[3].

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[1] 1 Construction Engineering Unit (1 CEU, Canadian Forces) Clean-Up: BAF-5, Resolution Island, NWT. Engineering Study 90-CEU-57, November, 1999: Contains Lane P and Associates Ltd., Site Assessment, BAF-5,Rresolution Island, NWT Final Report October 1990 as Appendix D.

[2] Environmental Sciences Group, Royal Roads Military College (1994) Environmental Study of a Military Installation at Resolution Island, BAF-5: Volume One. Prepared for Indian and Northern Affairs Canada.

[3] Analytical Services Unit (1995) Environmental Study of a Military Installation at Resolution Island, BAF-5: Volume Two. Prepared for Indian and Northern Affairs Canada.

The objective this year was to determine if PCB contamination was present in soils comprising the surface of the airstrip dump. A 10 m by 10 m grid was set up. Pink rope was used to initially set up two perpendicular lines, which divided the entire dump surface into four areas (Photograph III-8). The 10 m by 10 m grid was marked by tags that were placed in the ground at each corners of each quadrant. The tag number in the table refers to the tag at the top left-hand corner of the grid as viewed from the road and facing the dump. A composite sample was taken from each quadrant; five 0 - 10 cm samples were collected, one from towards each corner and one in the center, and these were then thoroughly mixed. In addition, depth samples (30-40 cm) were taken from four of the quadrants.

The results are presented in Table III-5 and Map III-4. The results indicate that PCB contamination was generally low. Soils from 8 of the 49 quadrants contained Tier II soils (5.5 to 33 ppm) while 14 quadrants contained soil with PCBs at concentrations less than 0.5 ppm. No samples were found to contain PCBs above the 50 ppm CEPA criterion. The average concentration across the 49 quadrants was 4.6 ppm. All four depth samples gave PCB concentrations below the 0.5 ppm detection limit.

The two highest concentrations were found in adjacent quadrant numbers 32 and 34 with concentrations of 28 and 33 ppm, respectively. Subsequently, additional samples were taken from these two areas by dividing them into smaller 5 m by 5 m grids. In addition, depth samples were taken from grid numbers 32 and 34 as well as two samples from the toe of the dump below these grids. Results of analyses of these samples are also shown in Table III-5 and Map III-4. Three of the 4 samples from quadrant 32 were at the Tier II level and all four from quadrant 34 contained below 5 ppm PCBs. The depth sample in quadrant 32 had a value of 9.4 ppm PCBs. The two samples taken from below the dump contained <0.5 ppm PCBs. The results suggest that the contamination on the surface is patchy but that soils are not contaminated above the 50 ppm CEPA level. There is no leaching of PCBs from the dump.

On the last day of work at the site, two test pits were dug in the general area of quadrants 32 and 34. One pit was shallow but filled with dark liquid. The other from next to the toe produced a transformer. Further investigations are needed.

Photograph III-7: The Airstrip Dump Showing the Leveled Top of the Dump and the Barrel Strewn Toe.

Photograph III-8: Sampling the Airstrip Dump: Ropes Were Set Out in a 10 Meter Square Grid on Top of the Dump

Map III-4: Sampling Locations and PCB Concentrations at the Airstrip Dump

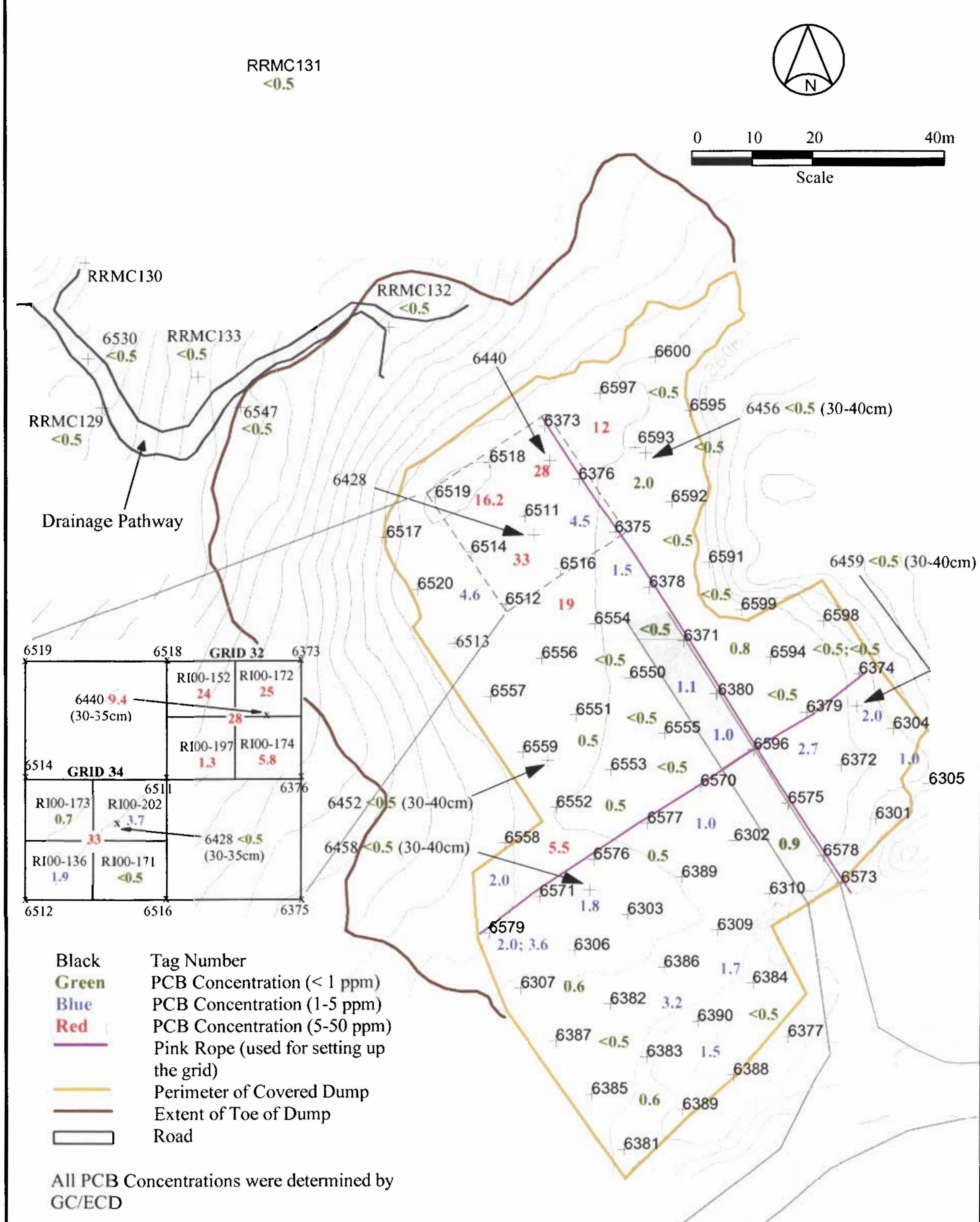

Table III-5: Sampling Locations and PCB Concentrations at the Airstrip Dump

Tag Number	Sample Number (prefix RI00-)	Grid Number	PCB Concentration by GC/ECD (ppm)[a]	Comment
-	178	45	2.0	-
6302	135	14	0.9	-
6303	137	12	2.7	laboratory duplicate
6306	134	11	17	-
6307	192	10	0.6	-
6308	99	13	5.0	-
6371	93	27	0.8	-
6372	131, 132	4	1.0	field duplicate
6373	94	21	12	-
6375	125	25	<0.5	-
6376	126	23	2.1	-
6378	92	26	<0.5	-
6379	121	2	2.0	-
6380	124	28	<0.5	-
6382	204	16	3.2	-
6383	190	19	1.5	-
6385	185	18	0.6	-
6386	203	17	1.7	-
6387	145	15	<0.5	-
6390	205	20	<0.5	laboratory duplicate
6452	114	42	<0.5	30-40 cm
6456	117	24	<0.5	30-40 cm
6458	113	6	<0.5	30-40 cm
6459	118	2	<0.5	30-40 cm
6511	105	35	4.5	-
6512	107	37	19	-
6513	103	36	2.1	-
6514	104	34	33	-

Tag Number	Sample Number (prefix RI00-)	Grid Number	PCB Concentration by GC/ECD (ppm)[a]	Comment
6516	108	38	1.5	-
6517	109	30	1.1	-
6518	110	32	28	-
6519	140	31	16.2	-
6520	186	33	4.6	-
6550	181	44	1.1	-
6551	180	43	<0.5	-
6552	187	47	<0.5	-
6553	188	48	<0.5	-
6554	120	41	<0.5	-
6555	189	49	1.0	-
6556	144	40	<0.5	-
6557	141	39	1.5	laboratory duplicate
6558	179	46	5.5	-
6559	139	42	0.5	-
6570	101	9	13	-
6575	98	3	19.9	-
6576	193	7	0.5	-
6577	100	8	1.0	-
6579	183, 184	5	3.0	field duplicate
6593	127	24	<0.5	-
6594	122, 123	29	<0.5	field duplicate
6596	90	1	2.7	-
6597	128	22	<0.5	-
7571	191	6	1.8	-
6511	174	32	5.8	5 m × 5 m sub-quadrant
6518	172	32	25	5 m × 5 m sub-quadrant
6373	152	32	24	5 m × 5 m sub-quadrant; Aroclor 1254

