Resolution Island 2000
Scientific Investigations

Prepared by

Analytical Services Unit
Queen's University
Kingston, Ontario

SAPIENTIA ET DOCTRINA STABILITAS

Contaminated Sites Office

ACKNOWLEDGMENTS

The entire project was supported by Indian and Northern Affairs Canada through its Contaminated Sites Office in Yellowknife. Special thanks to Scott Mitchell for his continued support, optimism and enthusiasm in making the project a success and to Marianne Kardash for keeping administrative affairs in order.

The work was conducted in conjunction with the Qikiqtaaluk Corporation. Thanks are due to the many QC personnel who helped us with our work.

The project was directed by John Poland and Allison Rutter, Queen's University. They were ably assisted by Maggie Lau, Sebastien Hogan, Graham Cairns and Jessica Patterson. This report was written by John Poland and edited by Allison Rutter. Maggie Lau was responsible for the logistics and the maps were drawn by Graham Cairns.

The laboratory analyses were conducted by Queen's University Analytical Services Unit, Kingston, Ontario. Thanks are due to Paula Whitley, Jody Bonsall, Mary Andrews, Sarah Keys, Tom Walsh, Sandra Graham and Shakeel Virk, who provided their usual high professional standards.

TABLE OF CONTENTS

LIST OF MAPS

LIST OF PHOTOGRAPHS

LIST OF TABLES

EXECUTIVE SUMMARY

This report is the seventh yearly report produced by the Analytical Services Unit (ASU) relating to the environmental assessment and remediation of the former military base at Resolution Island. The first three reports, pertaining to visits from 1994 to 1996, involved site assessment, remediation of critical areas and the development of cleanup plans and strategies. The work in these three years was managed by the ASU. In 1997 and 1998 the project focussed on infrastructure improvements and the purchasing and assembly of the equipment necessary for the cleanup of the site. From 1997 onwards, the management of the work has been conducted by the Qikiqtaaluk Corporation. Remediation activities started in 1998 and have continued each year. The ASU has provided analytical services and expertise to support this work and Dr. John Poland has been the Scientific Advisor to Indian and Northern Affairs Canada (INAC) for the project. This report details the work undertaken by the ASU, Queen's University in 2000.

Funding for the project was delayed this year and as a result the ASU field season was shortened to 58 days instead of the 81 day program that had been planned. This also resulted in a revised reduced remediation plan for the year.

This was the first year of excavation of PCB contaminated soil and as a result the methodology to be used for various facets of the work had to be developed. The main work of the ASU revolved around the excavation activities. The ASU was responsible for placing ropes on the ground marking the areas to be excavated, overseeing the excavation and ensuring that heavy equipment only excavated to the correct depth and did not stray into other areas, confirmatory testing and redirecting excavation to areas requiring more work. Details concerning items such as where to place materials contaminated with PCBs at various levels, the positioning of equipment and the order in which the work should be done were decided on by consultation between the key site personnel including the leader of the ASU team and also by the project management team.

The furniture dump and its drainage pathway were completely remediated this year. As part of the current clean up project all PCB contaminated materials down to 1 ppm PCBs in the furniture dump area were to be remediated; in the main S1/S4 areas only CEPA soil is currently scheduled to be excavated. Two more transformers were found in the dump. All CEPA soil was excavated and screened. The screened material was placed in the new main PCB storage facility on a liner at the former maintenance buildings. The metal debris from the dump which was found to be contaminated at the

Tier I/II level was placed on Tier II ground by the road to S4. All Tier II soils were excavated and placed alongside the metal parts; the Tier II soil included all the reject material from the screener. Tier I soils were excavated and placed in a separate cell at the core camp landfill. The amount of soil excavated was larger than expected due to the fact that the shape of the underlying bedrock was not known. The bedrock formed a surface along which highly concentrated PCBs liquids had travels below the surface layer.

The buildings S1, S2 and S3 were demolished. Parts of the floors of S1 and S3 were highly contaminated with PCBs and these were placed in steel vaults. The CEPA soil in the area around S3 was excavated, screened and the CEPA fine material transported to the PCB storage facility. Test pits were dug and trial excavations were carried out in the S1/S4 buildings area in order to find out more about the depth of contamination and difficulties with steep slope excavations in preparation for the work next year.