Tag Number	Sample Number (prefix RI00-)	Grid Number	PCB Concentration by GC/ECD (ppm)[a]	Comment
6376	197	32	1.3	5 m × 5 m sub-quadrant
6440	169	32	9.4	30 – 35 cm
6511	202	34	3.7	5 m × 5 m sub-quadrant
6512	136	34	1.9	5 m × 5 m sub-quadrant
6514	173	34	0.7	5 m × 5 m sub-quadrant
6516	171	34	<0.5	5 m × 5 m sub-quadrant
6428	170	34	<0.5	30 – 35 cm
6547	153	-	<0.5	near toe of dump
6530	176	-	<0.5	near toe of dump

a Aroclor 1260 unless otherwise specified

C. PCL Dump

This dump was originally established by PCL during the construction of the North Warning SRR Station in the late eighties. Small amounts of camp debris were added to one side of the dump in 1997 and 1998. The material was moved and shredded into the new landfill just across the road in 1999. The area was re-sampled in 1999 and two samples were found to contain PCBs at levels above 50 ppm (69 and 180 ppm). This finding was reported to Environment Canada.

Thirteen samples were collected this year to determine the exact extent of the CEPA contamination. None of the samples taken this year contained > 50 ppm PCBs as shown in Table III-6. Map III-5 shows the PCB concentrations and tag numbers of samples taken in the area in 1994, 1999 and 2000. Ropes have been placed on the ground showing the extent of the CEPA contamination (yellow) (Photograph III-9) and the perimeter of the Tier I contamination (pink) near to the camp; the Tier I contamination extends for several hundred meters down the narrow drainage course away from the camp

Photograph III-9: The PCL Dump Showing the CEPA Area Marked with Yellow Rope.

Map III-5: Sampling Locations and PCB Concentrations at the PCL Dump and its Drainage Pathway

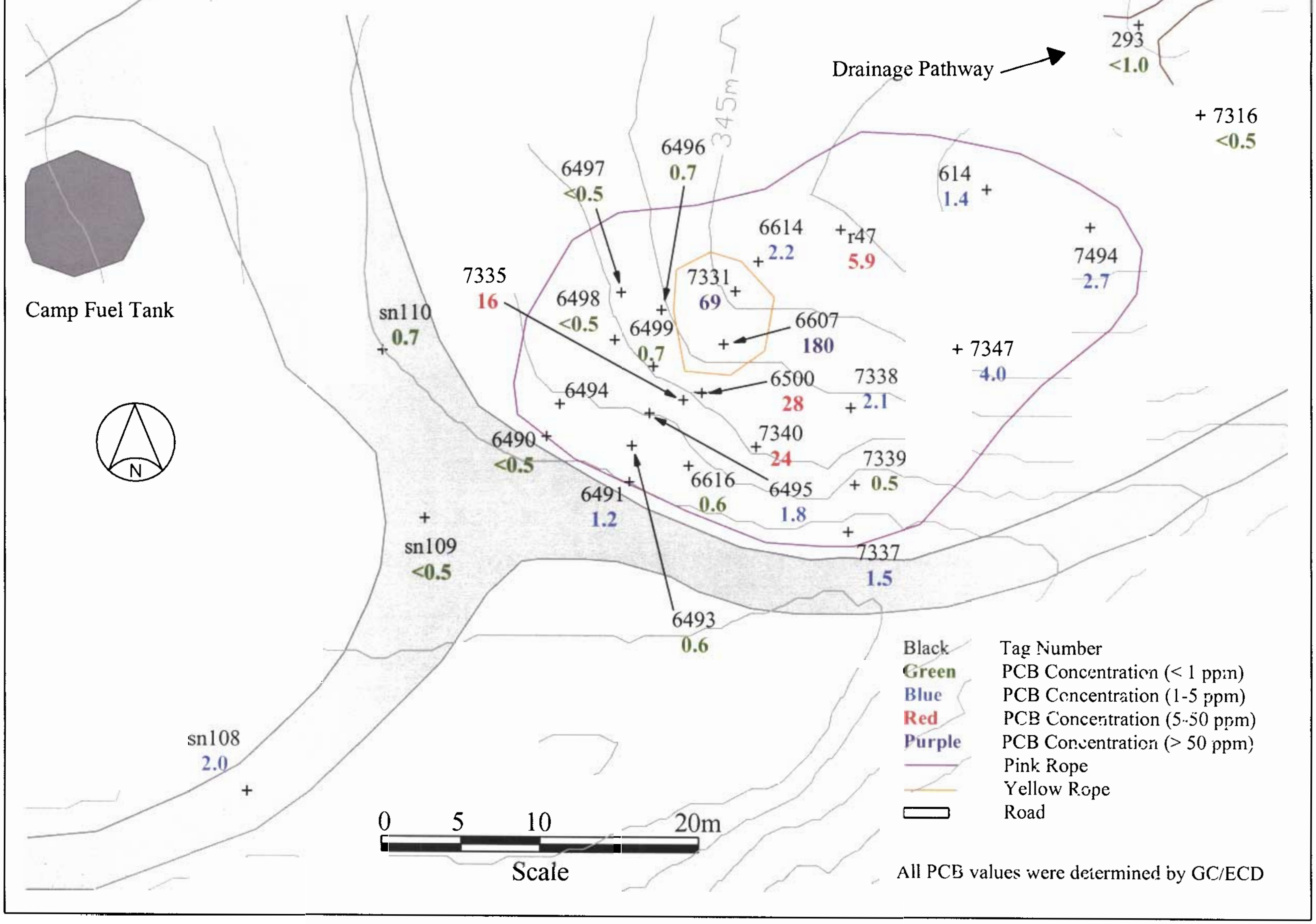

Table III-6: Sampling Locations and PCB Concentrations at the PCL Dump

Tag Number	Sample Number (prefix RI00-)	PCB Concentration by GC/ECD (ppm)	Comments
6490	058	<0.5	along road
6490	048	<0.5	-
6490	112	<0.5	30-40 cm
6491	060	1.1	along road, laboratory duplicate
6493	059	0.6	along road
6495	044	1.8	-
6496	030	0.7	-
6496	111	1.1	30-40 cm
6496	047	<0.5	-
6497	041	<0.5	-
6498	043, 045	<0.5	field duplicate
6499	046	0.7	-
6500	042	28	-

D. Monitoring of Barrier Performance

In 1994, barriers were constructed in the drainage pathways where PCB-contaminated soils were found to be present. These pathways comprise the large contaminated area originating at the S1/S4 building complex and extending through the S1/S4 valley to the S1/S4 beach area and the smaller leachate pathway from the furniture dump. Both drainage pathways have been shown to contain PCBs at levels above 50 ppm.

A soil monitoring system was instituted at three of the six barriers in 1994 in order to assess their effectiveness. This consisted of a clean cell and a series of soil monitoring points on either side of the barrier. The clean cells were installed on the lower side of the barrier, using PCB-free sand and sphagsorb. As a result, any PCBs passing through the barriers could be detected. Soil monitoring points were positioned on either side of the barriers so that levels of PCBs could be monitored and compared to levels found in the previous years. The full details of barrier construction, clean cells and monitoring points are described elsewhere[4]. The barriers have been inspected and monitored each year since their installation. The furniture dump barriers were removed this year as the furniture dump and its drainage pathway were removed. During the 2000 site visit, a full inspection was made of the S1/S4 barriers and drainage pathways. This included an assessment of physical damage, sampling at the soil monitoring points, sampling of barrier material at all six barriers and sampling of water. The barriers at the S1/S4 valley and beach were found to be in good condition with the exception of the brown sphagsorb booms. As observed in previous years, these booms were starting to show signs of rotting but since they are contained between the other booms this is not of great concern. The soil monitoring points, established in 1994, were re-sampled and soil samples submitted for analysis. Samples of barrier material from barriers were also collected and submitted for analyses as was water that was entering the ocean from the S1/S4 beach area and following the drainage pathway along the S1/S4 valley.

Maps III-6 and III-7 show the sampling locations and analytical results which are also given in Tables III-7, III-8 and III-9.

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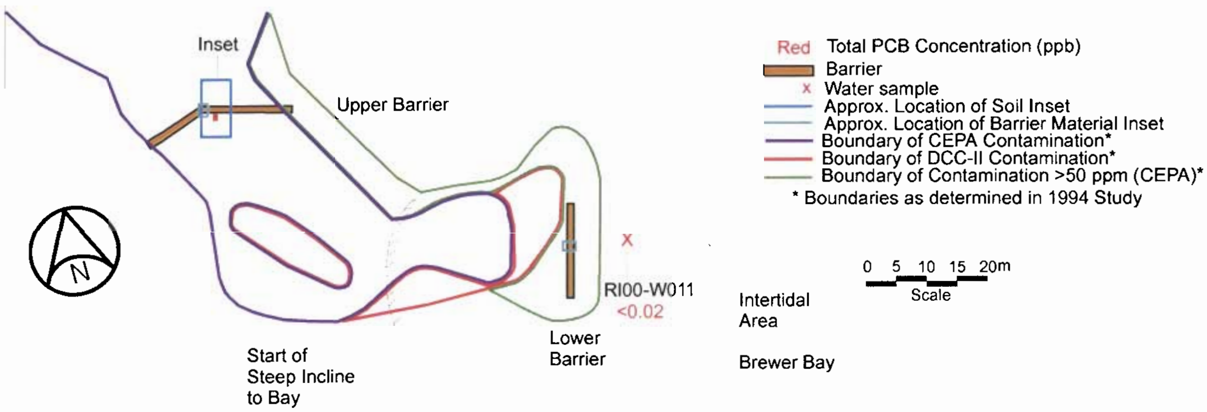
[4] Analytical Services Unit (1995) Environmental Study of a Military Installation at Resolution Island, BAF-5: Volume Two. Prepared for Indian and Northern Affairs Canada.

All samples of barrier material contained measurable levels of PCBs. The PCB levels in the booms ranged from 0.6 to 53 ppm. The PCB levels in the booms from the beach area were considerably less than those in the S1/S4 valley. Comparison of these results with those from previous years shows that this is a continuing trend indicating that there is more PCB migration in the S1/S4 valley. The results of analyses of the clean cells show that the barriers are still functioning well; the clean cell PCB concentrations found were 1.6 ppm at the beach and 1.5 ppm in the S1/S4 valley. Soil samples collected at the same monitoring points as in the previous years continued to show significant variation.

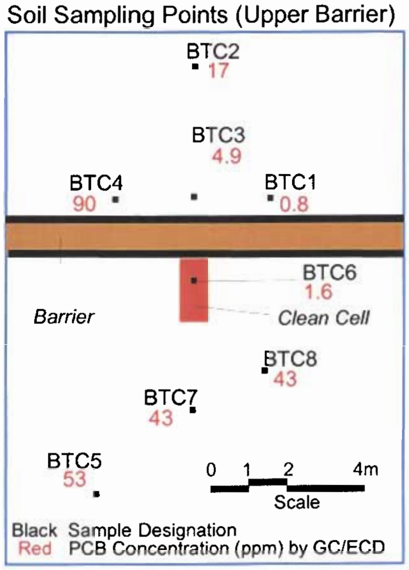
Three water samples were collected this year. Two of them contained less than the detection limit of 0.020 ppb PCBs (Table III-7). One of these samples was taken at the cliff below the lower barrier at the S1/S4 beach area where drainage enters the sea. A measurable level was found in a water sample collected below the barrier in the S1/S4 valley but the value of 0.25 ppb is still very low. No PCBs were found in water flowing over the top of the cliff.

Map III-6: Sampling Points and PCB Concentrations at the Upper Barrier in the S1/S4 Beach Area

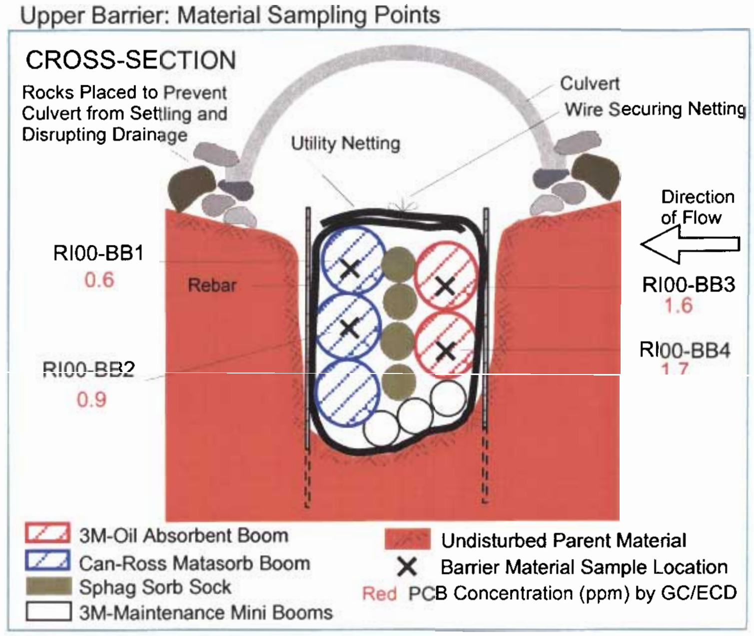
Barriers in the S1/S4 Beach Area



Soil Sampling Points (Upper Barrier)

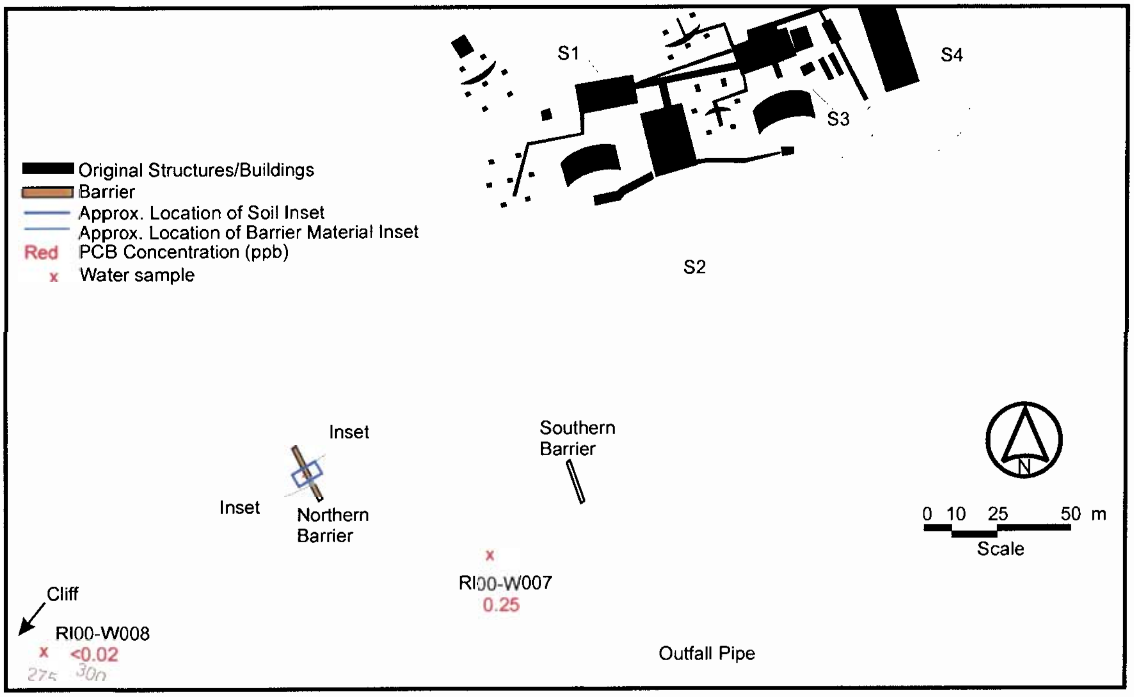


Upper Barrier: Material Sampling Points

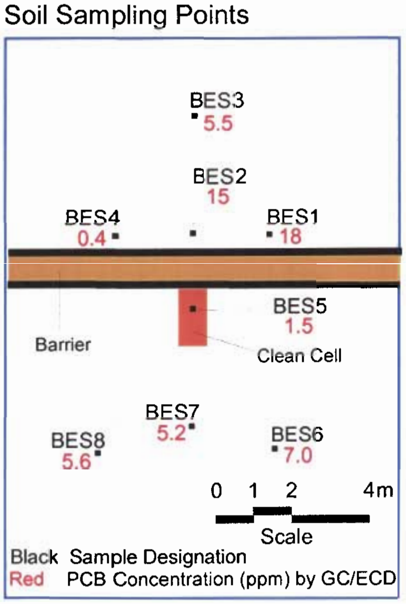


Map III-7: Sampling Points and PCB Concentrations at the Northern Barrier in the S1/S4 Valley