The PCB storage facilities at the island were reorganized. The existing PCB storage building was converted to a hazardous material storage facility for metal contaminated soils, batteries etc. A new beach PCB storage facility was established which comprised three specially constructed sea-cans for PCB containing electrical equipment, PCB contaminated oils etc and steel vaults containing other PCB contaminated materials. All PCB contaminated soils were placed in a new main PCB storage facility in the joined and lined maintenance buildings.

Delineation of contaminated areas was continued at the PLC dump, the DND helipad area and a complete delineation of the surface of the airstrip dump was conducted. PCB contamination at the airstrip dump was found at the Tier I and Tier II levels with an average value of ? 6.4 ppm. On the final day of work at the site two trial pits were dug in the dump. One produced a hole which filled with black liquid and a transformer was found in the other. The 48 vaults of soil belonging to DND were retested and confirmed to contain Tier I soils.

Other annual activities continued. These included the consolidation of barrel contents, the sampling and analysis the contents of barrels, the monitoring of barriers, and the testing drinking water and lake water. Air sampling was conducted to determine the level of PCBs and hydrocarbons in the air during various phases of the work.

I. OVERVIEW

A. General

This is the seventh year that the Analytical Services Unit (ASU) has conducted work at Resolution Island for Indian and Northern Affairs Canada (INAC). Over the period 1993-1996, environmental work at the site was detailed in a set of reports entitled "Environmental Study of a Military Installation at Resolution Island, BAF-5". These reports[1] fully described items such as site characteristics, history, and previous investigations. Scientific investigations have continued and have been reported annually[2]. From 1997 onwards, work at the site has been managed by the Qikiqtaaluk Corporation (QC) through a contribution agreement with INAC. This work started in 1997 with infrastructure improvements and expanded from 1998 onwards to include remediation activities and training. Map I-1 shows the location and general layout of the site at Resolution Island.

The work described in this report was conducted through a Contribution Agreement between Queen's University and INAC. This report details the tasks carried out by the ASU in 2000 and outlines the progress made in the Resolution Island remediation project.