Barriers in the S1/S4 Valley



Soil Sampling Points



Barrier Material Sampling Points

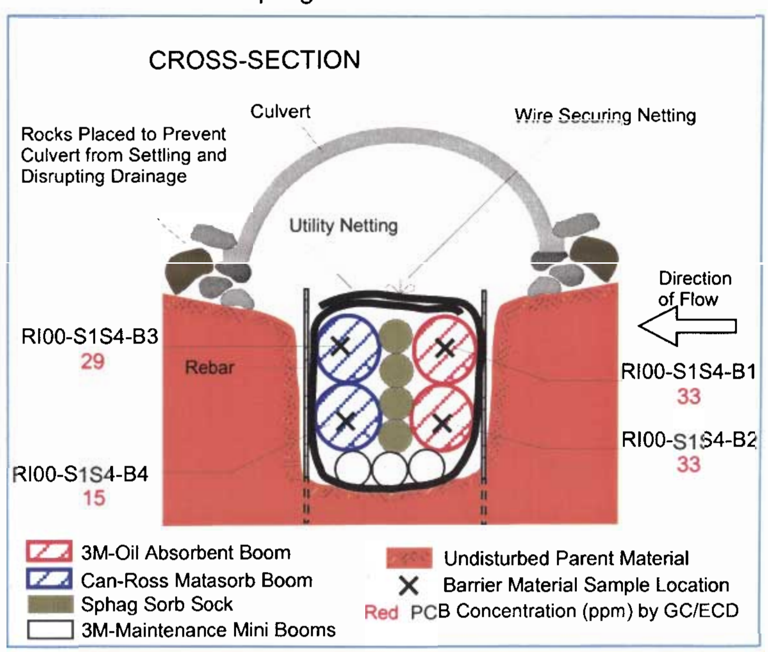


Table III-7: PCB Concentrations in Water Taken in the S1/S4 Drainage Pathway

Location	Sample	PCB Concentration (ppb)
S1/S4 Valley – above upper barrier	RI00-W007	0.25
S1/S4 Valley – near cliff	RI00-W008	<0.02
S1/S4 Beach	RI00-W011	<0.02

Table III-8: PCB Concentrations in Barrier Material Samples

Location of Sample	Material	Sample	PCB Concentration (ppm)
S1/S4 Valley – southern barrier	Matasorb	RI00-221	2.2
S1/S4 Valley – southern barrier	Matasorb	RI00-222	24
S1/S4 Valley – southern barrier	Matasorb	RI00-223	53
S1/S4 Valley – southern barrier	3M absorbent	RI00-226	3.7
S1/S4 Valley – southern barrier	3M absorbent	RI00-227	6.4
S1/S4 Valley – northern barrier	3M absorbent	RI00-S1S4-B1	33
S1/S4 Valley – northern barrier	3M absorbent	RI00-S1S4-B2	33
S1/S4 Valley – northern barrier	Matasorb	RI00-S1S4-B3	29
S1/S4 Valley – northern barrier	Matasorb	RI00-S1S4-B4	15
S1/S4 Beach – upper barrier	Matasorb	RI00-BB1	0.6
S1/S4 Beach – upper barrier	Matasorb	RI00-BB2	0.9
S1/S4 Beach – upper barrier	3M absorbent	RI00-BB3	1.6
S1/S4 Beach – upper barrier	3M absorbent	RI00-BB4	1.7

Table III-9 : PCB Concentrations in Soil at the Barrier Monitoring Points

Location	Sample	PCB Concentration (ppm)
S1/S4 Beach – above upper barrier	RI00-BTC1	0.8
S1/S4 Beach – above upper barrier	RI00-BTC2	17
S1/S4 Beach – below upper barrier	RI00-BTC3	4.9
S1/S4 Beach – below upper barrier	RI00-BTC4	90
S1/S4 Beach – above upper barrier	RI00-BTC5	53
S1/S4 Beach – below upper barrier	RI00-BTC6	1.6
S1/S4 Beach – below upper barrier	RI00-BTC7	43
S1/S4 Beach – bottom of the cliff	RI00-BTC8	43
S1/S4 Valley – above northern barrier	RI00-BES1	18
S1/S4 Valley – above northern barrier	RI00-BES2	15
S1/S4 Valley – below northern barrier	RI00-BES3	5.5
S1/S4 Valley – below northern barrier	RI00-BES4	0.4
S1/S4 Valley – above northern barrier	RI00-BES5	1.5
S1/S4 Valley – below northern barrier	RI00-BES6	7.0
S1/S4 Valley – above northern barrier	RI00-BES7	5.2
S1/S4 Valley – below northern barrier	RI00-BES8	5.6

E. Air Sampling for PCBs

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 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 PCBs 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 and solvents. These more volatile compounds are probably responsible for the characteristic PCB odour. Most of the chlorobenzenes that are found in Askarels are present as trichlorobenzenes with 1,2,4-trichlorobenzene being the predominant one. 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 ; 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. Samples were collected outside during excavation and screening activities and in the Main PCB storage facility. Results given in Table III-10 show that even under dusty conditions the PCB levels in air were extremely low and below the method detection limit.

In order to investigate the level of trichlorobenzenes in the air, samples were collected and analysed using a combination of NIOSH methods 1501 and 5517 with an air pump and charcoal tubes. The pump was run at a rate of about 170 mL/min for about 1-2 hours. Samples were collected at the Main PCB storage facility. The charcoal tube collection tubes were extracted with hexane and the extracts run on a gas chromatograph equipped with a mass spectrometric detector (GC/MS). Both 1,2,4-trichlorobenzene and

1,2,3-trichlorobenzene were detected in the two samples along with hydrocarbon compounds normally associated with diesel-like mixtures. Both samples were collected in the main PCB storage facility while PCB contaminated soils were being stockpiled. The amount of 1,2,4-trichlorobenzene found on the tubes were 2.2 ug and 5.9 ug which correspond to concentrations of 0.18 mg/m^3 and 0.25 mg/m^3. For 1,2,3-trichlorobenzene, the concentrations found were < 0.04 mg/m^3 and 0.09 mg/m^3. For the 1,2,4-trichlorobenzene, the concentrations found were much below the regulated value of 40 mg/m^3. However, it is still recommended that half-face respirators equipped with organic cartridges and filters be worn when the odour of PCBs is encountered because the actual concentrations may be higher on occasion and because the Inuit workers appear to be susceptible to elevated levels of hydrocarbon vapours.

Table III-10: PCB Concentrations in Air Samples Collected at Resolution Island

Sample (Prefix RI00-)	Location	PCB per tube (µg)	PCB Conc. in air (mg/m^3)
055	Maintenance building	<0.05	<0.001
302	Maintenance building	<0.05	<0.001
332	Maintenance building	<0.05	<0.001
333	Maintenance building	<0.05	<0.001
336	Maintenance building	<0.05	<0.001
146	Air samples taken at S1 while excavating soil	<0.05	<0.001
104	Air samples taken at S1 while excavating soil	<0.05	<0.001
219	Furniture Dump	<0.05	0.001
230	Furniture Dump – sample taken while screening soil	<0.05	<0.001
349	Furniture Dump	<0.05	<0.001
361	Furniture Dump	<0.05	<0.001

F. DND Helipad Area

In 1999, the roads around the core camp were sampled and analysed for PCBs. One area near the road between the NWS Helipad and the DIAND Helipad used in this project was found to be contaminated at concentrations up to 30 ppm PCBs. Surprisingly this contamination is with Aroclor 1254. The extent of the contaminated area was not completely delineated. This year a further 19 samples were taken and the results given in Map III-8 and Table III-11. These results show an area of high contamination, up to 55 ppm in the road leading to the NWS Helipad and station. The area is directly in the road and is composed of hard packed soil on rocks or bedrock. The depth of the soil is thought to be shallow but this could not be determined without the use of heavy equipment. The contamination is within the DND property boundary for their NWS Short Range Radar operation. DND have been informed about the contamination that exists within the area for which they are responsible.

Map III-8: PCB Concentrations in the Vicinity of the Helipad

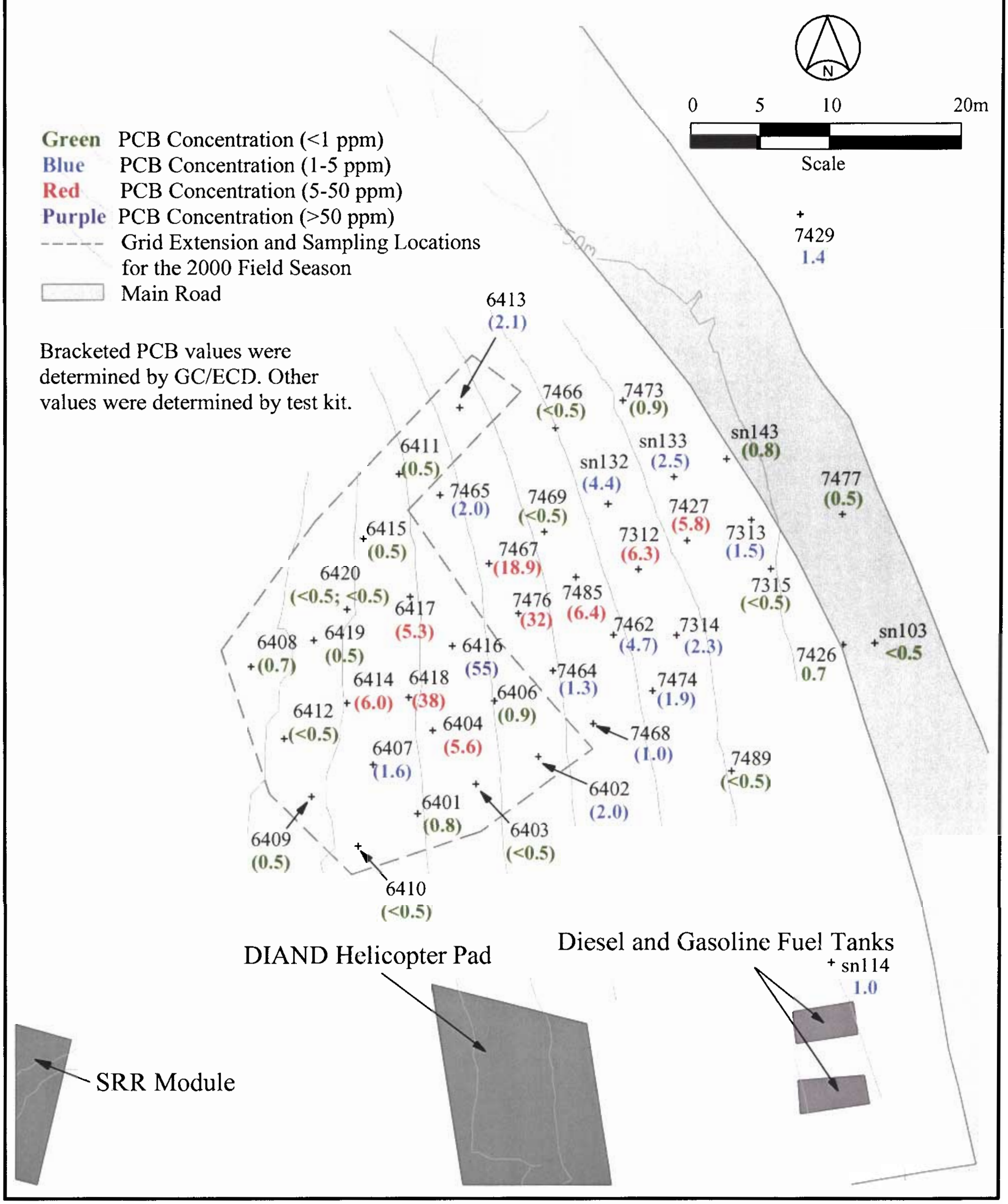


Table III-11: Sampling Locations and PCB Concentrations at the DND Helipad Area

Tag Number	Sample Number (prefix RI00-)	PCB Concentration by GC/ECD (ppm)
6401	015	0.8
6402	003	2.0
6403	004	<0.5
6404	010	5.6
6406	011	0.9
6407	016	1.6
6408	007	0.7
6409	006	0.5
6410	005	<0.5
6411	019	0.5
6412	008	<0.5
6413	009	2.1
6414	017	6.0
6415	020	0.5
6416	022	55
6417	023	5.3
6418	014	38
6419	018	0.5
6420	012, 013	<0.5

G. DND Vaults

During the construction of the Short Range Radar facilities in 1989-93, soil thought to be contaminated with PCBs was placed in 48 red steel vaults. Analyses at that time indicated that most contained < 1 ppm PCBs while 9 contained between 3 and 1 ppm PCBs. Before landfilling the soil in these vaults, it was decided to re-analyse the contents before disposal. The large number of bolts securing the lids were removed and core samples taken from the vaults. Results of PCB analyses are given in Table III-12. These show that none of the vaults contain PCBs at concentrations above 5 ppm and therefore they can be emptied into a landfill and the contents buried. The vaults will then be available for use to store the >2000 ppm unscreened soils.

Photograph III-10: Sampling the DND Vaults.

Table III-12: PCB Concentrations of Soil in the DND Vaults

Sample Number (prefix RI00-)	Vault Number	PCB Concentration by GC/ECD (ppm)
247	23	0.8
248	22	1.1
249	40	<0.5
250	41	1.4
251	42	<0.5
252	58	<0.5
253	68	0.8
254	61	1.5
255	24	1.5
256	60	0.9
257	15	0.7
258	14	<0.5
259	66	0.8
260	79	1.6
261	69	3.8
262	25	0.5
263	45	<0.5
264	47	<0.5
265	59	<0.5
266	71	<0.5
267	78	<0.5
268	65	<0.5
269	73	<0.5
270	39	<0.5
271	44	<0.5
281	18	<0.5
289	20	<0.5
290	49	<0.5

291	57	<0.5
292	37	<0.5
293	66	<0.5
293	56	<0.5
294	36	<0.5
295	21	<0.5
296	13	<0.5
297	32	1.2
298	17	<0.5
299	48	<0.5
300	70	<0.5
317	73	0.5
318	77	0.6
319	64	<0.5
320	72	0.5
321	75	<0.4
322	63	1.0
323	62	1.5
324	67	0.6

H. Annex A - Quality Control Data

Quality control was maintained through the analysis of standards, duplicates, and blanks.

1. PCB Quality Control/Quality Assurance (QA/QC)

Soil samples were analyzed for PCBs using test kits in the field and GC/ECD in the laboratory. Interference caused by high organic content or high oil content is known to compromise the accuracy of the immunoassay test kits. The relative standard deviations given in the tables demonstrate that the analyses were effective. Test kits were employed at the Furniture Dump whereas the GC/ECD method was generally employed for samples from other locations.

Table A-1: PCB Concentrations in Duplicate Analysis by Test Kit in Soil Samples From Various Locations at the Site

Sample Number	Sample Location	PCB Concentration (ppm)	Standard Deviation	Relative Standard Deviation (RSD) (%)
154	S1S4 Valley	17; 26	6.4	30
161	Furniture Dump -	<5; <5	0	0
337	Funiture Dump – close to bedrock	5; <5	0	0
378	Funiture Dump – test pit sample	<5; <5	0	0
383	Furniture Dump -	>50; >50	0	0
Average RSD	-	-	-	6

Table A-2: PCB Concentrations in Laboratory Duplicate Analysis by GC/ECD in Samples From Various Locations at the Site [1]

Sample Number	Sample Location	PCB Concentration (ppm)	Standard Deviation	Relative Standard Deviation (RSD) (%)
60	PCL Dump along road - tag number 6491	1.3; 0.9	0.3	26
137	Airstrip Dump - grid 12	2.8; 2.6	0.1	5
141	Airstrip Dump - grid 39	1.5; 1.5	0	0
205	Airstrip Dump - grid 20	<0.5; <0.5	0	0
248	DND Vault sample - number 22	1.2; 1.0	0.1	13
249	DND Vault sample - number 40	<0.5; <0.5	0	0
297	DND Vault sample - number 32	1.1; 1.2	0.1	6
BB4	S1/S4 Beach – upper barrier, 3M absorbent material	2.1; 1.2	0.6	39
BTC6	S1/S4 Beach – below upper barrier	0.8; 2.3	1	70
S1S4 SS2	S1S4 Valley sample	0.6; 0.6	0	0
Average RSD	-	-	-	16

Table A-3: PCB Concentrations in Field Duplicate Analysis by GC/ECD in Samples From Various Locations at the Site

Sample Number	Sample Location	PCB Concentration (ppm)	Standard Deviation	Relative Standard Deviation (RSD) (%)
012 , 013	DND Helipad – tag number 6420	<0.5; <0.5	0	0
043 , 045	PCL Dump – tag number 6498	<0.5; <0.5	0	0
122 , 123	Airstrip Dump - grid 29	<0.5; <0.5	0	0
131 , 132	Airstrip Dump – grid 4	1.0; 1.0	0	0
183 , 184	Airstrip Dump – grid 5	2.3; 3.6	0.9	31
Average RSD	-	-	-	6.2

IV. BARRELS

A. General

This year the cleanup of barrels and their contents continued in four areas. A total of 72 barrels were sampled and their contents analyzed. This chapter describes the activities undertaken and the data that resulted. The results are presented in Tables IV-1 and IV-2.

B. Barrel Sampling Methodology

Consolidation of barrel contents prior to sampling was carried out if barrels contained only a small amount of liquid. A convenient way to consolidate barrel contents was first to tip the barrels upside down on a containment tray. Oil from the barrel containment tray was then pumped into sound barrels which were then numbered, sampled and analysed. Barrels that had contained water or fuel were piled on their sides with the bungs out and then shredded after a few days. Barrels that contained oils need to be cleaned before shredding.

To sample barrels, they were first set in the upright position unless it caused the barrel to leak in that position. The lids on the barrels were opened by using a bung wrench. This was carefully done to ensure that all of the excess pressure is slowly released. There were several occasions where the lids could not be opened. In this case, these barrels were left unsampled and required another method in obtaining a sample. It should noted that barrels should not be opened by puncturing them with a sharp tool. The samples were taken by inserting a 25 mL glass sampling tube (drum thief) into the barrel. Generally a sample of 20 mL is obtained from the barrel and deposited into a 30 mL glass bottle with a teflon lid. Barrels were numbered with white spray paint using a letter number code and the same codes were used on the vials.