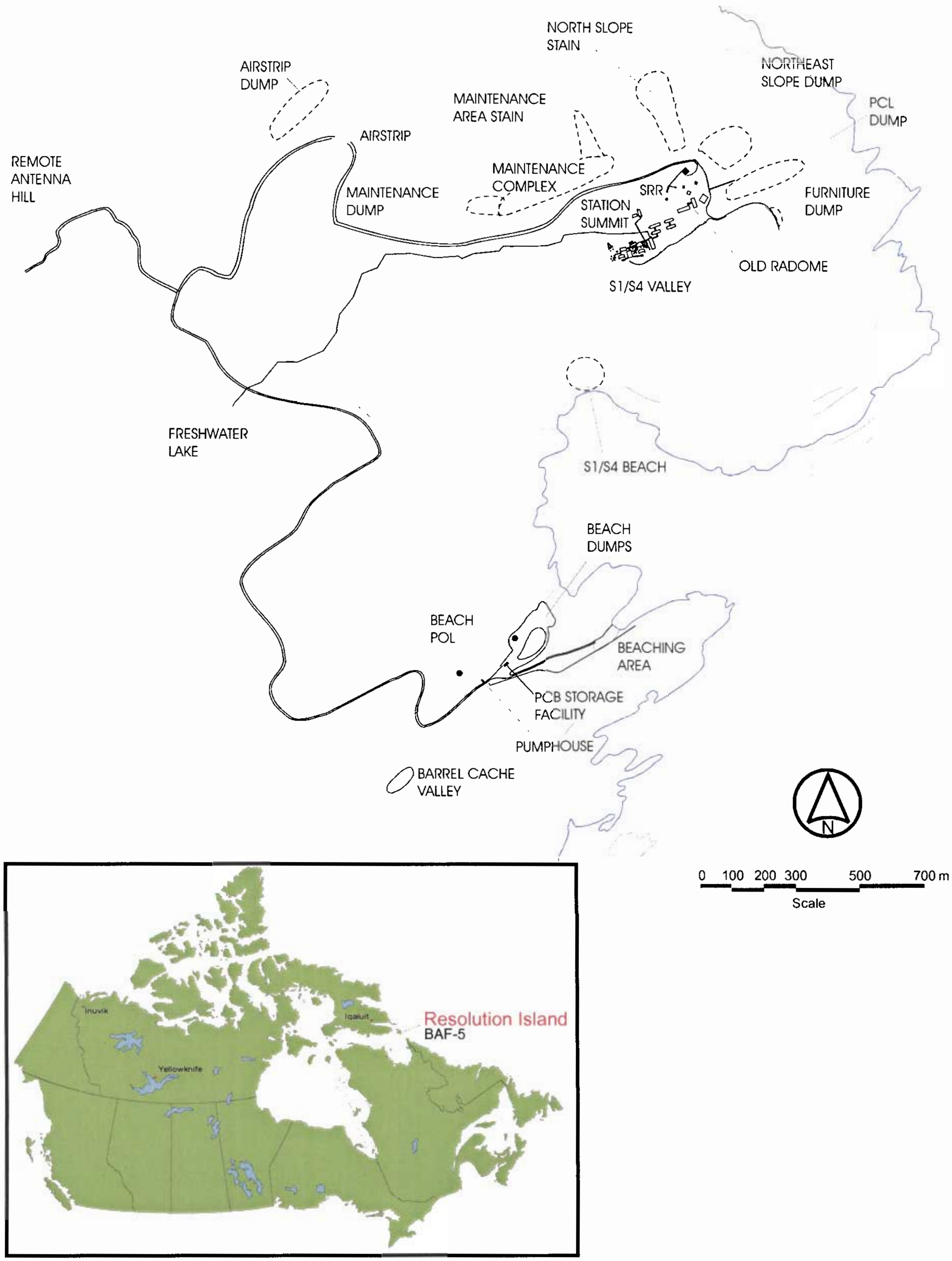
The on site activities this year were shortened due to funding difficulties in Ottawa. The team from Queen's University was on site from 14 July to 10 September 2000; a starting date of 20 June 2000 had been planned. On the positive side, this year saw the start of the excavation of PCB contaminated soils.

---

[1] Environmental Sciences Group (1994) Volume One, Analytical Services Unit (1995) Volume Two, Analytical Services Unit and Environmental Sciences Group (1996) Volume Three, and Analytical Services Unit (1997) Volume Four Environmental Study of a Military Installation at Resolution Island. BAF-5. Prepared for Indian and Northern Affairs Canada.

[2] Analytical Services Unit (1998), (1999) and (2000). Resolution Island 1997: Scientific Investigations and Analytical Services Unit, Resolution Island 1998: Scientific Investigations and Resolution Island 1999: Scientific Investigations. Prepared for Indian and Northern Affairs Canada.

Map I-1: Location and General Layout of the Site at Resolution Island



B. Site Activities

Most of the work conducted at Resolution Island this year was again managed by the Qikiqtaaluk Corporation (QC). QC managed the transportation to and from Iqaluit, provided meals and accommodation at the core camp and provided personnel and equipment to assist with our work.

The major accomplishments at the site for the year were:

- Excavation of the furniture dump and drainage pathway.
- Demolition of the buildings S1, S2 and S3.
- Excavation of PCB contaminated soil in the S1/S4 buildings area.
- Stockpiling of CEPA soil in the maintenance building.
- Construction of a road to a new gravel source.
- Reorganization of the PCB storage facility.
- Incineration of the contents of more barrels.
- Construction of a sewage line to replace the sewage lagoon adjacent to the camp.
- Establishment of a mobile laboratory on site.

C. Scientific Investigations

The activities conducted at the site this year by the ASU and described in Chapters II-V of this report are listed below. There were between two and four ASU personnel on site this summer including Jessica Patterson from Iqaluit. Jessica also spent three weeks in the ASU laboratories as part of the Resolution Island training program. Some of the equipment and supplies used by the ASU were flown to Iqaluit and transported into the site by helicopter or Twin Otter aircraft; the remainder, including the new Mobile Laboratory, were taken to Montreal and sent in by sea-lift.

1. Mobile Laboratory

Funding for a mobile laboratory was provided in 2000 by INAC.