1. Analysis of Barrel Contents

Chemical analyses were carried out on the samples obtained from the barrels in order to establish the identity of the contents (e.g., fuel oil, lubricating oil and grease, antifreeze, etc.) and to determine the PCB, chlorine, cadmium, chromium and lead concentrations. Samples were initially characterized as one phase, two phase or one phase with a trace (if the top layer was very thin). If required, one phase samples were mixed with methyl isobutyl ketone (MIBK) or hexane to determine if they were organic or aqueous. PCB, chlorine, cadmium, chromium and lead concentrations were not determined on the aqueous layer if two phases were present or if the sample was one phase and was determined to be water.

The infra-red spectra of all aqueous phases or samples were recorded and if applicable identified as water, ethylene glycol or other organic compound or mixture. All organic liquids were diluted with carbon disulfide and run on a Hewlett Packard 5890 chromatograph with an FID detector and a SPB-1 30 m capillary column. This enabled the petroleum product mixtures to be classified as either gasoline, fuel oil or lubricating oil and grease. To confirm identities, particularly for chlorinated compounds, some organic liquids were analyzed by GC/FID using either a 3 m 60/80 Carbopack B / 1% SP-1000 or a 6 m 100/120 Supelcoport / 10% FFAP column. GC/MS was also used for identification of unknowns and confirmation.

The PCB content of organic samples was determined by weighing approximately 0.2 g of material on to a LC-Florisil solid phase extraction tube and eluting with hexane. The resultant solutions were run on an HP 5890 gas chromatograph with ECD detector to determine the concentration of PCBs present; further cleanup was required in some cases. Aqueous samples were treated in the same manner but sodium sulphate was added to the top of the Florisil tube before adding the 0.2 g sample.

The concentration of chlorine in samples was determined by neutron activation analysis (NAA) using the Slowpoke reactor at the Royal Military College, Kingston, Ontario. Samples were weighed (0.3 g approximately) into a polyethylene vial and heat sealed. They were then irradiated with neutrons (5×10^{11} n cm^{-2} s^{-1}) for 1.0 minutes. After a delay time of 2.0 minutes the resulting gamma ray activity was counted for 5.0 minutes. The chlorine content was determined by comparing the peak area due to the chlorine-38 isotope with known standards.

Samples were analyzed for cadmium, lead and chromium by AAS. All samples were diluted with MIBK and run along with standards prepared in MIBK. Aqueous samples were diluted 1 in 100 in water and analyzed by AAS.

C. Airstrip

One hundred and twenty-six (126) barrels had been collected from around the airstrip in 1999 and left by the airstrip hut. Most of the barrels were partially full and needed to be consolidated. Several barrels were moved to the incinerator area and were not sampled this year; these barrels are currently stacked in a pile near to the incinerator. Forty two barrels at the airstrip were sampled and the empty barrels were marked with an X. Also there were six barrels that could not be opened and sampled by conventional means. By the end of the season, all of the barrels at the airstrip were moved to the incinerator area as it is not desirable to have barrels of fuel placed alongside the airstrip.

The results show that of the 42 barrels that were sampled, 10 contained only water which can therefore be discharged directly on the land. Twenty-eight of the barrels contained product consisting of fuel, and lubricating oil and grease, which can be incinerated. Three barrels contained lead exceeding the criterion and need to be shipped south for disposal. One barrel contained 11 ppm PCBs and will therefore be moved to the beach PCB storage facility to sea-can #3 next year.

D. Imploded Tank

At the imploded tank, the remaining barrels were sampled from pile M. The barrels labeled M were found in 1999 to contain leaded gasoline with a high lead content of about 1500 ppm. All 10 remaining barrels will have to be shipped south as 8 were found to contain elevated lead levels and two were not analysed but were assumed to contain leaded gasoline because of their pink colour and gasoline odour. There are still a few unlabelled barrels in piles containing mostly barrels labeled K and L that need to be sampled next year when they can be accessed.

E. Incinerator

Twenty samples were taken from barrels at the incinerator area. The analysis of these samples shows that all of the contents of these barrels can be incinerated.

F. PCL Dump

The contents of the 7 barrels found to contain water in 1999 were emptied on to the land. The contents of the remaining barrels were consolidated resulting in three samples. There was one barrel that could not be opened by conventional means and this was not sampled. The results for the three barrels are given at the end of the two tables. The empty barrels were marked with an X.

G. Other Areas

Barrels which contain material which will have to be shipped south for disposal were separated from several areas and placed in a central location near the maintenance buildings. Some barrels were taken from the barrel cache valley and imploded tank areas this year and their contents incinerated. Photograph IV-1 shows the barrier at the barrel cache valley area which is trapping oil leaching from the barrels. Other barrels that were moved and incinerated with were those at the head of the S1/S4 valley and those by the side of the road near the core camp which originally had been in the hollow which is now the landfill next to the core camp.

H. Quality Assurance/Quality Control (QA/QC)

Results given in Table IV-3 show that good agreement was obtained in the analysis of duplicates. Blanks and controls were run for all analyses.

Photograph IV-1: The Barrier at the Barrel Cache Valley: Note the Oily Material on the High Side of the Barrier and Cleaned Water on the Other.

Table IV-1: Description of Barrels and Description and Identity of Barrel Contents

Sample (Prefix: I00-)	Amount	Description of Contents	Identity of Barrel Contents
Airstrip			
D004	1/2 full	clear yellow	gasoline
D017	1/2 full	clear colorless	gasoline
D020	1/2 full	clear colorless with thin black layer on top	water with trace of fuel oil
D023	full	clear colorless	gasoline
D028	1/2 full	clear colorless	water
D031	full	clear colorless	water with trace of fuel oil
D033	1/2 full	rusty liquid	water
D034	1/2 full	2 phases (4:1): top clear blue, bottom clear yellow	top: gasoline, bottom: water
D036	full	clear colorless	fuel oil
D037	full	clear pale yellow	water
D038	full	2 phases (1:3): top clear grey, bottom clear grey with sediment on the bottom	top: fuel oil, bottom: water
D039	full	2 phases (1:1): top clear colorless, bottom clear colorless	top: gasoline and fuel oil (1:2), bottom: water
D040	1/2 full	clear pale yellow with sediment on the bottom	water
D041	full	clear colorless	fuel oil
D042	full	2 phases (12:1): top clear pale blue, bottom clear colorless	top: gasoline and fuel oil (8:1), bottom: water
D043	full	clear pink	gasoline and fuel oil (8:1)
D044	full	clear colorless	gasoline and fuel oil (1:2)
D045	full	clear pale yellow with thin brown layer on top	water with trace of fuel oil
D046	1/2 full	clear colorless	water
D050	full	2 phases (1:3): top clear grey, bottom colorless with	top: fuel oil, bottom: water

Sample (Prefix: I00-)	Amount	Description of Contents	Identity of Barrel Contents
		sediment on the bottom	
D051	full	2 phases (1:4): top yellow, bottom clear colorless with sediment on bottom	top: gasoline and fuel oil (1:1), bottom: water
D052	full	clear colorless	gasoline and fuel oil (2:1)
D053	full	2 phases (1:4):top clear grey, bottom clear colorless with sediment on the bottom	top: gasoline and fuel oil (1:2), bottom: water
D084	full	clear colorless	gasoline
D088	1/4 full	clear colorless	water
D091	full	clear colorless	gasoline
D094	1/4 full	clear yellowish	gasoline
D095	full	clear colorless	gasoline and fuel oil (1:1)
D098	full	clear yellowish	fuel oil
D101	full	clear yellowish	fuel oil
D112	3/4 full	clear colorless	gasoline and fuel oil (1:5)
D121	full	clear colorless	gasoline and fuel oil (1:2)
D122	full	2 phases (1:1): top clear pale yellow, bottom clear colorless with sediments	top: gasoline and fuel oil (1:4), bottom: water
D123	1/2 full	2 phases (3:1): top clear colorless, bottom clear colorless	top: gasoline and fuel oil (1:4), bottom: water
D124	full	clear colorless	gasoline and fuel oil (1:2)
D128	1/2 full	clear colorless	water with trace of fuel oil
D129	full	clear colorless	gasoline and fuel oil (1:1)
D130	full	clear colorless	gasoline and fuel oil (1:1)
D135	full	clear colorless	gasoline and fuel oil (1:2)
D137	full	clear colorless	gasoline and fuel oil (1:1)
D138	full	clear colorless	gasoline and fuel oil (1:1)
D144	full	clear colorless with thin brown layer on top	water with trace of fuel oil