The reason for wanting a laboratory on site came mainly from the fact that the weather in the previous two years had been so bad as to severely limit helicopter transportation to and from the island. In order to conduct an efficient soil remediation project the turn around time for samples to be analyzed by the laboratory needs to be about 1-3; bad weather at the site can limit flights up to 7-10 days because of fog. There are two methods currently used by the ASU to determine PCBs - the field test kit method and the gas chromatography (GC/ECD) technique. The Test Kit Method yields results in about 2 hours at a rate of about 10 results per hour while the GC/ECD Method yields results in about 1 day at a rate of about 12 per day. However the test kit method suffers from several problems. The results are generally good when differentiating CEPA soil from lower levels of contamination and when dealing with soils with low levels of oil and organic content. Thus it was suitable for the furniture dump excavation but not necessarily for the soils in the S1/S4 buildings and valley areas which contain high levels of oil in some places. For the S1/S4 beach area, it is known that the test kits do not work with the soil at this location and this is thought to be related to either high bacteriological activity or high organic and oil content; sewage from the site used to flow down the S1/S4 valley to this area.

Construction of the Mobile Laboratory (44 ft by 10 ft) was tendered to three companies and built by the successful bidder, AFA Structure Inc. (Montreal) for Associated Mobile Technologies (Amtec). The laboratory was delivered to Queen's University on 25 May 2000 where it was fitted out with equipment and modified in various ways. It was then shipped to Montreal on 29 June 2000 (Photograph I-1) and arrived on the sea lift at Resolution Island on 22 August 2000. The wheels were removed from the laboratory which was placed on wooden beams and secured to the ground by cables (Photograph I-2) attached to rock bolts and "dead men" (large steel pipes buried in the ground to which the cables were welded). The laboratory was positioned opposite the core camp and the sea-can containing additional ASU supplies was placed next to it (Photograph I-3).

The laboratory was constructed with three separate areas (Photograph I-4). The utilities area contains cold water storage, water pump, hot water tank and electrical panel. In order to operate the GC, gases are required. These gases are normally supplied by cylinders of helium, nitrogen, hydrogen and air. For the laboratory, these cylinders have been replaced by a separate hydrogen generator and an air and a nitrogen system that are jointly connected to an air compressor. Hydrogen is used in place of the helium.

The middle section of the laboratory contains benches, a sink, and an emergency shower and is used for activities relating to sampling. Sampling supplies and containers for soil, water, air and oils are stored in the area as well as equipment for the measurement of air quality, radioactivity, dust etc.

The final section of the laboratory is primarily devoted to the gas chromatograph and the associated equipment needed for the GC/ECD analysis for PCBs; the GC is also equipped with an FID detector for the identification of organic compounds. The analysis of soils by GC/ECD also requires a flask shaker unit, drying oven, rotary evaporator and sets of glassware. The rotary evaporator uses cold water supplied by a refrigerator unit and vacuum provided by a special apparatus. This section also houses a large fume hood since the analysis uses organic solvents - dichloromethane, hexane and acetone.

Photograph I-1: The Mobile Laboratory Leaving Queen's University

Photograph I-2: The Mobile Laboratory in Position at the Site; The Wheel Assembly was Removed and the Photograph Shows the Trailer Being Secured to the Ground.

Photograph I-3: The Mobile Laboratory and Sea-Can in September 2000

Photograph I-4: The Interior of the Mobile Laboratory Showing the Gas Chromatograph With Gas Controllers and the Fume Hood.

2. *On Site Activities*

The main tasks completed by the ASU this year are listed below:

- Testing and confirmation testing, and identification of PCB containing items at the Furniture dump.
- Confirmation testing, mapping and roping in the Furniture dump drainage area.
- Confirmation testing, mapping and roping at the S1/S4 Buildings and Valley area.
- Overseeing the removal of hazardous materials and floor removal during the demolition of buildings S1 and S3.
- Development of protocols for excavation and removal of contaminated soils
- PCB Storage facility – PCB containing materials (capacitors) were separated from electrical items removed from dumps and placed in CEPA barrels; overseeing the redistribution of materials in the storage facility to the new sea-cans and the maintenance buildings. An inventory all items was taken.
- Grid and delineate the top of the airstrip dump for PCBs
- Monitor, inspect and repair barriers
- Testing miscellaneous materials for PCBs, metals etc. e.g. used decontamination supplies and used matasorb from beach dump operations.
- Delineation, mapping and roping at the PCL Dump.
- Sampling the water in POL tanks and analysing them for discharge criteria
- Drinking water and lake water. Testing pH daily, and potability of drinking water three times during the summer and lake water once.
- Barrels – testing, sorting and labelling as required
- Training of one Inuit worker on site and for three weeks at the ASU laboratory at Queen's.
- Collecting air samples for PCBs when excavation was in progress to check for airborne contaminants. Dust levels were also monitored.
- Testing for PCB contamination near the DND helipad and in soil in the DND vaults at the beach; this work was financed, in part, by DND

3. *Other Activities*

The ASU provided scientific and engineering support at the site and assisted with the visit of delegates from the Nunavut Impact Review Board (NIRB) who visited the site on 22 August 2000 (Photograph I-5). The ASU also produced two posters showing the 1999 activities and one showing the on site work conducted in 2000. Dr. Allison Rutter attended a meeting on the remediation of chlorinated and recalcitrant compounds where she presented a poster entitled "PCB Pathways and Analysis in Novel Matrices in the Arctic" and Dr. John Poland participated in a conference on contaminants in freezing ground where he discussed various aspects of the cleanup activities conducted by INAC over the last five years. Dr. Poland also attended planning meetings in Victoria and Yellowknife, assisted in the production of the Environmental Impact Statement produced by INAC for NIRB and in the hearings held in Iqaluit.

Photograph I-5: Members of the Nunavut Impact Review Board Visiting Resolution Island in August 2000.

II. PCB REMEDIATION

A. General

Much of the work conducted at Resolution Island this year involved the excavation of PCB contaminated soils. Some excavation of the furniture dump was started last year with the removal of 14 transformers from the center of the dump. This year the entire dump was removed together with contaminated soils from its drainage pathway. This work is detailed in Section C. Three buildings, S1, S2 and S3 were demolished this year and a start was made on removing the contaminated soils from beneath and around these buildings. This work is discussed in Section D. Section B describes the methodology for this work. The sampling and analytical sections also include the methodologies used in the work described in Chapters III and V.

B. Methodology

1. Building Demolition

Buildings were demolished with heavy equipment using normal procedures. Access to the buildings was generally achieved by clearing away contaminated soil to allow access without contaminating the equipment or by placing timbers so as to keep the equipment from contacting contaminated ground. Equipment tracks which became contaminated by direct contact with PCBs in the soils were decontaminated following the work. A more detailed discussion concerning the demolition of buildings is given in section D.

2. Excavation

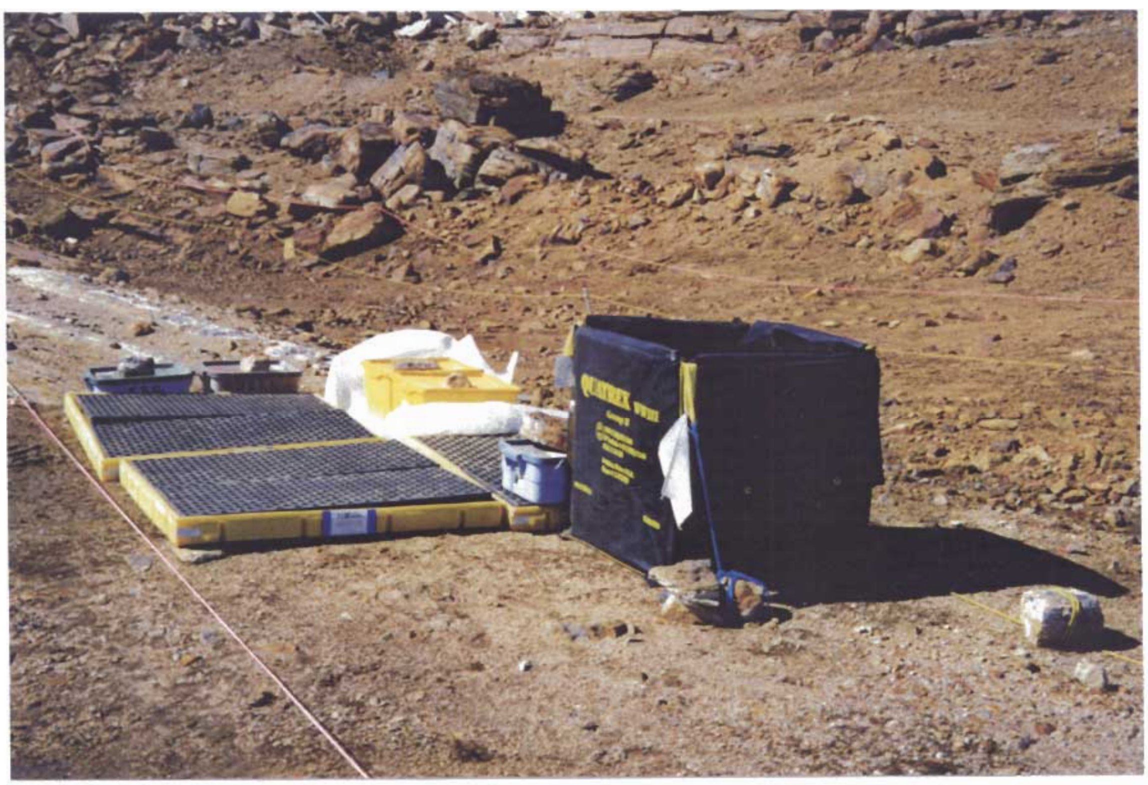
The following is the general methodology that was used to excavate CEPA soils. Ropes of various colours were placed on the ground to indicate the extent of PCB contamination at the >2000 ppm (green), CEPA (yellow), Tier II (blue) and Tier I (pink) levels. Soil containing >2000 ppm were excavated and placed directly into steel containers. Other CEPA soils were excavated and taken to the screening plant. Material not passing through the screener was classified as Tier II and stockpiled. The CEPA material passing through the 2 inch screen was classified as CEPA soil and taken to the main PCB storage facility. After excavating to the depth indicated from the sampling/analysis work, the soil in the area was tested to ascertain if its concentration was now below the CEPA criterion. If not, further excavation was carried out. The soils were dug up with an excavator equipped with a bucket or clam. In many cases bedrock was reached and so confirmation testing was not required. However, the bedrock needed to be further cleared of PCB-contaminated soils which could not be excavated with heavy machinery and this was achieved by shoveling by hand and by using a vacuum truck. This work was slow and arduous. If the slope and shape of the bedrock permitted, the remaining soil was washed down with water from the water truck and this water and associated soil were more readily removed with the vacuum truck.

The two old International trucks were used to transport the CEPA soils. The trucks stayed in the clean area and the screened CEPA soils were loaded on to them carefully so as not to contaminate the outer parts of the truck. The wheels of the truck did not contact the soil in the storage facility because they only drove to the edge of the soil pile each time; a piece of geotextile fabric was used to cover part of the soil pile in order that truckloads of soil could be added further into the facility. The soil within the facility was piled higher initially with a large loader and later with a Bobcat.

Decontamination of equipment was carried out with brushes and scrapers. Removed soil was collected on sheets of geotextile fabric. Inside the main PCB storage building an air compressor was successfully employed to complete the work. At outside locations, water was used and this was then picked up with the vacuum truck. CEPA material, both water and soil were emptied from the vacuum truck on to a highly contaminated area that was due to be excavated.

Decontamination centers were set up for personnel at all locations where CEPA soil was being dealt with. The large decontamination trailer was used at the S1/S4 area but smaller units comprised of containers of wash water and supplies of personal protective equipment were used elsewhere. The personal protective equipment used is given in the Health and Safety Plan and was described fully in the 1999 ASU report. Tyvec suits, gloves and rubber boots were always worn in contaminated areas. In general half-faced respirators were used whenever the odour of askarel (PCB mixture) was encountered; dust masks were worn whenever it was dusty. This is further discussed in Chapter III, section E.

Photograph II-1: Decontaminating the Wheels of a loader in the Main PCB Storage Facility



Photograph II-2: Decontamination Unit for Personnel in the Furniture Dump Drainage Pathway