Sample (Prefix: I00-)	Amount	Description of Contents	Identity of Barrel Contents
Imploded Tank			
D105	full	2 phases (2:1): top clear grey, bottom clear yellowish	top: gasoline, bottom: water
D106	full	clear blue	gasoline
D114	full	clear blue	gasoline
D115	full	clear colorless	gasoline
D116	full	clear colorless	gasoline
D117	full	clear colorless	gasoline
D136	full	2 phases (1:3): top clear grey, bottom clear yellow	top: gasoline, bottom: water
D142	full	clear colorless	gasoline
Incinerator			
D111	<1/4 full	2 phases (1:4): top grey, bottom clear colorless with sediment on the bottom	top: fuel oil, bottom: water
D118	1/3 full	2 phases (1:3): top clear pale yellow, bottom clear colorless with sediment on the bottom	top: fuel oil, bottom: water
D119	2 inches	2 phases (1:10): top clear pink, bottom clear colorless with sediment on the bottom	top: fuel oil, bottom: water
D131	full	2 phases (1:1): top clear brown, bottom clear pale yellow	top: gasoline, bottom: water
D132	full	clear pale yellow	fuel oil
D134	1/2 full	clear colorless	gasoline and fuel oil (1:2)
D140	full	2 phases (8:1): top clear pink, bottom clear yellow	top: fuel oil, bottom: water
D141	full	clear orange	gasoline
D143	full	2 phases (8:1): top clear pink, bottom clear yellow	top: fuel oil, bottom: water

Sample (Prefix: I00-)	Amount	Description of Contents	Identity of Barrel Contents
D147	1/3 full	2 phases (1:3): top clear grey, bottom clear colorless	top: gasoline and fuel oil (1:1), bottom: water
D148	1/3 full	clear colorless	gasoline and fuel oil (1:1)
D301	full	clear colorless	gasoline and fuel oil (1:2)
D302	full	clear pale yellow	lubricating oil and grease
D304	<1/4 full	2 phases (1:8): top clear yellowish, bottom clear colorless	top: gasoline and fuel oil (2:1), bottom: water
D305	1/4 full	2 phases (1:4): top thick amber oily, bottom clear colorless	top: lubricating oil and grease, bottom: water
D306	full	2 phases (1:1): top black thick oily, bottom clear orange	top: fuel oil and lubricating oil & grease (1:3), bottom: water
D307	full	2 phases (2:1): top black thick oily, bottom clear orange	top: fuel oil and lubricating oil & grease (1:1), bottom: water
D308	1/3 full	dark brown liquid	fuel oil and lubricating oil & grease (1:2)
D309	full	clear grey liquid	fuel oil
D310	full	2 phases (2:1): top thick black oily, bottom clear orange	top: fuel oil and lubricating oil & grease (1:1), bottom: water
PCL Dump			
D125	full	2 phases (1:2): top orange brown, bottom clear colorless	top: lubricating oil and grease, bottom: water
D126	full	2 phases (1:8): top brown, bottom clear grey	top: gasoline, bottom: water
D127	full	clear yellow	water with a trace of fuel oil

Table IV-2: PCB, Chlorine, and Metal Concentrations of Barrel Contents

Sample Prefix: RI00-	PCBs ppm[b]	Chlorine ppm[b]	Chromium ppm[b]	Lead ppm[b]	Cadmium ppm[b]	Disposal Option[a]
Airstrip						
D004	<2.0	<1000	<10	<100	<2	incinerate
D017	<2.0	<1000	<10	<100	<2	incinerate
D020	water	water	water	water	water	on land[d]
D023	<2.0	<1000	<10	<100	<2	incinerate
D028	water	water	water	water	water	on land[c]
D031	water	water	water	water	water	on land[d]
D033	water	water	water	water	water	on land[c]
D034	<2.0	<1000	<10	1500	<2	ship south
D036	<2.0	<1000	<10	<100	<2	incinerate
D037	water	water	water	water	water	on land[c]
D038	<2.0	<1000	<10	<100	<2	incinerate
D039	<2.0	<1000	<10	<100	<2	incinerate
D040	water	water	water	water	water	on land[c]
D041	<2.0	<1000	<10	<100	<2	incinerate
D042	<2.0	<1000	<10	927	<2	ship south
D043	<2.0	<1000	<10	147	<2	ship south
D044	<2.0	<1000	<10	<100	<2	incinerate
D045	water	water	water	water	water	on land[d]
D046	water	water	water	water	water	on land[c]
D050	<2.0	<1000	<10	<100	<2	incinerate
D051	<2.0	<1000	<10	<100	<2	incinerate
D052	<2.0	<1000	<10	<100	<2	incinerate
D053	<2.0	<1000	<10	<100	<2	incinerate
D084	<2.0	<1000	<10	<100	<2	incinerate
D088	water	water	water	water	water	on land[c]
D091	<2.0	<1000	<10	<100	<2	incinerate

Sample Prefix: RI00-	PCBs ppm[b]	Chlorine ppm[b]	Chromium ppm[b]	Lead ppm[b]	Cadmium ppm[b]	Disposal Option[a]
D094	<2.0	<1000	<10	<100	<2	incinerate
D095	<2.0	<1000	<10	<100	<2	incinerate
D098	<2.0	<1000	<10	<100	<2	incinerate
D101	<2.0	<1000	<10	<100	<2	incinerate
D112	<2.0	<1000	<10	<100	<2	incinerate
D121	<2.0	<1000	<10	<100	<2	incinerate
D122	<2.0	<1000	<10	<100	<2	incinerate
D123	<2.0	<1000	<10	<100	<2	incinerate
D124	<2.0	<1000	<10	<100	<2	incinerate
D128	water	water	water	water	water	on land[d]
D129	<2.0	<1000	<10	<100	<2	incinerate
D130	<2.0	<1000	<10	<100	<2	incinerate
D135	<2.0	<1000	<10	<100	<2	incinerate
D137	<2.0	<1000	<10	<100	<2	incinerate
D138	<2.0	<1000	<10	<100	<2	incinerate
D144	water	water	water	water	water	on land[d]
Imploded Tank						
D105	<2.0	<1000	<10	1400	<2	ship south
D106	<2.0	<1000	<10	<100	<2	incinerate
D114	<2.0	<1000	<10	960	<2	ship south
D115	<2.0	<1000	<10	960	<2	ship south
D116	<2.0	<1000	<10	980	<2	ship south
D117	<2.0	<1000	<10	920	<2	ship south
D136	<2.0	<1000	<10	<100	<2	incinerate
D142	<2.0	<1000	<10	960	<2	ship south
Incinerator						
D111	<2.0	<1000	<10	<100	<2.0	incinerate
D118	<2.0	<1000	<10	<100	<2.0	incinerate

Sample Prefix: RI00-	PCBs ppm[b]	Chlorine ppm[b]	Chromium ppm[b]	Lead ppm[b]	Cadmium ppm[b]	Disposal Option[a]
D119	<2.0	<1000	<10	<100	<2.0	incinerate
D131	<2.0	<1000	<10	<100	<2.0	incinerate
D132	<2.0	<1000	<10	<100	<2.0	incinerate
D134	<2.0	<1000	<10	<100	<2.0	incinerate
D140	<2.0	<1000	<10	<100	<2.0	incinerate
D141	<2.0	<1000	<10	<100	<2.0	incinerate
D143	<2.0	<1000	<10	<100	<2.0	incinerate
D147	<2.0	<1000	<10	<100	<2.0	incinerate
D148	<2.0	<1000	<10	<100	<2.0	incinerate
D301	<2.0	<1000	<10	<100	<2.0	incinerate
D302	<2.0	<1000	<10	<100	<2.0	incinerate
D304	<2.0	<1000	<10	<100	<2.0	incinerate
D305	<2.0	<1000	<10	<100	<2.0	incinerate
D306	<2.0	<1000	<10	<100	<2.0	incinerate
D307	<2.0	<1000	<10	<100	<2.0	incinerate
D308	11.0	<1000	<10	<100	<2.0	ship south
D309	<2.0	<1000	<10	<100	<2.0	incinerate
D310	<2.0	<1000	<10	<100	<2.0	incinerate
PCL Dump						
D125	<2.0	<1000	-	-	-	incinerate
D126	<2.0	<1000	<10	860	<2.0	ship south
D127	water	water	water	water	water	on land[d]

Bottom phase was also analyzed when the top phase contained greater than the DLCU Barrel Incineration Criteria: a: Disposal as per DCLU Barrel Protocol: b: Top phase where there are two phases present: c: Water disposal by dumping on land at least 30 m from natural water courses: d: Thin layer of petroleum product to be removed by oil absorbent material prior to disposal as above.

Table IV-3: Replicate Analysis Results for Barrel Contents

Sample	PCBs	Chlorine	Chromium	Lead	Cadmium
	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
39	<2.0, <2.0	<1000	<10	<100	<2.0
42	<2.0	<1000, <1000	<10	<100	<2.0
51	<2.0	<1000, <1000	<10	<100	<2.0
94	<2.0	<1000, <1000	<10, <10	<100, <100	<2.0, <2.0
105	<2.0	<1000, <1000	<10	1400	<2.0
114	<2.0, <2.0	<1000	<10	960	<2.0
122	<2.0	<1000, <1000	<10, <10	<100, <100	<2.0, <2.0
126	<2.0, <2.0	<1000, <1000	<10	860	<2.0
129	<2.0	<1000	<10, <10	<100, <100	<2.0, <2.0
131	<2.0	<1000, <1000	<10	<100	<2.0
132	<2.0, <2.0	<1000	<10	<100	<2.0
306	<2.0	<1000, <1000	<10	<100	<2.0
308	9, 13	<1000	<10	<100	<2.0
310	<2.0	<1000, <1000	<10	<100	<2.0

V. OTHER ACTIVITIES

A. Drinking Water

1. Analysis

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

2. Methods

Water samples were collected in 1 litre polyethylene bottles for general water quality parameters and inorganic elements analysis and in 1 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 V-1. The water at Resolution Island contains no buffering capacity and is therefore quite acidic. Experiments conducted on water samples in 1998 concluded that the addition of sodium carbonate could be added to each cubic meter of water to raise the pH to 7. The pH was monitored daily but no carbonate buffer was added. The pH ranged from 4.0 to 4.9. None of the parameters measures, with the exception of the pH, were outside of the Ontario Ministry of the Environment Guidelines.

Table V-1: Drinking Water Results and Guidelines

Parameter	Units	July 30	August 9	August 22	OME Guidelines
Alkalinity	mg/L	<1	<1	<1	30-500
Ammonia	mg/L	<0.1	<0.1	<0.1	-
Calcium	mg/L	2.1	1.8	14.0	-
COD	mg/L	<3	<3	3	-
Conductivity	uS/cm	72.5	69.8	72.5	-

Parameter	Units	July 30	August 9	August 22	OME Guidelines
Copper	mg/L	0.06	0.05	0.12	<1.0
Hardness	mg/L	11	10	41	80-100
Iron	mg/L	<0.10	<0.10	0.07	<0.30
Lead	mg/L	<0.010	<0.010	<0.010	<0.010
Magnesium	mg/L	1.66	1.42	1.57	-
PCB	ug/L	<3.0	<3.0	<3.0	< 3.0
pH	-	4.5	4.5	4.4	6.5-8.5
Phenols	ug/L	<1.0	<1.0	<1.0	-
Potassium	mg/L	0.30	0.29	0.20	-
Sodium	mg/L	3.00	2.80	2.83	<200
Sulphate	mg/L	18.6	18.1	19.6	<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	6.0	5.2	5.3	<250
TDS	mg/L	142	174	131	<500
TKN	mg/L	<0.2	<0.2	<0.2	-
TSS	mg/L	<1	<1	<1	<500
Zinc	mg/L	0.061	0.040	0.082	5
Total Coliforms	Cts/100 mL	3	3	2	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 Count (48 hrs)	Cts/1 mL	1	5	3	500
Background Count	Cts/100 mL	31	48	121	250

B. Lake Water

In order to comply with the water board licence (NWB5RES9803) water samples were required to be collected and analyzed for a variety of substances. Water samples were to be taken of raw water from the Water Lake (Photograph V-1) and runoff from the new non-hazardous landfills. However, there was no runoff from the new non-hazardous landfills so only results from the water lake are presented here. A sample of lake water was collected on August 4, 2000 and analyzed to give the results presented in Table V-2.

Table V-2: Lake Water Results

Parameter	Unit	Lake Water
Copper	mg/L	0.020
Iron	mg/L	<0.05
Lead	mg/L	<0.010
Manganese	mg/L	<0.05
Mercury	mg/L	<0.0005
Cadmium	mg/L	<0.001
Nickel	mg/L	<0.005
Chromium	mg/L	<0.005
Cobalt	mg/L	<0.005
Zinc	mg/L	0.040
Phenols	ug/L	<1.0
pH	-	4.3
TSS	mg/L	<1
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

C. Beach POL Tanks

A water sample was collected from each of the large POL tanks at the beach (Photograph V-2). The tank farthest from the beach also contains a large amount of diesel fuel on top of the water. The results show that all parameters except phenols meet the discharge criteria. The water in both these tanks will need to be treated to remove the phenols before it can be discharged to the ground.

Table V-3: Results of the Analyses of Water From the Two Beach POL Tanks

Parameter	Units	POL Tank Nearest Beach	POL Tank Farthest From Beach	Waste Water Discharge Criteria
pH	-	6.1	6.3	6-9
Arsenic (total)	ug/L	<3	6	100
Cadmium (dissolved)	ug/L	<1	<1	10
Chromium (total)	ug/L	<5	70	100
Cobalt (dissolved)	ug/L	<5	6	50
Copper (dissolved)	ug/L	25	32	200
Lead (dissolved)	ug/L	35	26	50
Mercury (total)	ug/L	<0.5	<0.5	0.6
Nickel (dissolved)	ug/L	<5	6	200
PCB	ug/L	<3	<3	5 ; 50
Phenols	ug/L	188	1320	20
Zinc (total)	ug/L	68; 70	310	1000

Photograph V-1: The Water Lake From Which the Camp Drinking Water is Taken

Photograph V-2: The Two Large POL Tanks Near the Beach at Resolution Island

D. Air Sampling in the Core Camp

At the core camp there is sometimes an odour of diesel fuel. When the doors are shut during the day due to poor weather there is sometimes an increase in headaches among the workers. In order to investigate this, the air was sampled using charcoal tubes and these were analysed to yield the results shown in Table V-4. The gas chromatograms obtained from the analysis were consistent with fuel oil. The results for the core camp of 2.1 and 0.4 mg/m^3 of hydrocarbon are much lower than legislated levels, which are generally of the order of 100 mg/m^3 or higher. However, these levels could be the cause of headaches. These symptoms could also be the result of higher than normal carbon dioxide levels or more likely elevated levels of particulate matter associated with smoking. The main PCB storage facility showed higher concentrations of hydrocarbon which presumably arise from petroleum products volatilizing from the contaminated soils which have recently been excavated (see Chapter III, Section E).

Table V-4: Results of Analyses of Air Samples for Hydrocarbons

Sample Number	Location	Mass of Hydrocarbon per tube (ug)	Concentration of Hydrocarbon in Air (mg/m^3)
RI00-054	Core Camp Room 10 Near Vent	25	2.1
RI00-329	Core Camp in Kitchen	5	0.41
RI00-276	Main PCB Storage Facility – No Activity	175	13.2

E. Battery Area near Furniture Dump

In 1999 a small area was found to the north of the furniture dump drainage pathway in which batteries had been disposed of. These batteries as shown in Photographs V-3 and V-4 were composed of a central metal electrode embedded in graphite and a whitish material which was previously housed in a black casing. Samples where collected of the graphite and white material and each was analysed for metals. The black graphite material was not found to contain any metals in significant amounts; manganese dioxide was expected to be present. The whitish material was found to contain a high level of zinc (35 %). Three soil samples were collected from the area and analyzed for their zinc content. The values found were 382, 335 and 5140 ppm. The high value was from a sample which contained a lot of the whitish material. It is therefore suggested that the visible pieces of the batteries plus the white solid and associated soil be placed in a lined wooden box and taken to the hazardous waste storage facility. Because of the remote location of the site, removal of the wooden box or boxes by helicopter is probably warranted.

Photograph V-3: The Battery Pile at the Edge of the Cliff near the Furniture Dump

Photograph V-4: Close-up of Broken Batteries

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ASU #:	2534	Report I.D.	Rilakewater24Aug00
Client:	DIAND	Date Submitted:	24-Aug-00
		Date Analysis Initiated:	24-Aug-00
		Date Reported:	29-Sep-00
Method:	Standard Methods	Matrix:	Water

Parameter	Units	W004	BLANK	QC	QC TARGET
Copper	mg/L	0.020	<0.005	1.54	1.50
Iron	mg/L	<0.05	<0.05	1.71	1.70
Lead	mg/L	<0.010	<0.005	2.37	2.40
Manganese	mg/L	<0.05	<0.05	0.25	0.24
Mercury	mg/L	<0.0005	<0.0005	0.0010	0.0010
Cadmium	mg/L	<0.001	<0.001	0.25	0.24
Nickel	mg/L	<0.005	<0.005	1.70	1.70
Chromium	mg/L	<0.005	<0.005	1.71	1.70
Cobalt	mg/L	<0.005	<0.005	1.77	1.70
Zinc	mg/L	0.040	<0.001	0.16	0.18
Phenols	ug/L	<1.0	<1.0	10.6	10.0
pH	-	4.3	-	-	-
TSS	mg/L	<1	-	-	-
Nitrate	mg/L	<0.05	<0.05	1.03	1.00
Nitrite	mg/L	<0.05	<0.05	0.98	1.00
Oil and Grease	mg/L	<1.0	<1.0	-	-
BOD	mg/L	<3	-	-	-
Faecal Coliforms	Cts/100 mL	0	-	-	-

Prepared by: A. Natta

Authorization: