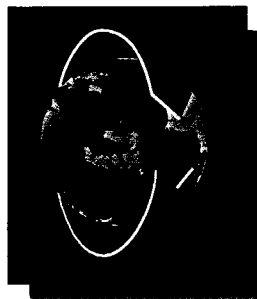


An Environmental Assessment of Snag Airstrip Yukon Territory

Prepared by

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EXECUTIVE SUMMARY

The scientific investigation of Snag Airstrip was carried out by the Environmental Sciences Group on June 13, 1994 (initial reconnaissance) and from June 28 to July 6, 1995 (detailed site investigation). The environmental assessment of the site addressed visible debris and physical structures, the dump, and contaminated soil. An emphasis has been placed on the evaluation of the potential for chemical contaminants to enter the food chain.

The assessment and the cleanup recommendations proposed for the airstrip are based on requirements as outlined in federal regulations (in particular the Canadian Environmental Protection Act) and on remediation objectives as outlined by the Canadian Council of Ministers of the Environment.

A total of 237 soil samples were collected at Snag Airstrip and form the basis of the assessment of the site. These can be divided into assessment soil samples (137) which were collected in previously uninvestigated areas and delineation soil samples (100) which were collected in areas previously investigated and found to contain contaminants at levels exceeding the applicable criteria. Thirty-four plant samples were collected to assess whether contaminants detected in the soil samples were migrating into the food chain. The sampling program was rounded out with the collection of water, barrel, paint chip, wall swab, building material and oil filter samples.

Soil samples were screened for polychlorinated biphenyls (PCBs), inorganic elements, polycyclic aromatic hydrocarbons (PAHs), pesticides, and dioxins. Plant, water and paint chip samples were analyzed for inorganic elements and PCBs. Wall swabs were analyzed for PCBs only, and the barrel samples and the oil filter were analyzed for PCBs, total chlorine and the inorganic elements lead, chromium and cadmium. The asbestos content of building materials was also determined.

High level PCB contamination at the powerhouse and pump house was delineated using field test kits. High level inorganic element contamination at the tower building and

warehouse was delineated using an x-ray fluorescence field test kit. Field test kit results were confirmed by standard laboratory methods.

Forty percent of assessment soil samples collected at Snag Airstrip contained at least one analyte at a concentration exceeding the applicable criteria. Zinc and lead were the most common contaminants detected in these samples. PCBs were also prevalent in soil samples collected at Snag Airstrip; 25 percent of assessment samples contained PCBs in excess of the CCME criterion. PCBs were also found to be present in soils in five locations at concentrations in excess of the level (50 ppm) regulated under the *Storage of PCB Material Regulations* arising from the Canadian Environmental Protection Act.

Seventy percent of delineation soil samples analyzed contained PCBs in excess of the CCME criterion; 52 percent of these violated the CEPA regulation. Sixty-nine percent of delineation soil samples analyzed for inorganic elements contained at least one element in excess of the CCME R/P Remediation Criteria. Lead was detected in 87 percent of these samples and was the most prevalent contaminant exceeding the criteria. Lead was also found to be significantly leachable in two areas of the site.

At least one inorganic element or PCBs in excess of the Impact Criteria were detected in 76 percent of plant samples. Contaminant levels in plants reflected the trends observed in the assessment soil samples. PCBs were also highly elevated compared to background levels in plant samples collected in the vicinity of Snag Airstrip.

The screen conducted for pesticides suggested that these compounds were widely used at Snag Airstrip. Soils in which high concentrations of pesticides were found also contained high levels of PCBs and inorganic elements. The three samples that contained dioxins in excess of the CCME R/P Remediation Criterion also contained PCBs in violation of CEPA and will therefore be removed. PAHs were detected in only one sample collected, and this sample was also from a CEPA contaminated area.

The total volume of soil containing PCBs in excess of the level regulated by

CEPA is approximately 34 m³. Approximately 15 m³ of soil at the site was categorized as hazardous waste based on Ontario Ministry of the Environment Leachate Quality Standards. A total of 282 m³ of soil was estimated to contain metals above the CCME Residential/Parkland Remediation Criteria.

The cleanup of PCB-contaminated soils at Snag Airstrip requires the most immediate action. Other contaminants, including lead-contaminated leachate toxic soils should be addressed without delay. The proposed cleanup plan, contained in this report, will restore the site to an environmentally safe condition - one in which contaminants in soil do not pose a threat to living organisms, including humans.

Funding for this study was provided by the *Arctic Environmental Strategy - Action on Waste* administered by Indian and Northern Affairs Canada.

Environmental Summary

Area	Contaminants Exceeding the Applicable Criteria ^a	Criteria/Regulation Exceeded	Total Volume of Soil Affected (m ³)
Tower Building	Pb, Zn, Cu, Cd, PCBs, Pesticides	CCME R/P	65
DOT Barracks Building	PCBs, PCDDs/PCDFs, Zn, Pb, Cu, Ni	CEPA CCME R/P	10 40
Warehouse	Pb, Cu, Zn, Cr, PCBs	LQS ^b CCME R/P	15 55
Powerhouse & Pump House	PCBs, Zn, Pb, Cu, Cd, Ni, Cr	CEPA CCME R/P	20 47
Fire Hall	Zn	CCME R/P	4.5
Garage	PCBs, PCDDs/PCDFs, Pesticides, PAHs, Zn, Pb, Cu, Ni, Cd, Cr	CEPA CCME R/P	4 40
Dump	-	-	-
Septic Field	Cu, Zn, Pesticides	CCME R/P	Manholes to be backfilled
General Site Proximity	Zn	CCME R/P	10
Beacon Site	Zn, Cu, As, Ni	CCME R/P	31

a. Listed in order of degree

b. Leachate Quality Standards

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GLOSSARY AND LIST OF ABBREVIATIONS

Various abbreviations and terms are used throughout the report. These include;

AES	=	Arctic Environmental Strategy
anthropogenic	=	derived directly or indirectly from human activity
As	=	Arsenic
ASU	=	Analytical Services Unit (Queens University, Kingston, Ont.)
BCMOE	=	British Columbia Ministry of Environment
Be	=	Beryllium
CCME	=	Canadian Council of Ministers of the Environment
Cd	=	Cadmium
CEPA	=	Canadian Environmental Protection Act
Co	=	Cobalt
Cr	=	Chromium
Cu	=	Copper
DCC	=	DEW Line Cleanup Criteria
DDT	=	Dichlorodiphenyltrichloroethane
DEW	=	Distant Early Warning
DIAND	=	Indian and Northern Affairs Canada
DND	=	Department of National Defence
DOT	=	Department of Transport
EC	=	Environment Canada
EPA	=	Environmental Protection Agency (US)
ESG	=	Environmental Sciences Group
FAL	=	Freshwater Aquatic Life
flora	=	vegetation
GC	=	Gas Chromatography
GC/ECD	=	Gas Chromatography/Electron Capture Detection
GC/MS	=	Gas Chromatography/Mass Spectroscopy
GNWT	=	Government of the Northwest Territories
Hazmat	=	Hazardous Material
HCB	=	Hexachlorobenzene
HCH	=	Hexachlorocyclohexane
Hazmat	=	Hazardous Material
HCB	=	Hexachlorobenzene

GLOSSARY AND LIST OF ABBREVIATIONS cont'd

HCH	=	Hexachlorocyclohexane
High res	=	High resolution (usually in association with mass spectrometry)
Hg	=	Mercury
HRGC	=	High Resolution Gas Chromatography
HRMS	=	High Resolution Mass Spectrometry
HS-1	=	NRC Marine Reference Standard
leachate	=	substances (usually in solution) migrating from a more concentrated source.
LQS	=	Leachate Quality Standards
MENVIQ	=	Ministère de l'Environnement du Québec
Mn	=	Manganese
Mo	=	Molybdenum
NA	=	Not analyzed due to a coeluting interference
NCSCS	=	National Contaminated Sites Classification System
NBS	=	National Bureau of Standards (US)
NCSRP	=	National Contaminated Sites Remediation Program
NDR	=	Not reliably detected
Ni	=	Nickel
NIST	=	National Institute of Standards and Technology
NM	=	Not Measured
NWSR	=	Northwest Staging Route
NRC	=	National Research Council
NWT	=	Northwest Territories
permafrost	=	ground remaining frozen through two or more consecutive winters and intervening summer.
PAH	=	Polycyclic Aromatic Hydrocarbon
Pb	=	Lead
PCB	=	Polychlorinated Biphenyl
PCDDs		Polychlorinated dibenzodioxins
PCDFs		Polychlorinated dibenzofurans
POL	=	Petroleum, Oil, Lubricants
ppb	=	parts per billion; ng/g that is, nanograms of substance per gram of soil or sediment sample; µg/L that is, micrograms of substance per litre of aqueous solution.

GLOSSARY AND LIST OF ABBREVIATIONS cont'd

ppm	=	parts per million; $\mu\text{g/g}$ that is, microgram of substance per gram of soil or sediment sample.
ppt	=	parts per trillion; ng/L in aqueous solutions.
PCDDs		Polychlorinated dibenzodioxins
PCDFs		Polychlorinated dibenzofurans
POL	=	Petroleum, Oil, Lubricants
ppb	=	parts per billion; ng/g that is, nanograms of substance per gram of soil or sediment sample; $\mu\text{g/L}$ that is, micrograms of substance per litre of aqueous solution.
ppm	=	parts per million; $\mu\text{g/g}$ that is, microgram of substance per gram of soil or sediment sample.
ppt	=	parts per trillion; ng/L in aqueous solutions.
R/P	=	Residential/Parkland
Se	=	Selenium
TEL	=	Threshold Effect Level
TPH	=	Total Petroleum Hydrocarbons
UMA	=	UMA Engineering Ltd.
USAF	=	United States Air Force
US EPA	=	United States Environmental Protection Act
Zn	=	Zinc

I. INTRODUCTION

Snag Airstrip is an abandoned site which is 30 km by road southeast of the community of Beaver Creek in Yukon Territory (62° 20' N, 140° 29' W, Map I-1). The airstrip was constructed in 1942 as part of the Northwest Staging Route, a series of airstrips forming a flight corridor from Edmonton to Fairbanks. The site consisted of several buildings and a single landing strip. In addition, there was an intermediate range beacon site on the highest point in the vicinity, approximately 7 km northeast of the airstrip. Between 1942 and 1945 the airstrip was administered by the Royal Canadian Air Force. The Department of Transport was given use of the site during this period, and formally took over its administration in 1957. In 1966 Snag Airstrip, along with other airstrips still in operation, was handed over to the territorial government. The property came under the management of Indian and Northern Affairs Canada (DIAND) in 1971, and under DIAND's *Arctic Environmental Strategy* (AES) Action on Waste program, environmental assessments of facilities associated with the Northwest Staging Route were initiated in 1994.

A. Assessment Objectives

The objective of the work described in this report was to determine the environmental status of Snag Airstrip, and to provide recommendations for its cleanup.

The specific objectives of the study were to:

- ascertain the current physical status of the airstrip and associated facilities;
- assess the extent of chemical contamination;
- evaluate the potential for chemical contaminants to enter the food chain; and
- propose realistic and practical cleanup plans for the site.

Field sampling was conducted by the Environmental Sciences Group (ESG) on June 13th, 1994 (preliminary reconnaissance) and from June 28 to July 6, 1995 (detailed site investigation).

B. Related Environmental Studies Conducted by the ESG

The development of cleanup recommendations requires the application of realistic, and appropriate, environmental standards. This is especially important when dealing with chemical contamination. The Arctic and sub-Arctic ecosystems are unique and the simple adoption of standards used in southern Canada may not provide the necessary degree of environmental protection. Fortunately, related environmental studies conducted in the North have provided a large database on which decisions can be based. Much of the work conducted at Snag Airstrip was directly influenced by the knowledge gained in earlier work on the Distant Early Warning (DEW) Line and other northern military facilities (ESG 1991, 1992, 1993a, 1993b, 1993c, 1995a, 1995b).

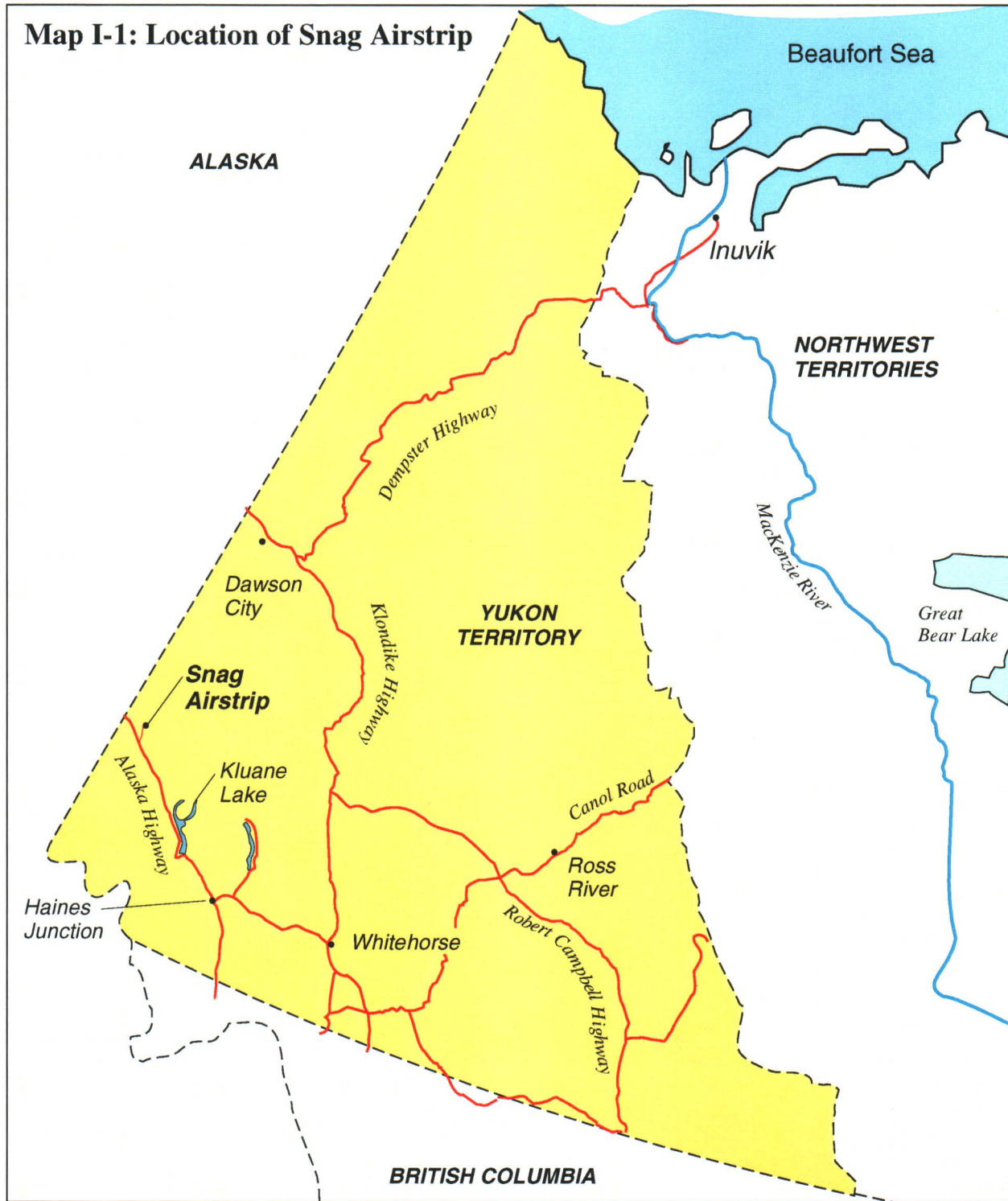
Numerous other installations were created in the North as a consequence of military activities during the Second World War and the ensuing Cold War period. In Canada, 42 DEW Line sites were built in the 1950s, half of which were subsequently abandoned due to advances in technology. The closed facilities were transferred to the jurisdiction of DIAND. Those which continued to operate were eventually modernized and transferred between 1989 to 1993 from the United States Air Force to the Canadian Department of National Defense (DND).

Beginning in 1989, DND sponsored a series of scientific studies to assess the environmental problems at the DEW Line sites and to develop a practical restoration strategy aimed at protecting the Arctic. This work was conducted by the ESG previously at Royal Roads Military College, and now at the Royal Military College of Canada. After a two year investigation which involved the assessments of representative sites, the ESG proposed a general approach, or protocol, for remediating the DEW Line sites. The results were reviewed by representatives of Indian and Northern Affairs, Environment Canada, Government of the Northwest Territories, and the Department of Fisheries and Oceans, and in October 1991 the DEW Line Cleanup Protocol was adopted. This protocol formed the basis for the assessment of the remaining sites and was used as the foundation for an engineering design, completed in 1994 by a consortium of engineering firms led by UMA Engineering Ltd., to implement the cleanup of all 21 of the DND sites.

In order to meet the Arctic Environmental Strategy's objective of eliminating unsafe, hazardous and unsightly waste at abandoned military bases, DIAND, with the assistance of the National Contaminated Sites Remediation Program, asked the ESG to apply the DEW Line Cleanup Protocol to the assessment of the abandoned DEW Line sites, to other former military installations located at Iqaluit, Resolution Island and to the Canol Pipeline. The scientific information resulting from these studies now represents one of the largest data bases in the world on contaminant cycling from local sources in the Arctic.

The DEW Line Cleanup Protocol, and the specific results from the scientific and engineering studies, have been regularly reviewed by government agencies and elected officials of the Northwest Territories Legislative Assembly, as well as by residents of northern communities. Elements of the protocol were used in the cleanup of the Intermediate site at Horton River in 1993 (ESG & ASU 1994), the 1995 cleanup of the Pole Vault Station at Iqaluit (ASU 1996), for work at Resolution Island in 1994 (ASU & ESG 1995) and 1995 (ASU 1996) and for the 1995 cleanup of Aishihik Airstrip in Yukon Territory (ESG 1996).

Map I-1: Location of Snag Airstrip



II. BACKGROUND

A. Location and General Description of Snag Airstrip

Snag Airstrip is located in Yukon Territory about 400 km northwest of Whitehorse and 29 km east of the Alaska border at mile 16.2 (km 26.1) along Snag Road which travels north from the Alaska Highway (62° 20' N, 140° 29' W, see Map I-1). Snag Village 4 km to the north was the closest settlement to the site. The village, consisting of a Catholic church, several permanent and some temporary dwellings, was likely abandoned in the 1950s. Currently the village site is used as a summer camping area by the local First Nations Band. Other temporary dwellings near the airstrip include a number of trappers' log cabins and a trailer formerly occupied by a trapper.

During its peak period of operation as part of the Northwest Staging Route, Snag Airstrip consisted of twelve buildings including the airstrip tower building, two barracks buildings, three log cabins making up the married quarters, a warehouse, powerhouse, pump house, fire hall, garage and a small storage shack (Map II-1). The remains of nine buildings can still be found at the main site. The areas occupied by one of the barracks buildings (that which housed members of the RCAF) and two of the married quarters have been worked extensively. The tower building is only partially intact following an attempt to remove it in 1995; the fire hall and one of the married quarters are the only two buildings still intact. The other buildings are evidenced by their foundations only, or, as in the case of the tower building and storage shack, by their collapsed remains. In addition to the buildings there is an intricate system of underground pipes which constituted water and sewage transport systems; these can be accessed via numerous manholes. Staining in the vicinity of the buildings is limited primarily to the area on and surrounding the powerhouse foundations. There is evidence of a septic field to the north of the site where the three log cabins stood. Areas of lower density vegetation west of the garage mark the previous locations of a set of six fuel storage tanks. The airstrip, located east of the main area of the site, is becoming overgrown with poplar shrubs and is no longer suitable for use by fixed-wing aircraft, although helicopter landings are still possible.

Some debris was found in the main area of the site, but material from the demolition of the buildings and the removal of the fuel tanks was not apparent. There is a dump on the side of a medium grade slope approximately 1 km southwest of the main area of the site, at the end of a short access road that runs southwest of the main road. In the spring of 1995, as part of the Action on Waste Program administered by

DIAND, most of the visible debris was removed from the dump and the area was covered with clean fill. Debris still visible in the area at the time of the ESG visit consisted of two vehicles at the top of the slope, some vehicle tires at the base of the slope and a small amount of domestic debris scattered about the area. Erosion of the face of the dump by runoff was not apparent.

In addition to the area in the immediate vicinity of the airstrip, there is a beacon site northeast of the main site consisting of a single building and antenna towers. The road to the beacon site is now impassable, but the remains of the road ascending the hill to the site, the charred remains of the building, a single downed telegraph/electrical pole and the dismantled wooden antenna towers identify the location.

B. History of Snag Airstrip

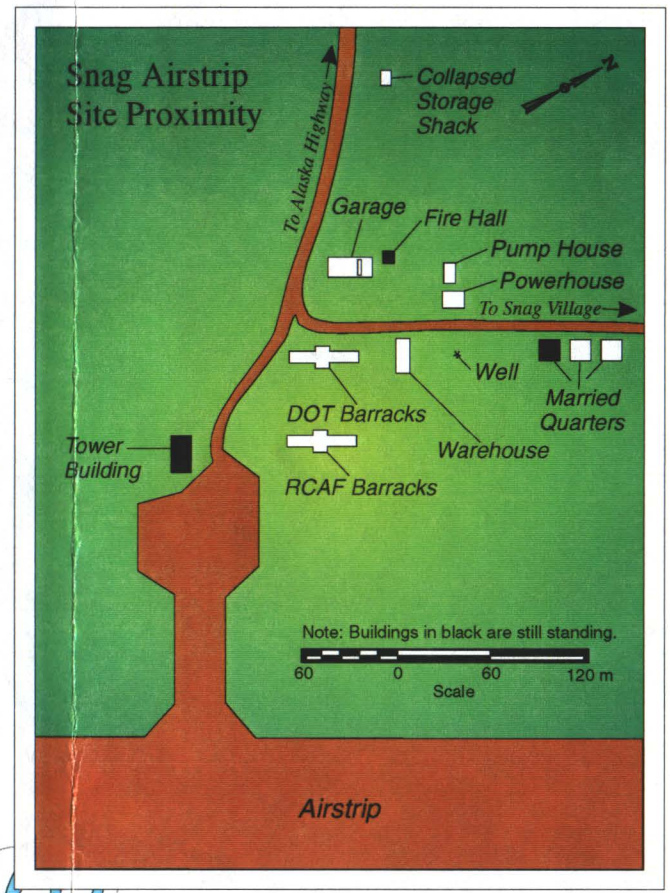
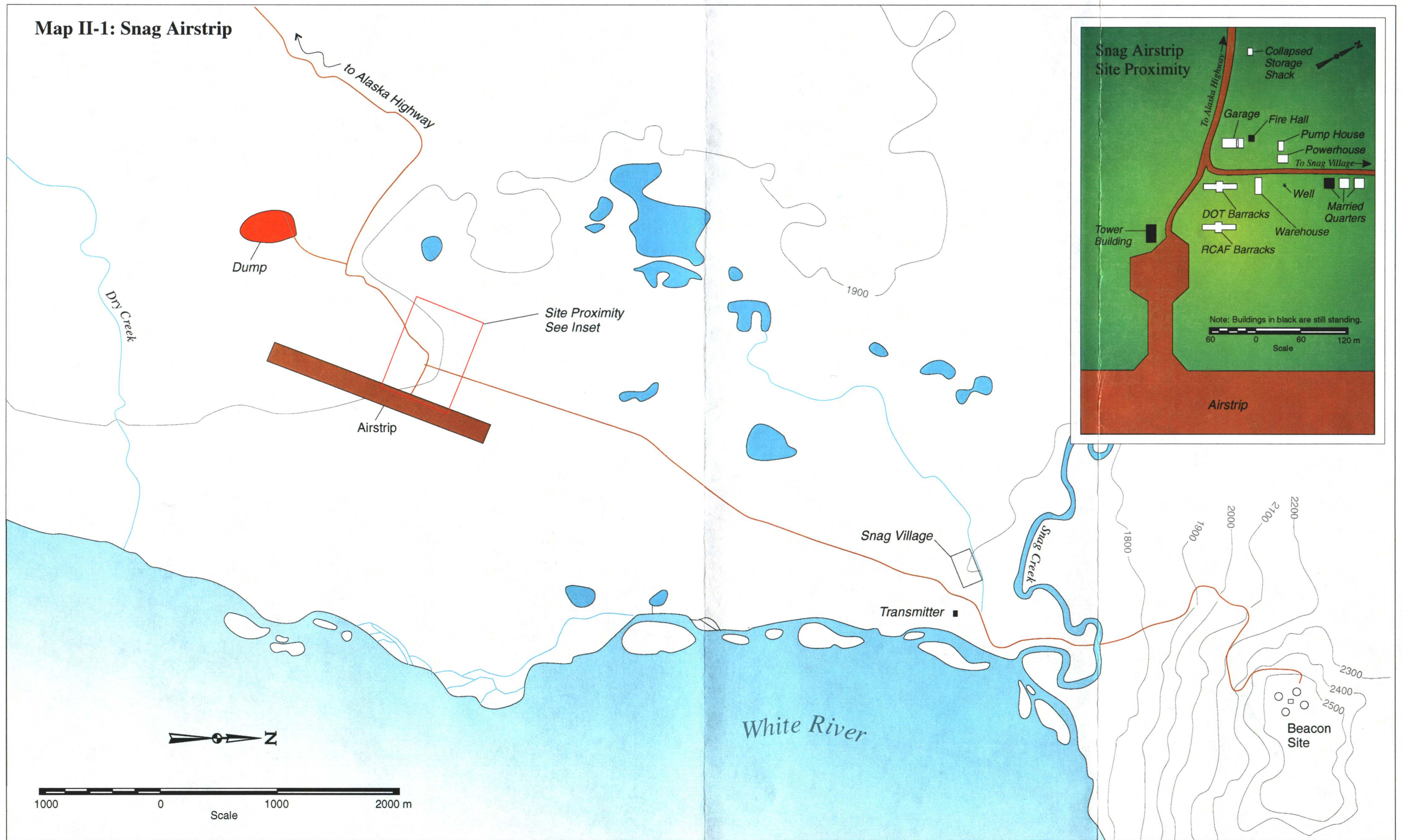
Snag Airstrip derives its name from nearby Snag Creek, a tributary of the White River (Map II-1). Two members of the United States Geological Survey, A.H. Brooks and W.J. Peters, named Snag Creek in 1899. Apparently the epithet "snag" accurately described the difficulties they encountered while attempting to travel along the creek (Coutts 1980, p 245).

The whole stream was called Snag Creek until 1902, when the upper part nearest the Alaska-Yukon border was renamed Beaver Creek. The area was heavily prospected between 1909 and 1914, and the creek itself was used as a supply route and a winter trail between the Chisma diggings and the steamboat landing on the White River (Coutts 1980, p 18). It was around this time that the present site of Snag Village was developed.

The decision to build an airstrip at Snag was a direct result of joint American and Canadian efforts to establish a viable air traffic corridor between Edmonton and Alaska during the Second World War. This series of airstrips would come to be known as the Northwest Staging Route (NWSR).

Before 7 December 1941 joint American and Canadian defensive operations were concentrated on the east coast, but with the bombing of Pearl Harbor, there was a rapid reorientation of Canadian defense planning (Dziuban 1954, p 425) resulting in the posting of large numbers of American troops to defensive garrisons in Alaska. Construction of the Alaska Highway and the CANOL pipeline, two of the largest projects ever undertaken in northern Canada, were initiated in conjunction with this effort. With the sudden, intense concentration of activities in the North, there was an urgent need for improved air transportation to service the region.

Map II-1: Snag Airstrip



The necessity for an improved route for military traffic was graphically illustrated by early attempts to send aircraft to the defence of the Alaskan coast. In early January 1942, two squadrons were dispatched to Alaska. A month later only 21 of the 38 aircraft had arrived; the remainder had crashed along the way (Dziuban 1954, p 433). Official reports blamed "...the inexperience of the pilots, together with poor communications and inadequate landing fields along the routes..." (Brebner 1985, p 51).

Strengthening and supplementing the existing air routes became one of the first priorities of the construction crews arriving in the Yukon and Alaska, and construction began in the winter of 1940-41. In 1942 several new fields, including Snag and Aishihik, as well as a number of emergency strips were added to the corridor (Coates and Morrison 1992, p 41).

Snag airstrip was designated an intermediate airstrip, rather than a main airstrip like that of Fairbanks or Whitehorse. Snag Airstrip was constructed during a period of extreme tension between Canadian and American authorities over the development of the NWSR. The Americans, speculating that there would be a large increase in air traffic along the corridor, were pushing for major additions and improvements to the existing facilities, which they felt were not progressing quickly enough. The Canadian government wanted to ensure that new facilities would be of lasting benefit, and would remain under Canadian authority, so they appeared to be dragging their heels. There was also pressure from Canadian construction workers' unions not to lose jobs to the (arguably) more efficient American Army Corps of Engineers.

As a result of repeated negotiations, American troops took over completion of improvements to major airstrips along the route, while Canadian construction crews serving under the direction of the Canadian Department of Transportation and the RCAF, performed the initial work on the new and existing facilities (Coates and Morrison 1992, p 42).

One notable effect of the work was that some of the most isolated aboriginal populations in Canada were abruptly placed in direct contact with American and Canadian construction work forces. In places like Fort Nelson, Ross River, Burwash, Snag and Aishihik, the native communities grew overnight into communities with sizable non-native populations (Coates and Morrison 1992, p 74).

Construction first began on Detachment Snag with the arrival of the "cats", primarily hauling supplies. These bulldozers followed part of the trail that had been blazed by the sourdoughs of 1913. The first cat to reach Snag was flown unassembled to a small unnamed lake about three miles north of the site. There it was reassembled, driven to the site location, and work on the runway began. When a suitable area was cleared, steel for the landing towers was flown in by Dakota aircraft. Reportedly some of the equipment was so large that pilots often had to leave the doors of the aircraft open during flight with part of the cargo sticking out (French 1957, p 10).

Control of the NWSR had been nominally handed over to the Royal Canadian Air Force (RCAF) in September 1942 (French 1957, p 13). Most of the aircraft that flew over the route were American, primarily destined for lend/lease to the Soviet Union (Dziuban, 1954, p 455). The route was also used by the many American personnel providing vital services at bases along the route.

In June 1944 American expenditures associated with the NWSR and the CANOL MacKenzie flight strips totaled some \$53,345,580. On assuming control, the Canadian government paid them \$45,180,241. A more accurate assessment of Canadian investment in the air routes includes an additional \$23,520,953 for Canadian financed development work undertaken during the construction at the request of the United States (Carr, 1949, p 232).

The end of the war in Europe in May 1945 called for a major regrouping of military personnel. By October Canada had officially notified American authorities that they would assume all responsibilities along the NWSR at any time the United States wished to relinquish them (Carr, 1949, p 228). It was not until 1955, when the importance and the usefulness of the NWSR had begun to decline that most of the airstrips, including Snag, were handed over to the Canadian Department of Transport (French, 1957, p 4; Hans-Bastedo, 1986, p 20).

After the war, Snag was manned by one RCAF officer, five airmen, and approximately nine civilian employees of the RCAF, as well as seven members of the Department of Transport. Their job was to maintain the airstrip and the Department of Transport radio and weather station (the beacon site).

No history of Snag would be complete without mention of the fact that on the third of February 1947, the temperature was recorded at -81 degrees F, the coldest in

North American history. People there reported that the air was so cold that sounds from Snag Village penetrated three miles of dense forest to be heard plainly at the airstrip. They said that the freezing of human breath produced a continuous hissing sound, and that as people moved around they left vapor trails of breath that lasted three to four minutes and were 100 to 500 yards long (Spencer, 1947, p1).

Around 1955, a small settlement started at mile 1196 (km 1914) where Beaver Creek crossed the Alaska Highway. The settlement had a post office by 1958, and later Canada Customs and other organizations expanded the community. Anecdotal evidence indicates that several of the buildings now used in the community as dwellings were once the married quarters at Snag. Apparently they were cut from their foundations and hauled to Beaver Creek after Snag was abandoned.

Today Snag Airstrip is abandoned. Most of the buildings have been removed as part of a salvage operation. Nearby Snag Village is being used as a cultural camp during the summer by the local First Nations population. Traffic to Snag Village must pass through the airstrip site, and there is some evidence that hunters and trappers intermittently use some of the outlying buildings in the area.

C. Cleanup Criteria

1. Introduction

An investigation has been carried out at the facilities associated with Snag Airstrip. The environmental assessment of this site addresses visible debris, dumps, and contaminated soil; cleanup should ensure that contaminants in soil, sediment, water and vegetation do not pose a threat to living organisms (including humans) in the future. **This section describes the approach used by the Environmental Sciences Group in the establishment of cleanup strategies.**

2. How is Environmental Impact Assessed?

While it is generally agreed that the effect of contaminants on the environment must be minimized, defining the level at which contamination risks to the environment become acceptable is a subject of some contention. The question of "how clean is clean?" or "what constitutes an acceptable level?" is a complex one. Two approaches are used to evaluate environmental quality - absolute and relative.

An "absolute", or criteria-based, method defines numerical values or limits that can be compared with measured environmental contaminant concentrations. It establishes baseline concentrations for various substances below which the impact on the environment is negligible. When environmental samples contain concentrations above this limit, there is a need for further investigation and/or remediation of the sampling area, depending on the amount by which the baseline value is exceeded. This approach has certain advantages: it is relatively easy to use and administer, it provides a common base for communication between interested parties, and it minimizes confusion. The approach suffers, however, from the *assumption* that the concentration limits apply equally in all circumstances.

The "relative" strategy of environmental monitoring also begins with the determination of the concentration of a contaminant in field samples. The focus, however, is not on the comparison of this result with a baseline criterion, but on an assessment of the potential for the movement of the contaminant from the substrate in which it is contained, to humans or other parts of the environment. In order to make this assessment it is necessary to examine the pathways for this migration in a *site-specific* context and to gauge the resulting impact. Not surprisingly, the same concentration of a contaminant can display very different effects under different circumstances. The US Environmental Protection Agency uses this approach for the Superfund program (*Superfund Risk Assessment Guide* US EPA 1989); mathematical models are used to estimate exposures/dose and the results are then combined with toxicological information to obtain site-specific risk. This methodology has some inherent difficulties such as applying the procedures correctly, having all the toxicological information and defining acceptable risk levels.

A bridging of the two methods can be achieved by modifying absolute - or criteria-based - assessments by taking into account factors at the contaminated site which affect the fate of the contaminant. This approach has been used in the environmental assessment of Snag Airstrip.

3. Criteria

Samples obtained from Snag Airstrip underwent a broad screen for contaminants, which included inorganic elements¹, polychlorinated biphenyls, polychlorodibenzodioxins and polychlorodibenzofurans, pesticides and polycyclic aromatic hydrocarbons (PAHs). Where applicable the Canadian Council of Ministers of the Environment's Interim Canadian Environmental Quality Criteria for Contaminated Sites (CCME 1991a) were applied to the results of these analyses. These criteria consist of three tiers, Agricultural (AG), Residential/Parkland (R/P) and Commercial/Industrial (C/I), which address land use objectives for a site under consideration. Based on the rationale outlined in the CCME report "Review and Recommendations for Canadian Interim Environmental Quality Criteria for Contaminated Sites" (CCME 1991b) the Residential/Parkland criteria were applied in the assessment of Snag Airstrip. This is consistent with the intensity of area-use by local First Nations people and the absence of any commercial agricultural activity in the area.

In those instances where the CCME criteria did not treat a particular contaminant or types of contaminants, the most stringent provincial/territorial criteria available were applied. In the absence of provincial or territorial criteria, the contaminant concentrations were compared to foreign criteria included in the CCME document *Review and Recommendations for Canadian Interim Environmental Quality Criteria for Contaminated Sites* (CCME 1991b).

All criteria are outlined in tables at the end of this chapter, and the various criteria are discussed in more detail in the following sections.

i. Background Criteria

In conducting environmental studies, it is important to take into account prevailing, or background, conditions. The Canadian Council of Ministers of the Environment (CCME) Interim Canadian Environmental Quality Criteria include "Assessment Criteria". Assessment criteria are either approximate background concentrations or approximate analytical detection limits which provide a starting point

¹ Included were copper, nickel, cobalt, cadmium, lead, zinc, chromium, arsenic and mercury.

for examining data. In this study, efforts were made to obtain samples from locations that were removed from any direct influence by the site, and that were representative of the local geomorphology. Data from these samples were compared to the CCME Assessment Criteria (Annex A, Table A-1). Results obtained from soil samples collected in the proximity of Snag Airstrip were interpreted, in part, in the context of the concentrations observed in background material.

ii. Canadian Council of Ministers of the Environment Criteria

Concentrations of inorganic elements and PCBs in soil were compared to the CCME Residential/Parkland Remediation Criteria (Annex A, Table A-1). CCME criteria exist for most of the compounds included in the broad screen analysis for polycyclic aromatic hydrocarbons (PAHs). Polychlorinated dibenzodioxin and dibenzofuran concentrations in soil were also compared to CCME Residential/Parkland Remediation Criteria. The CCME Freshwater Aquatic Life (FAL) Remediation Criteria (Annex A, Table A-3), the CCME Remediation Criteria for drinking water (Annex A, Table A-3) and the Canadian Drinking Water Quality Criteria (CCME 1991b) were applied to results for water samples.

iii. Provincial and Territorial Criteria

PAHs not covered by the CCME criteria were compared to the Cleanup Criteria Proposed for British Columbia (CCME 1991b) and presented in italics in Table II-1.

The CCME Interim Remediation Criteria for soil currently do not contain numerical values for most pesticides and their metabolites. Two of the most comprehensive criteria for contaminated soils available in Canada are the British Columbia Ministry of the Environment Proposed Cleanup Criteria, and the Soil and Ground Water Guidelines recommended by the Ministère de l'Environnement du Québec (CCME 1991b). Both of these criteria use the three-tiered A, B, C format; soils containing substances in excess of the B level are considered contaminated for residential or recreational use and are therefore analogous to the R/P level of the CCME criteria. The Québec B level and the BCMOE B level both suggest a maximum acceptable total concentration of pesticides and metabolites of 2 ppm (see Table II-2).

iv. Foreign Criteria

Criteria developed as part of the Soil Cleanup (Interim) Act of The Netherlands' Soil Protection Act incorporate A, B and C levels much like the aforementioned provincial criteria (CCME 1991b). The Netherlands Cleanup Criteria recommend maximum acceptable levels of 0.5 ppm for each chlorinated pesticide, 1.0 ppm for each non-chlorinated pesticide and 3.0 ppm total pesticides in soil (see Table II-2).

v. Plant Criteria

One fate of contaminants in the environment is their entry into the living components of that system. It is this aspect of environmental impact that is often overlooked in wholly criteria-based assessments. Of considerable note is that contaminant concentrations in vegetation can exceed soil concentrations, particularly if vegetation is growing close to a highly contaminated area (ESG 1995b). The impact of contaminants on an ecosystem can be measured directly by determining the extent to which these substances have entered the food chain. Plants are particularly useful indicators of contaminant impact because of their location at the base of this chain, and their ready accessibility. The results obtained from the analysis of these samples are not intended to preclude the interpretation of soil and water data. Instead, plants provide additional information about the environmental status of a site. This information helps to identify substances with particular biological activity, and assists in the selection of remedial options.

Based on previous studies (ESG 1993a) a method for establishing site-specific criteria for the assessment of ecosystem impact by contaminants was developed by the ESG. These criteria have withstood extensive scrutiny by federal, territorial and provincial government agencies, Inuit and First Nations groups. The criteria involve comparing contaminant levels in plants from potentially impacted sites with those from areas where human activity is rare (background locations). For the purpose of this assessment, plants containing a contaminant at a concentration greater than twice the mean background plant concentration are considered to be exhibiting the influence of elevated soil contaminant concentrations. The site-specific plant criteria as determined for assessment of ecosystem impact at Snag Airstrip are presented in Table III-4 of Chapter III.

vi. Environmental Regulations

The only legislation governing the cleanup of Snag Airstrip is the *Storage of PCB Material Regulations* under the Canadian Environmental Protection Act (Canada Gazette Extract, Part II, September 9, 1992). The *Storage of PCB Material Regulations* govern the amount of PCB material that is in or on a property or a parcel of land; materials containing PCBs at concentrations in excess of 50 ppm must be remedied.

vii. Surface Cleanup Standard

The options for disposition of site buildings are partially governed by whether their inner surfaces are contaminated with PCBs. There are no federal or territorial regulations that direct the demolition and disposal of PCB-contaminated physical structures. Health and Welfare Canada have provided advice to northern agencies on criteria for occupied buildings. Based on a draft policy statement by the United States Environmental Protection Agency (US EPA 1985), a surface cleanup standard for a residential area is 10,000 ng/100 cm² of PCBs, while that of an electrical substation area is 100,000 ng/100 cm². In the absence of any regulatory policy, these levels were used to guide site-specific cleanup as follows: buildings with PCBs on inner surfaces at levels higher than 10,000 ng/100 cm² should not be made available for future human habitation, but they can be used as storage areas provided PCB levels do not exceed 100,000 ng/100 cm².

Table II-1: CCME Interim Criteria for Polycyclic Aromatic Hydrocarbons (PAHs) in Soils^{a,b}

Substance	Assessment Criteria	Remediation Criteria		
		Agricultural	Residential/ Parkland	Commercial/ Industrial
ppb or ng/g dry weight				
Naphthalene	100	100	5000	50000
Acenaphthylene	<i>100</i>	<i>10000</i>	<i>10000</i>	<i>100000</i>
Acenaphthene	<i>100</i>	<i>10000</i>	<i>10000</i>	<i>100000</i>
Fluorene	<i>100</i>	<i>10000</i>	<i>10000</i>	<i>100000</i>
Phenanthrene	100	100	5000	50000
Anthracene	<i>100</i>	<i>10000</i>	<i>10000</i>	<i>100000</i>
Fluoranthene	<i>100</i>	<i>10000</i>	<i>10000</i>	<i>100000</i>
Pyrene	100	100	10000	100000
Benz(a)anthracene	100	<i>1000</i>	<i>1000</i>	<i>10000</i>
Chrysene	<i>100</i>	<i>1000</i>	<i>1000</i>	<i>10000</i>
Benzofluoranthenes	<i>100</i>	<i>1000</i>	<i>1000</i>	<i>10000</i>
Benzo(a)pyrene	100	100	1000	10000
Dibenz(a,h)anthracene	100	100	1000	10000
Indeno(1,2,3-c,d)pyrene	100	100	1000	10000
Benzo(ghi)perylene	--	--	--	--

a. Figures in italics are equivalent values from "Criteria for Managing Contaminated Sites in British Columbia", BC MOE); CCME criteria are yet to be established.

b. No criteria are available for the substances with a -- symbol.

Table II-2: List of Criteria for Pesticides

Criteria	Pesticides ^a (ppm)			
	Level A	Level B	Level C	
British Columbia Cleanup Criteria ^b :	Total Pesticides in Soil	0.10	2.0	20
	Total Pesticides in Water	0.00005	0.10	
MENVIQ Soil Guidelines ^c :	Total Pesticides	0.10	2.0	30
Netherlands Soil Guidelines ^d :	Total Pesticides	-	3.0	30
	Individual Chlorinated Pesticides		0.50	5.0
	Individual Non-Chlorinated Pesticides		1.0	10

a. Pesticides analyzed include:

Hexachlorobenzene	o,p'-DDE	Mirex
alpha BHC	p,p'-DDE	Heptachlor Epoxide
beta BHC	trans-Nonachlor	alpha-Endosulphan
gamma BHC	cis-Nonachlor	Aldrin
Heptachlor	o,p'-DDD	Dieldrin
Oxychlordane	p,p'-DDD	Endrin
trans-Chlordane	p,p'-DDT	Methoxychlor
cis-Chlordane		

- b. From "Criteria for Managing Contaminated Sites in British Columbia, Ministry of Environment, Waste Management Program, November 1989". Level A represents background levels or achievable detection limits; Level B is the remediation criteria for residential, recreational and agricultural land use; and Level C represents significant soil contamination and is the remediation criterion for commercial or industrial land use.
- c. Ministère de l'Environnement du Québec (MENVIQ), 1988. "Contaminated Sites Rehabilitation Policy". Prepared by the Direction des Substances Dangereuses. Level A indicates background concentrations or analytical detection limits; concentrations between A and B are slightly contaminated. Site investigation is needed if concentrations exceed Level B. Concentrations between B and C are considered to be contaminated; concentration above C indicate serious contamination.
- d. From "Review and Recommendations for Canadian Interim Environmental Quality Criteria for Contaminated sites". The National Contaminated Sites Remediation Program, Scientific Series No.197. The A level marks the boundary between contaminated and uncontaminated soil; B level indicates the relative extent of contamination and potential seriousness of the risk that the contamination might pose; and C level represents the concentration above which a soil was considered to be polluted to such an extent that all potential exposure routes present an intolerable risk to humans or the environment.

Annex A: Canadian Council of Ministers of the Environment (CCME) Assessment and Remediation Criteria for Soil and Water

Excerpts from Canadian Council of Ministers of the Environment (1991) Interim Canadian Environmental Quality Criteria for Contaminated Sites. Prepared by the CCME Subcommittee on Environmental Quality Criteria for Contaminated Sites, September 1991.

Assessment and Remediation Criteria Tables

Table A-1. Interim Assessment Criteria for Soil and Water

	Soil	Water
General Parameters		
pH	6 to 8	---
conductivity	2 dS/m	---
sodium adsorption ratio	5	---
Inorganic Parameters		
antimony	20 ¹	---
arsenic	5	5
barium	200	50
beryllium	4	---
boron (hot water soluble)	1	---
cadmium	0.5 ⁻	1
chromium (*6)	2.5	---
chromium (total)	20	15
cobalt	10	10
copper	30	25
cyanide (free)	0.25	40
cyanide (total)	2.5	40
fluoride (total)	200	---
lead	25	10
mercury	0.1	0.1
molybdenum	2	5
nickel	20	10
selenium	1	1

Notes: All values in µg/g dry weight or µg/L unless otherwise stated.

Interim assessment criteria are largely based on ambient or background concentrations for most general and inorganic parameters and on analytical detection limits for most organic parameters.

--- value not established.

See page 7 for numbered footnotes.

Table A-1. Interim Assessment Criteria for Soil and Water (Continued)

	Soil	Water
Inorganic Parameters (cont'd)		
silver	2	5
sulphur (elemental)	250	---
thallium	0.5	---
tin	5	10
vanadium	25	---
zinc	60	50
Monocyclic Aromatic Hydrocarbons		
benzene	0.05	0.5
chlorobenzene	0.1	0.1
1,2-dichlorobenzene	0.1	0.2
1,3-dichlorobenzene	0.1	0.2
1,4-dichlorobenzene	0.1	0.2
ethylbenzene	0.1	0.5
styrene	0.1	0.5
toluene	0.1	0.5
xylene	0.1	0.5
Phenolic Compounds		
non-chlorinated ² (each)	0.1	0.1
chlorophenols ³ (each)	0.05	1.0
Polycyclic Aromatic Hydrocarbons (PAHs)		
benzo(a)anthracene	0.1	0.01
benzo(a)pyrene	0.1	0.01
benzo(b)fluoranthene	0.1	0.01
benzo(k)fluoranthene	0.1	0.01
dibenz(a,h)anthracene	0.1	0.01
indeno(1,2,3-c,d)pyrene	0.1	0.1
naphthalene	0.1	0.2
phenanthrene	0.1	0.2
pyrene	0.1	0.2
Chlorinated Hydrocarbons		
chlorinated aliphatics ⁴ (each)	0.1	0.1
chlorobenzenes ⁵ (each)	0.05	0.3
hexachlorobenzene	0.1	0.1
hexachlorocyclohexane	0.01	---
PCBs ⁶	0.1	0.1
PCDDs and PCDFs ⁷	0.00001	---

Table A-1. Interim Assessment Criteria for Soil and Water (Continued)

	Soil	Water
Miscellaneous Organic Parameters		
non-chlorinated aliphatics (each)	0.3	---
phthalic acid esters (each)	30	---
quinoline	0.1	---
thiophene	0.1	---

Table A-1 footnotes.

¹Set equal to the Agricultural Remediation Criteria value (see Table A-2).

²Non-chlorinated phenolic compounds include

- 2,4-dimethylphenol
- 2,4-dinitrophenol
- 2-methyl 4,6-dinitrophenol
- nitrophenol (2-, 4-)
- phenol
- cresol

³Chlorophenols include

- chlorophenol isomers (ortho, meta, para)
- dichlorophenols (2,6- 2,5- 2,4- 3,5- 2,3- 3,4-)
- trichlorophenols (2,4,6- 2,3,6- 2,4,5- 2,3,5- 2,3,4- 3,4,5-)
- tetrachlorophenols (2,3,5,6- 2,3,4,5- 2,3,4,6-)
- pentachlorophenol

⁴Aliphatic chlorinated hydrocarbons include

- chloroform
- dichloroethane (1,1- 1,2-), dichloroethene (1,1- 1,2-)
- dichloromethane
- 1,2-dichloropropane, 1,2-dichloropropene (cis and trans)
- 1,1,2,2-tetrachloroethane, tetrachloroethene
- carbon tetrachloride
- trichloroethane (1,1,1- 1,1,2-), trichloroethene

⁵Chlorobenzenes include

- all trichlorobenzene isomers
- all tetrachlorobenzene isomers
- pentachlorobenzene

⁶PCBs include mixtures 1242, 1248, 1254, and 1260.

⁷PCDDs and PCDFs expressed in 2,3,7,8,-TCDD equivalents. NATO International Toxicity Equivalency Factors (I-TEFs) for congeners and isomers of PCDDs and PCDFs are as follows:

Congener	TEF	Congener	TEF
2,3,7,8-T ₄ CDD	1.0	2,3,7,8-T ₄ CDF	0.1
1,2,3,7,8-P ₅ CDD	0.5	2,3,4,7,8-P ₅ CDF	0.5
1,2,3,4,7,8-H ₆ CDD	0.1	1,2,3,7,8-P ₅ CDF	0.05
1,2,3,7,8,9-H ₆ CDD	0.1	1,2,3,4,7,8-H ₆ CDF	0.1
1,2,3,6,7,8-H ₆ CDD	0.1	1,2,3,7,8,9-H ₆ CDF	0.1
1,2,3,4,6,7,8-H ₇ CDD	0.1	1,2,3,6,7,8-H ₆ CDF	0.1
O ₈ CDD	0.001	2,3,4,6,7,8-H ₆ CDF	0.1
		1,2,3,4,6,7,8-H ₇ CDF	0.1
		1,2,3,4,7,8,9-H ₇ CDF	0.01
		O ₈ CDF	0.001

Table A-2. Interim Remediation Criteria for Soil

	Agricultural	Residential/ Parkland	Commercial/ Industrial
General Parameters			
pH	6 to 8	6 to 8	6 to 8
conductivity	2	2	4
sodium adsorption ratio	5	5	12
Inorganic Parameters			
antimony	20	20	40
arsenic	20	30	50
barium	750	500	2000
beryllium	4	4	8
boron (hot water soluble)	2	---	---
cadmium	3	5	20
chromium (*6)	8	8	--- ¹
chromium (total)	750	250	800
cobalt	40	50	300
copper	150	100	500
cyanide (free)	0.5	10	100
cyanide (total)	5	50	500
fluoride (total)	200	400	2000
lead	375	500	1000
mercury	0.8	2	10
molybdenum	5	10	40
nickel	150	100	500
selenium	2	3	10
silver	20	20	40
sulphur (elemental)	500	---	---
thallium	1	---	---
tin	5	50	300
vanadium	200	200	--- ¹
zinc	600	500	1500

Notes: All values in µg/g dry weight unless otherwise stated.

--- value not established.

See page 10 for numbered footnotes.

Table A-2. Interim Remediation Criteria for Soil (Continued)

	Agricultural	Residential/ Parkland	Commercial/ Industrial
Monocyclic Aromatic Hydrocarbons			
benzene	0.05	0.5	5
chlorobenzene	0.1	1	10
1,2-dichlorobenzene	0.1	1	10
1,3-dichlorobenzene	0.1	1	10
1,4-dichlorobenzene	0.1	1	10
ethylbenzene	0.1	5	50
styrene	0.1	5	50
toluene	0.1	3	30
xylene	0.1	5	50
Phenolic Compounds			
non-chlorinated ² (each)	0.1	1	10
chlorophenols ³ (each)	0.05	0.5	5
Polycyclic Aromatic Hydrocarbons (PAHs)			
benzo(a)anthracene	0.1	1	10
benzo(a)pyrene	0.1	1	10
benzo(b)fluoranthene	0.1	1	10
benzo(k)fluoranthene	0.1	1	10
dibenz(a,h)anthracene	0.1	1	10
indeno(1,2,3-c,d)pyrene	0.1	1	10
naphthalene	0.1	5	50
phenanthrene	0.1	5	50
pyrene	0.1	10	100
Chlorinated Hydrocarbons			
chlorinated aliphatics ⁴ (each)	0.1	5	50
chlorobenzenes ⁵ (each)	0.05	2	10
hexachlorobenzene	0.05	2	10
hexachlorocyclohexane	0.01	---	---
PCBs ⁶	0.5	5	50
PCDDs and PCDFs ⁷	0.00001	0.001	---
Miscellaneous Organic Parameters			
non-chlorinated			
aliphatics (each)	0.3	---	---
phthalic acid esters (each)	30	---	---
quinoline	0.1	---	---
thiophene	0.1	---	---

Table A-2 footnotes.

¹Criteria not recommended for commercial/industrial. One possible recourse is to use the residential/parkland value.

²Non-chlorinated phenolic compounds include

- 2,4-dimethylphenol
- 2,4-dinitrophenol
- 2-methyl 4,6-dinitrophenol
- nitrophenol (2-, 4-)
- phenol
- cresol

³Chlorophenols include

- chlorophenol isomers (ortho, meta, para)
- dichlorophenols (2,6- 2,5- 2,4- 3,5- 2,3- 3,4-)
- trichlorophenols (2,4,6- 2,3,6- 2,4,5- 2,3,5- 2,3,4- 3,4,5-)
- tetrachlorophenols (2,3,5,6- 2,3,4,5- 2,3,4,6-)
- pentachlorophenol

⁴Aliphatic chlorinated hydrocarbons include

- chloroform
- dichloroethane (1,1- 1,2-), dichloroethene (1,1- 1,2-)
- dichloromethane
- 1,2-dichloropropane, 1,2-dichloropropene (cis and trans)
- 1,1,1,2-tetrachloroethane, tetrachloroethene
- carbon tetrachloride
- trichloroethane (1,1,1- 1,1,2-), trichloroethene

⁵Chlorobenzenes include

- all trichlorobenzene isomers
- all tetrachlorobenzene isomers
- pentachlorobenzene

⁶PCBs include mixtures 1242, 1248, 1254, and 1260.

⁷PCDDs and PCDFs expressed in 2,3,7,8-TCDD equivalents. NATO International Toxicity Equivalency Factors (I-TEFs) for congeners and isomers of PCDDs and PCDFs are as follows:

Congener	TEF
2,3,7,8-T ₄ CDD	1.0
1,2,3,7,8-P ₅ CDD	0.5
1,2,3,4,7,8-H ₆ CDD	0.1
1,2,3,7,8,9-H ₆ CDD	0.1
1,2,3,6,7,8-H ₆ CDD	0.1
1,2,3,4,6,7,8-H ₇ CDD	0.1
O ₈ CDD	0.001
2,3,7,8-T ₄ CDF	0.1
2,3,4,7,8-P ₅ CDF	0.5
1,2,3,7,8-P ₅ CDF	0.05
1,2,3,4,7,8-H ₆ CDF	0.1
1,2,3,7,8,9-H ₆ CDF	0.1
1,2,3,6,7,8-H ₆ CDF	0.1
2,3,4,6,7,8-H ₆ CDF	0.1
1,2,3,4,6,7,8-H ₇ CDF	0.1
1,2,3,4,7,8,9-H ₇ CDF	0.01
O ₉ CDF	0.001

Table A-3. Remediation Criteria for Water¹

	Freshwater Aquatic Life ²	Irrigation ^{2,3}	Livestock Watering ²	Drinking Water ^{4,5}
General Parameters				
oxygen, dissolved	5-9.5 mg/L	---	---	---
pH (unitless)	6.5-9.0	---	---	6.5-8.5
total dissolved solids	---	500-3500 mg/L	3000 mg/L	≤500 mg/L ^{6,7}
Inorganic Parameters				
aluminum	5-100 ⁸	5000	5000	---
ammonia	1.37-2.2 mg/L ⁹	---	---	---
antimony	---	---	---	---
arsenic	50	100	500-5000	25 ¹⁰
barium	---	---	---	1000 ¹⁰
beryllium	---	100	100 ¹¹	---
boron (hot water soluble)	---	---	---	---
boron (total)	---	500-6000	5000	5000 ⁶
cadmium	0.2-1.8 ¹²	10	20	5
calcium	---	---	1000 mg/L	---
chloride (total)	---	100-700 mg/L	---	≤250 mg/L
chloride (total residual)	2	---	---	---
chromium (*6)	---	---	---	---
chromium (total)	2-20	100	1000	50
cobalt	---	50	1000	---
copper	2-4 ¹²	200-1000 ¹³	500-5000	≤1000 ⁶
cyanide (free)	5	---	---	---
cyanide (total)	---	---	---	200 ⁶
fluoride (free)	---	---	---	---
fluoride (total)	---	1000	1000-2000	1500 ⁶
iron	300	5000	---	≤300 ¹⁰
lead	1-7 ¹²	200 ¹¹	100	10 ¹⁰
lithium	---	2500	---	---
manganese	---	200	---	≤50 ¹⁰
mercury	0.1	---	3	1
molybdenum	---	10-50	500	---
nickel	25-150 ¹²	200	1000	---
nitrate	---	---	---	45 mg/L ^{10,15}
nitrate and nitrite	---	---	100 mg/L	---
nitrite	0.06 mg/L	---	10 mg/L	4.5 mg/L ^{10,15}

Notes: All values in µg/L unless otherwise stated.

--- value not established.

See pages 15-16 for numbered footnotes.

Table A-3. Remediation Criteria for Water (Continued)

	Freshwater Aquatic Life ²	Irrigation ^{2,3}	Livestock Watering ²	Drinking Water ^{4,5}
Inorganic Parameters (cont'd)				
selenium	1	20-50	50	10
silver	0.1	---	---	---
sodium	---	--- ¹⁶	---	≤200 mg/L ¹⁰
sulphate	---	---	1000 mg/L	≤500 mg/L ¹⁰
sulphur (total)	---	---	---	---
thallium	---	---	---	---
tin	---	---	---	---
uranium	---	10 ¹¹	200	100
vanadium	---	100	100	---
zinc (total)	30 ¹¹	1000-5000 ¹⁷	50 000	≤5000 ¹⁰
Monocyclic Aromatic Hydrocarbons				
benzene	300 ¹¹	---	---	5
ethylbenzene	700 ¹¹	---	---	≤2.4
styrene	---	---	---	---
toluene	300	---	---	≤24
xylenes	---	---	---	≤300
Phenolic Compounds				
non-chlorinated ¹⁸ (each)	---	---	---	---
phenols (total)	1	---	---	---
chlorinated phenols				
monochlorophenol	7	---	---	---
dichlorophenols	0.2	---	---	900 ¹⁹ ; ≤0.3 ¹⁹
trichlorophenols	18	---	---	5 ²⁰ ; ≤2 ²⁰
tetrachlorophenols	1	---	---	100 ²¹ ; ≤1 ²¹
pentachlorophenol	0.5	---	---	60; ≤30
Polycyclic Aromatic Hydrocarbons (PAHs)				
benzo(a)anthracene	---	---	---	---
benzo(a)pyrene	---	---	---	0.01
benzo(b)fluoranthene	---	---	---	---
benzo(k)fluoranthene	---	---	---	---
dibenz(a,h)anthracene	---	---	---	---
indeno(1,2,3-c,d) pyrene	---	---	---	---
naphthalene	---	---	---	---
phenanthrene	---	---	---	---
pyrene	---	---	---	---

Table A-3. Remediation Criteria for Water (Continued)

	Freshwater Aquatic Life ²	Irrigation ^{2,3}	Livestock Watering ²	Drinking Water ^{4,5}
Chlorinated Hydrocarbons				
chlorinated aliphatics				
dichloroethane, 1,2-	100	---	---	5 ^{10,11}
dichloromethane	---	---	---	50
hexachlorobutadiene	0.1	---	---	---
hexachlorocyclohexane isomers	0.01	---	---	---
tetrachloroethylene	260 ¹¹	---	---	---
trichloroethylene	20	---	---	50 ¹⁰
chlorinated benzenes				
monochlorobenzene	15 ¹¹	---	---	80 ¹⁰ ; ≤30 ¹⁰
dichlorobenzene, 1,2-	2.5 ¹¹	---	---	200; ≤3
dichlorobenzene, 1,3-	2.5 ¹¹	---	---	---
dichlorobenzene, 1,4-	4 ¹¹	---	---	5; ≤1
trichlorobenzene, 1,2,3-	0.9 ¹¹	---	---	---
trichlorobenzene, 1,2,4-	0.5 ¹¹	---	---	---
trichlorobenzene, 1,3,5-	0.65 ¹¹	---	---	---
tetrachlorobenzene, 1,2,3,4-	0.1 ¹¹	---	---	---
tetrachlorobenzene, 1,2,3,5-	0.1 ¹¹	---	---	---
tetrachlorobenzene, 1,2,4,5-	0.15 ¹¹	---	---	---
pentachlorobenzene	0.03 ¹¹	---	---	---
hexachlorobenzene	0.0065 ¹¹	---	---	---
PCBs ²²	1 ng/L	---	---	---
PCDDs and PCDFs ²³	---	---	---	---
Halogenated Methanes				
carbon tetrachloride	---	---	---	5
trihalomethanes	---	---	---	350 ⁶
Phthalate Esters				
DBP	4	---	---	---
DEHP	0.6	---	---	---
other phthalate esters	0.2	---	---	---
Pesticides				
aldicarb	---	---	---	9
aldrin and dieldrin	4 ng/L	---	---	0.7 ⁶
atrazine	2	---	---	60 ¹¹
azinphos-methyl	---	---	---	20
bendiocarb	---	---	---	40

Table A-3. Remediation Criteria for Water (Continued)

	Freshwater Aquatic Life ²	Irrigation ^{2,3}	Livestock Watering ²	Drinking Water ^{4,5}
Pesticides (cont'd)				
bromoxynil	---	---	---	5 ¹¹
carbaryl	---	---	---	90
carbofuran	1.75	---	---	90
chlordane	6 ng/L	---	---	7 ⁶
chlorpyrifos	---	---	---	90
cyanazine	2 ¹¹	---	---	10 ¹¹
2,4-D	4	---	---	100 ⁶
DDT	1 ng/L	---	---	30 ^{6,24}
diazinon	---	---	---	20
dicamba	---	---	---	120
diclofop-methyl	---	---	---	9
dimethoate	---	---	---	20 ¹¹
diquat	---	---	---	70
diuron	---	---	---	150
endosulfan	0.02	---	---	---
endrin	2.3 ng/L	---	---	---
glyphosate	65	---	---	280 ¹¹
heptachlor (+ metabolite)	0.01	---	---	3 ⁶
lindane	---	---	---	4 ⁶
malathion	---	---	---	190
methoxychlor	---	---	---	900
metolachlor	---	---	---	50 ¹¹
metribuzin	1	---	---	80
paraquat	---	---	---	10 ¹¹
parathion	---	---	---	50
phorate	---	---	---	2 ¹¹
picloram	29 ¹¹	---	---	190 ^{10,11}
simazine	---	---	---	10 ¹¹
2,4,5-T	---	---	---	280; ≤20
temephos	---	---	---	280 ¹¹
terbufos	---	---	---	1 ¹¹
toxaphene	8 ng/L	---	---	---
triallate	---	---	---	230
trifluralin	---	---	---	45 ^{10,11}

Table A-3. Remediation Criteria for Water (Continued)

	Freshwater Aquatic Life ²	Irrigation ^{2,3}	Livestock Watering ²	Drinking Water ^{4,5}
Radiological Parameters				
¹³⁷ cesium	---	---	---	50 Bq/L ⁶
¹³¹ iodine	---	---	---	10 Bq/L ⁶
²²⁶ radium	---	---	---	1 Bq/L ⁶
⁹⁰ strontium	---	---	---	10 Bq/L ⁶
³ tritium	---	---	---	40 000 Bq/L ⁶

Table A-3 footnotes.

¹ Guidelines for freshwater aquatic life, irrigation, and livestock watering (columns 1, 2, and 3, respectively) are taken from the Canadian Water Quality Guidelines (CWQG) (CCREM 1987). The CWQG also recommends guidelines for recreational uses and several specific industrial uses, which are not included in this table. Guidelines for drinking water (column 4) are taken from the Guidelines for Canadian Drinking Water Quality (GCDWQ) (Health and Welfare Canada 1989).

² Guidelines for heavy metals and trace ions are reported as total concentrations in an unfiltered sample.

³ Applies to all soils; for details on neutral to alkaline soils, refer to CCREM (1987).

⁴ Drinking water guidelines are expressed as maximum acceptable concentrations (MAC), and are for unfiltered samples at the point of consumption. Heavy metals and trace ions are expressed as total concentrations (particulate and dissolved) unless otherwise indicated.

⁵ Several parameters also have aesthetic objectives; these are indicated by a "≤" symbol.

⁶ Guideline under review for addition to the GCDWQ or possible changes to the current value. Refer to the latest edition of the GCDWQ.

⁷ The total dissolved solids concentration of 500 mg/L is approximately equal to a conductivity of 1 dS/m.

⁸ Guideline varies with pH, calcium, and dissolved organic carbon concentrations.

⁹ Guideline changes with temperature and pH.

¹⁰ A modification to the previous guideline is proposed. If after one year, no evidence is presented that questions the suitability of this proposal, it will be adopted as the guideline. Refer to the latest edition of the GCDWQ.

¹¹ Tentative water quality guideline/interim drinking water guideline because of insufficient evidence; refer to the latest edition of the CWQG or GCDWQ.

¹² Guideline changes with hardness.

¹³ Guideline varies depending on crop.

¹⁴ Avoid concentrations that stimulate prolific weed growth.

¹⁵ Equivalent to 10.0 mg/L nitrate as nitrogen. Where nitrate and nitrite are determined separately, levels of nitrite should not exceed 4.5 mg/L (1.0 mg/L as nitrogen).

¹⁶ Refer to CCREM (1987).

¹⁷ Guideline changes with pH.

Table A-3 footnotes continued.

¹⁸Non-chlorinated phenolic compounds include

- 2,4-dimethylphenol
- 2,4-dinitrophenol
- 2-methyl 4,6-dinitrophenol
- nitrophenol (2-, 4-)
- phenol
- cresol

¹⁹As 2,4-dichlorophenol.

²⁰As 2,4,6-trichlorophenol.

²¹As 2,3,4,6-tetrachlorophenol.

²²Total PCB analysis only for freshwater aquatic life guidelines.

²³Quoted as 2,3,7,8-TCDD equivalents. PCDDs and PCDFs expressed in 2,3,7,8-TCDD equivalents. NATO International Toxicity Equivalency Factors (I-TEFs) for congeners and isomers of PCDDs and PCDFs are as follows:

Congener	TEF
2,3,7,8-T ₄ CDD	1.0
1,2,3,7,8-P ₅ CDD	0.5
1,2,3,4,7,8-H ₆ CDD	0.1
1,2,3,7,8,9-H ₆ CDD	0.1
1,2,3,6,7,8-H ₆ CDD	0.1
1,2,3,4,6,7,8-H ₇ CDD	0.1
O ₈ CDD	0.001
2,3,7,8-T ₄ CDF	0.1
2,3,4,7,8-P ₅ CDF	0.5
1,2,3,7,8-P ₅ CDF	0.05
1,2,3,4,7,8-H ₆ CDF	0.1
1,2,3,7,8,9-H ₆ CDF	0.1
1,2,3,6,7,8-H ₆ CDF	0.1
2,3,4,6,7,8-H ₆ CDF	0.1
1,2,3,4,6,7,8-H ₇ CDF	0.1
1,2,3,4,7,8,9-H ₇ CDF	0.01
O ₉ CDF	0.001

²⁴Includes DDT metabolites.

III. SITE ASSESSMENT

The results of the current environmental assessment of Snag Airstrip are presented in this chapter. Results have been compared with the applicable criteria as outlined in Chapter II and their implication for the environmental health of the site is discussed. This chapter provides the basis for Chapter IV, which outlines cleanup options and recommendations.

A. Sampling and Analytical Programs

1. Sampling Program

A preliminary assessment of Snag Airstrip was made by the ESG in June of 1994, at which time nine soil, nine wall swab, one plant, one paint and two barrel oil samples were collected (see ESG 1994, "Draft 2, Preliminary Investigations - Four Abandoned Pumping Stations and Two Airstrips"). Analysis of a portion of these samples indicated that the soils at the airstrip contained elevated concentrations of PCBs, copper, lead, zinc, nickel and chromium. Two soil samples, collected at the pump house and powerhouse, respectively, were found to contain levels of PCBs elevated above the CCME R/P criteria, and one of these contained PCBs at a concentration exceeding the level (50 ppm) regulated under the Canadian Environmental Protection Act (CEPA). The concentrations of mercury in all of the samples analyzed were below the limit of detection (0.2 ppm).

The remaining unanalyzed soil samples collected in 1994 were tested for PCBs and inorganic contaminants prior to the start of a detailed assessment of the site in June 1995. In addition, two soil samples were submitted for pesticide analysis. PCB and inorganic element data were consistent with 1994 data. Pesticide results from the two soil samples did not exceed the applicable criteria.

Snag Airstrip was visited again by the ESG on June 28th through the 6th of July, 1995. The group was based at Beaver Creek and drove to the site daily.

In the 1995 assessment of Snag Airstrip two sampling approaches were employed. The objective of the first approach was to characterize the extent of contamination in soils, biota, water and building materials at the site. Areas were targeted for sampling

based on suspected land use practices as well as physical evidence (for example, staining, physical debris). In addition, general site samples were collected throughout areas that may not have been directly influenced by activities undertaken at the site. A total of 128 assessment soil samples were collected during the field investigation including five from background locations. The second sampling approach was designed to delineate those areas of contamination known to exceed the CCME R/P Remediation Criteria, as well as the soils containing concentrations of PCBs in excess of the level regulated under CEPA. Assessment soil samples were collected from the top 10 cm of the soil layer, while delineation of contaminated areas necessitated the collection of samples at depth as well as at the surface. One hundred delineation soil samples were collected at Snag Airstrip. Thirty plant samples were also collected at the site to examine whether contaminants were entering the food chain. Site investigation also included the collection of nine wall swab, five water, four building material, three oil and two paint chip samples.

Each sample has been identified by a letter prefix, identifying it with a specific land use category, as shown in Table III-1. This coding, which is also used to designate sample locations on the maps, provides a convenient way of ascertaining the land use patterns at the site. It should be emphasized that the prefix only implies a suspected land usage, and subsequent analysis sometimes indicates other inputs. Nevertheless, the codings provide an indication of the clues revealed by the visual inspection of the site, and thus reflect the emphasis of the sampling program.

2. Analytical Program

There is a lack of reliable information regarding the total range of materials used or disposed of at the site over its period of operation. Under such circumstances, there is normally a requirement to conduct a screen for a wide range of Environment Canada and/or United States Environmental Protection Agency (US EPA) priority pollutants. A selected number of soil samples were therefore screened for polychlorinated biphenyls (PCBs), inorganic elements¹, polycyclic aromatic hydrocarbons (PAHs), pesticides, and

¹ The term inorganic element is used here to refer to metals and metalloids. Frequently in environmental work, these are all grouped into the category of metals. Arsenic, cadmium, chromium, cobalt, copper, lead, nickel, zinc and mercury were analyzed for in this work.

dioxins. Plant, water and paint chip samples were analyzed for inorganic elements and PCBs. Wall swabs were analyzed for PCBs only, and the barrel samples and the oil filter were analyzed for PCBs, total chlorine, lead, chromium and cadmium. The asbestos content of insulation and pressboard samples was also determined.

Table III-1: Codes Used for Sample Designation ^a

Prefix ^b	Description
<i>1. Soil Samples</i>	
G	General site assessment collected in 1995
SN	General site assessment collected in 1994
L	Landfill or dump assessment
O	Outfall or septic field assessment
SN##	Delineation at tag ##
<i>2. Water Samples</i>	
PW	Potable water from town sources
GW	Ground water from wells and manholes
<i>3. Other Samples</i>	
BS-SN	Barrel contents
SW	Surface swab
ASB	Insulation material
SNPC	Paint chip
OIL	Engine oil filter

a. The designation often implies only suspected land usage. Thus an O prefix indicates a sample that is believed to have been influenced by sewage discharge. It should be pointed out that the area could also have been subject to unknown inputs.

b. Each prefix is followed by a number starting at 6100. Thus G6100 is the first sample collected from a general location at the site.

High levels of PCB contamination detected in soil samples collected at the powerhouse and at the pump house during the 1994 sampling program were delineated using field test kits; 25 and eight samples, respectively were tested. High levels of inorganic element contamination at the tower building and at the warehouse were delineated using an XRF (x-ray fluorescence) field test kit on 22 and 41 soil samples,

respectively. Field test kit results were confirmed by standard laboratory methods for 100 percent of PCB tested samples and 46 percent of samples analyzed for inorganic elements (see Appendix B: QA/QC).

Inorganic element analysis was conducted on 127 (93%) of the assessment soil samples, 78 (78%) delineation soil samples, 31 (91%) of the plant samples and three (60%) of the water samples. Leachate analyses were conducted on 18 soil samples including four delineation soil samples. All three paint chip samples and the oil sample were also analyzed for inorganic contaminants.

Analysis for PCBs as Aroclors was conducted on 127 (93%) of the assessment soil samples, 33 (33%) delineation soil samples, 30 (88%) of the plant samples, and all five water samples. Background soil and plant samples were analyzed by high resolution gas chromatography/mass spectrometry. Three (33%) of the wall swab samples (one from each triplicate) were analyzed for PCBs, as were one of the paint chip samples and the barrel and oil samples.

Additional analyses were done for polychlorinated dibenzodioxins and dibenzofurans on 11 of the assessment soil samples. Thirteen assessment soil samples were analyzed for 22 different pesticide compounds. Polycyclic aromatic hydrocarbon analysis was conducted on 17 assessment soil samples. Four samples of building materials including three of insulation and one of pressboard were analyzed for their asbestos content.

Tabulated values of all of the analytical results are presented in Appendix D. Analytical procedures and quality control are discussed in Appendices A and B, respectively. Details of the possible sources of the substances analyzed (both natural and anthropogenic) and the associated environmental concerns are discussed in ESG 1991 and 1993a.

B. Results

1. Background Contaminant Concentrations in Soils and Plants

Soil and plant samples were collected from areas presumed not to be impacted directly by operation of the airstrip, termed *background* locations. By comparing the concentrations of compounds in samples from potentially impacted areas to those from background locations, a distinction can be made between elevated concentrations of compounds which have resulted from local human activity and those resulting from the geological makeup of an area or from atmospheric transport.

Average background soil concentrations have been based on ten samples including two field duplicates. Five background soil samples, including one field duplicate, were collected from four locations near Snag Airstrip between July 2nd and 4th, 1995. An additional five background soil samples, including one field duplicate, were collected in 1994 near another Northwest Staging Route site, Aishihik Airstrip, and are incorporated to represent general background contaminant concentrations in the southwestern regions of Yukon Territory. Average background contaminant concentrations in vegetation are based on six samples. Three samples of vegetation were collected near Snag Airstrip, one each from three of the five background locations. An additional three background plants were collected in 1994 near Aishihik Airstrip. Detailed descriptions of individual sampling locations, and vegetation collected and surveyed are provided in Appendix C.

The analytical results for background samples can be found along with the results for samples collected at the airstrip in Appendix D.

i. Inorganic Elements

Nine background soil samples, including the two field duplicates, were analyzed for inorganic elements. Mean, maximum and minimum background soil concentrations are presented in Table III-2. Since cadmium and lead were not detectable in any of the

background soil samples, their means are presented as half their detection limit - 0.5 ppm for cadmium and 5.0 ppm for lead.

Table III-2: Mean, Maximum and Minimum Background Soil Inorganic Element Concentrations (ppm)

Element	Copper	Nickel	Cobalt	Cadmium	Lead	Zinc	Chromium	Arsenic
Mean Concentration	23	15	7.8	0.50	5.0	64	31	4.7
Minimum Concentration Detected	12	<5.0	<5.0	<1.0	<10	13	<20	0.94
Maximum Concentration Detected	42	30	13	<1.0	<10	87	61	12
CCME Assessment Criteria	30	20	10	0.50	25	60	20	5.0

The mean background concentrations of all elements except chromium were comparable to or below the CCME Assessment Criteria for Soils (see Chapter II). The mean concentration of chromium in background soils (31 ppm) and the concentration of chromium in five of the nine individual background soil samples exceeded the CCME Assessment Criterion (20 ppm). A maximum chromium concentration of 61 ppm was detected in background soil sample G6194. Concentrations of zinc were higher than the CCME Assessment Criterion (60 ppm) in five of the background soils; the same sample that was high in chromium (G6194) also contained the maximum zinc concentration, which was 87 ppm. Three individual background soil samples, including a field duplicate, contained copper, nickel and chromium at concentrations that exceeded the Assessment Criteria. As well, cobalt and arsenic concentrations over the criteria were detected in three background soil samples.

Five background plant samples were analyzed for inorganic elements. Mean, minimum and maximum background plant concentrations are presented in Table III-3.

Table III-3: Mean and Maximum Background Vegetation Inorganic Element Concentrations (ppm)

Element	Copper	Nickel	Cobalt	Cadmiu	Lead	Zinc	Chromiu	Arsenic
Mean Concentration	8.1	5.3	1.6	1.4	4.0	64	9.7	0.10
Minimum Concentration Detected	5.0	2.5	<2.0	<0.50	<2.0	13	5.6	<0.20
Maximum Concentration Detected	12	8.7	<5.0	3.2	<15	130	20	<0.20

The mean concentrations of all inorganic analytes except cadmium and zinc were lower in background plant samples than in background soils. The mean cadmium concentration in background plants was 2.8 times the mean background soil concentration. The mean concentration of zinc in background plants was equivalent to the mean background soil concentration (64 ppm), but the maximum concentration of zinc in background plants was 1.5 times the maximum level detected in background soils.

For the purpose of the current study, mean background concentrations of inorganic elements for plants have been defined as either the mean or the analytical detection limit for those compounds not detected in any of the plant samples (cobalt and arsenic). In plants collected from the immediate vicinity of Snag Airstrip for the current assessment, concentrations of inorganic elements that are more than twice the mean background value are considered indicative of environmental impact. The Inorganic Element Impact Criteria, developed specifically for Snag Airstrip and defined in the current study as twice the mean background plant concentration, are presented in Table III-4.

Table III-4: Impact Criteria for Inorganic Elements in Plants Collected at Snag Airstrip

Element	Copper	Nickel	Cobalt	Cadmium	Lead	Zinc	Chromium	Arsenic
Concentration (ppm)	16	11	10	2.8	30	130	19	0.40

In summary, levels of chromium in background soils were elevated above the CCME Assessment Criteria, but did not approach the CCME R/P Remediation Criteria. Background plants contained cadmium at concentrations significantly higher than background soil concentrations. Zinc concentrations in background plants exceeded soil concentrations in three out of five instances, although mean concentrations in background soils and plants were equivalent. The concentrations of all other inorganic analytes in background plants were below those detected in background soils. Impact criteria for the current investigation were established based on inorganic element concentrations in background plants.

ii. Polychlorinated Biphenyls (PCBs)

All ten background soil samples were analyzed for PCBs as Aroclors by high resolution mass spectrometry. The mean concentration of PCBs in background soils (0.60 ppb) was much less than the CCME Assessment Criterion (100 ppb). The maximum concentration of PCBs detected in a background soil sample (1.2 ppb) was also well below the assessment criterion.

Five out of the six background plant samples collected were analyzed for PCBs by high resolution mass spectrometry. The mean concentration of PCBs detected in the background plants (0.10 ppb) was six times less than the mean for background soils (0.60 ppb). Under the current assessment, environmental impact is defined by plants containing PCBs at a concentration greater than twice the mean concentration in background plants (0.20 ppb).

The concentration of PCBs in background soils was much less than the CCME Assessment Criterion. The concentration of PCBs detected in background plant samples was lower than that detected in background soils. Based on PCB concentrations in plants collected from locations not directly influenced by human activities, plants collected from the vicinity of Snag Airstrip containing PCBs at a concentration greater than 0.20 ppb will be considered to demonstrate environmental impact.

2. Tower Building

The tower building was located on the south side of the site, approximately 100 m northwest of the airstrip (see Map II-1, Photograph III-1). In 1994, during the preliminary ESG study, the building was intact and standing (Photograph III-2), but during partial cleanup of the site in the spring of 1995, it was partly pulled over, scattering much debris including painted wood, pressboard, glass, sheet metal and piping, around the building and some distance from it (Photograph III-3). The wooden building frame remained standing on a cement foundation with a basement. The substrate in the vicinity of the tower building consisted of a thin layer of detritus and dead vegetation over fine to medium sand and rocks. Vegetation in the vicinity of the building was sparse, consisting primarily of early successional species including herbs (*Oxytropis campestris*, *Solidago decumbens*, *Epilobium angustifolium*) and shrubs like poplars (*Populus balsamifera*, *P. tremuloides*) and willows (*Salix* spp.). The soil surface was exposed in much of the area surrounding the building.

A total of 13 assessment soil samples, including two field duplicates, were collected in the vicinity of the tower building (Map III-1). Twenty-three delineation soil samples were collected from the south side of the building including one collected at depth (>10 cm). Three plant samples were obtained at three of the sampling locations near the tower building. Three swabs were taken from the west wall in 1994 before the building was partially demolished, in order to determine levels of surface contamination. A sample of wall insulation was collected for asbestos analysis. The analytical results for samples collected in the vicinity of the tower building can be found in Appendix D.

i. Inorganic Elements

All 13 assessment soil samples collected in the vicinity of the tower building were analyzed for inorganic contaminants. Mean concentrations of lead and zinc exceeded the CCME R/P Remediation Criteria. Mean concentrations of all other analytes were below the criteria, and the mean concentrations of nickel, cobalt and arsenic in soils from around

the tower building were comparable to the averages for background soils. Maximum concentrations of copper (190 ppm), cadmium (46 ppm), lead (6300 ppm) and zinc (16,000 ppm) were significantly elevated above the CCME R/P Remediation Criteria. Eight soil samples, including two field duplicates, contained at least one of these elements at concentrations exceeding the criteria.

Four assessment soil samples including one field duplicate, collected on the south side of the building, contained significantly elevated concentrations of lead. In addition to lead, zinc and copper were present in three of the samples taken closest to the south side of the building (G6100, G6101A&B). The fourth sample from the south side of the tower building, collected in a pile of burnt debris approximately 13 m south of the building (G6109), contained zinc (16000 ppm), lead (640 ppm), copper (190 ppm) and cadmium (46 ppm) at significantly elevated concentrations (Photograph III-4).

Three out of four assessment soil samples including one field duplicate, collected on the north side of the tower building, contained lead at concentrations exceeding the CCME R/P Remediation Criteria. The two samples collected at sample location G6104 (field duplicates A&B) both contained zinc (ave. = 1200 ppm) at concentrations which exceeded the criteria.

Twenty-three delineation soil samples were collected in one metre increments away from soil sample location G6100 (SN1 delineation sample series), based on the results of field analyses indicating that copper, lead and zinc were elevated above the CCME R/P Remediation Criteria in soil in this area (Photograph III-5). All twenty-three delineation soil samples were analyzed for these three inorganic contaminants, and eighteen contained at least one of them at concentrations exceeding their respective CCME R/P Remediation Criteria. The inset in Map III-1 illustrates the samples exceeding the criteria, and shows that the number of samples collected was insufficient to provide a complete outline of the area of soil containing elevated metal concentrations. The sample collected at depth (SN1-4D) contained none of the analytes at concentrations exceeding the criteria, suggesting that the contamination detected does not extend beyond the top 10 cm of the substrate.



Photograph III-1: Aerial view from the south of the tower building.



Photograph III-2: The tower building as it appeared during the preliminary investigation of Snag Airstrip in 1994.

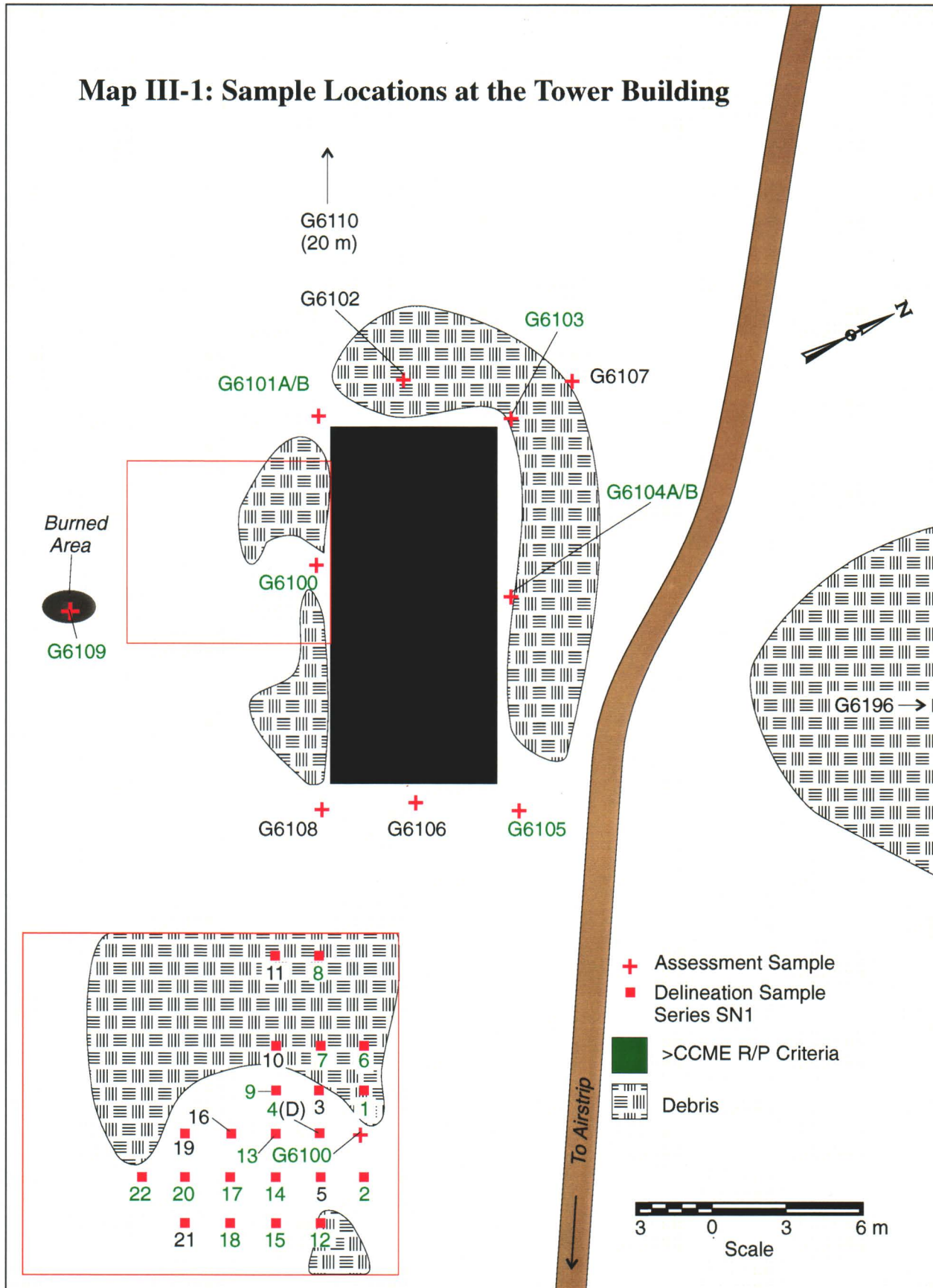


Photograph III-3: View from the south of the tower building in 1995 following its partial demolition.



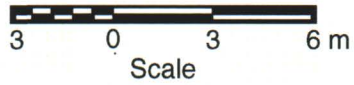
Photograph III-4: G6109 contained copper, lead, zinc, cadmium and pesticides at concentrations exceeding the criteria.

Map III-1: Sample Locations at the Tower Building



- + Assessment Sample
- Delineation Sample Series SN1

- >CCME R/P Criteria
- Debris





Photograph III-5: Delineation soil samples collected around G6100 which contained elevated concentrations of copper, lead and zinc.

Leachate tests were conducted on two assessment soil samples collected in the vicinity of the tower building. None of the analytes detected were present at concentrations exceeding the Leachate Quality Standards (Regulation 347 Schedule 4). Leachate from soil sample G6100 (collected on the south side of the tower building), contained detectable concentrations of leachable lead, fluoride and zinc, but these were all at least one order of magnitude less than their respective quality standards. All other analytes were below the limits of detection. Leachate generated from G6109, a sample consisting of ash and debris, contained detectable concentrations of only cadmium, copper and zinc, at 2.8, 1400 and 2.2 times less than the Leachate Quality Standards, respectively.

All three plant samples collected in the vicinity of the tower building were analyzed for inorganic elements. Mean concentrations of all inorganic analytes except lead and zinc were comparable to the mean calculated for background plants. The mean concentration of lead in plants collected from around the tower building (22 ppm) was 5.5 times that calculated for background plants (4 ppm). The concentration of lead in plant sample G6105P (*Oxytropis campestris*, 40 ppm) exceeded the Snag Airstrip Impact Criterion for lead in plants (30 ppm); the assessment soil sample (G6105) collected in the same location contained lead in excess of the CCME R/P Remediation Criterion for soils.

The mean concentration of zinc in plants collected near the tower building (180 ppm) was 2.8 times that calculated for background plants (64 ppm). This result was driven entirely by one sample: the concentration of zinc in plant sample G6100P (*Populus balsamifera*, 430 ppm) was nearly seven times the mean background concentration in plants and 3.3 times the Snag Airstrip Impact Criterion (128 ppm). The concentration of zinc in the assessment soil sample collected in the same location (G6100, 3200 ppm) was 6.4 times the CCME R/P Remediation Criterion for soils (500 ppm). Soil sample G6100 also contained significantly elevated levels of copper and lead, but this was not reflected in the concentrations of these elements in plant sample G6100P.

Two paint chip samples, including a field duplicate, collected from the interior walls of the tower building were analyzed for inorganic elements. Cobalt, lead, zinc, chromium and arsenic were detected in the paint and could represent a human health hazard during demolition activities.

In summary, concentrations of inorganic elements including copper, cadmium, lead and zinc were elevated above the CCME R/P Remediation Criteria in eight assessment soil samples collected around the perimeter of the tower building. Concentrations of copper, lead or zinc in 18 out of 23 delineation soil samples exceeded the criteria and indicate that contamination extends at least 7 m south from the building edge. Leachate tests conducted on two assessment soil samples indicate that the contaminants are not leachable as defined by the Leachate Quality Standards. Lead and zinc were detected at concentrations above the Impact Criteria in plants collected near the building. Lead, cobalt, zinc, chromium and arsenic were present at very high concentrations in paint from the interior walls of the tower building.

ii. Polychlorinated Biphenyls

Twelve assessment soil samples collected in the vicinity of the tower building, including two sets of field duplicates, were analyzed for PCBs. The mean concentration of PCBs (1400 ppb) in assessment soils collected near the building did not exceed the CCME R/P Remediation Criterion (5000 ppb). The average concentration of PCBs (7700 ppb) in the field duplicates G6104A and G6104B, collected just outside the doorway on the north side of the building, exceeded the criterion. Although PCB concentrations in the remaining assessment soil samples from the vicinity of the tower building were all below the CCME R/P Remediation Criteria, all were orders of magnitude greater than the mean background soil concentration.

All three plant samples collected near the tower building were analyzed for PCBs. Mean (7.1 ppb) and maximum (11 ppb) concentrations of PCBs in plants collected in this

area were 71 and 37 times the mean and maximum concentrations in background plants. The lowest PCB concentration (4.4 ppb) in a plant sample collected in the vicinity of the tower building was 44 times the mean background plant concentration.

The paint sample collected from the interior walls of the tower building contained PCBs at elevated concentrations (19000 ppb). The PCBs were not easily extractable, however - one of the three hexane swabs taken in the tower building did not contain concentrations of PCBs elevated above the US EPA guideline for interior solid surface contamination (10,000 ng/100 cm²).

PCB contamination above the CCME R/P Remediation Criterion in soils near the tower building was localized to the area immediately outside the doorway on the north side of building. Soil PCB concentrations in other areas around the building were elevated relative to background soil concentrations. Elevated concentrations of PCBs in vegetation collected near the tower building suggest that the impact of soil contamination on local biota may be significant and is not limited to plants growing directly in contaminated soil. Paint chips from the building contained elevated levels of PCBs.

iii. Other Organic Contaminants

One assessment soil sample collected in the vicinity of the tower building was analyzed for polychlorinated dibenzodioxins and dibenzofurans (referred to collectively as dioxins). Low level dioxins were detected in sample G6104A, collected outside the doorway on the north side of the building, but the total concentration of dioxins in the soil sample (expressed as 2,3,7,8-TCDD TEQs² = 21 ppt) did not approach the CCME

² TEQs = toxic equivalents which are used to express the concentrations of polychlorinated dibenzodioxins and dibenzofurans collectively, based on their relative toxicities as compared to the most toxic dioxin congener 2,3,7,8-tetrachlorodibenzodioxin.

R/P Remediation Criterion (1000 ppt). PCBs in the same soil sample (9100 ppb) exceeded the CCME R/P Remediation Criteria.

Two soil samples collected at the tower building were analyzed for pesticides. The total concentration of pesticides (2100 ppb) in G6109, collected in a burn stain approximately 13 m south of the building, exceeded both the BC and Québec Level B remediation criteria (2000 ppb). Four of the 22 pesticide analytes were detected in this sample. Three of the four detected pesticide analytes were in the chlordane family of compounds. (Chlordane is a technical mixture of at least 23 components which together form a persistent organochlorine insecticide.) Oxychlordane constituted the bulk of pesticide in this sample, but precise quantification was not possible (reported as NDR 1900 ppb). In addition to oxychlordane, *trans*- and *cis*- chlordane were detected at low levels (96 and 75 ppb, respectively).

The total concentration of pesticides (1600 ppb) in G6104A, collected outside the north-facing doorway, did not exceed the BC (2000 ppb), Québec (2000 ppb) or Netherlands (3000 ppb) Level B remediation criteria. Three of the 22 pesticide analytes were detected in this sample. The widely used insecticide 2,2-*bis*-(*p*-chlorophenyl)-1,1,1-trichloroethane (DDT) and two of its metabolites (1600 ppb), were the only pesticides detected in G6104A. The dominant DDT compound was *p,p'*-DDT, the parent compound (1300 ppb), which exceeded the Netherlands Level B criteria for individual chlorinated pesticides (500 ppb). Concentrations of the metabolic products *p,p'*-DDE (270 ppb) and *p,p'*-DDD (18 ppb) did not approach the applicable criteria.

Two assessment soil samples collected in the vicinity of the tower building were analyzed for polycyclic aromatic hydrocarbons (PAHs). Neither of the samples contained any of the PAH analytes at levels exceeding the CCME R/P or BCMOE Level B remediation criteria.

Alkylated PAH data includes mono- through penta-alkylated isomers of naphthalene, phenanthrene and anthracene combined (for example, C1 phen,anth), and fluoranthene and pyrenes combined (for example, C1 fluor,pyrenes). No criteria presently

exist to address the environmental impact of the alkylated forms of PAHs, and debate surrounding the bioavailability of the various isomers is ongoing. Impact can be assessed by comparing the reported levels of these compounds to those expected under background conditions. The concentrations of alkylated PAHs in assessment soil sample G6109 were generally higher than the concentrations in soils from areas unaffected by inorganic element and PCB contamination. PAHs are only found in areas impacted to some extent by the use of petroleum products; hence their presence reflects a man-made disturbance. For this reason background values for PAHs are not required. Assessment soil sample G6104A did not contain significantly elevated levels of alkylated PAHs.

Pesticide concentrations in soils near the tower building were significantly higher than the applicable criteria. Both of the samples with elevated concentrations of these compounds also contained inorganic elements and/or PCBs at concentrations exceeding the CCME R/P Remediation Criteria. Dioxins and PAHs were detected in soils collected near the tower building, but not at levels requiring remediation.

iv. Asbestos

The concentration of asbestos in the single sample of wall insulation collected from the tower building was below the limit of detection (0.5%).

v. Conclusions

Soils in six locations around the tower building were found to contain at least one contaminant at a concentration exceeding the CCME R/P Remediation Criteria. The inorganic elements lead, zinc and copper were the main contaminants of concern detected in soils near the tower building. Delineation of one area affected by elevated levels of inorganic contaminants through the collection of 23 gridded soil samples was only partly successful, hence further delineation will be required in order to make an accurate estimate of the volume of soil requiring removal. Biota, in the form of plants growing near the tower building, have been shown to be impacted by the presence of high concentrations of lead and zinc. Elevated concentrations of PCBs in all the plant samples collected from the tower building area, but not in the corresponding soils, hint at the great

mobility of these compounds. The paint in the tower building also contains inorganic elements, in particular lead, and PCBs. Recommendations for the demolition of the building remains will be based on the potential for human health impact which this represents. Removal of soils containing elevated concentrations of inorganic elements should effectively remediate the areas affected by elevated concentrations of PCBs and pesticides.

3. *Department of Transport (DOT) Barracks Building*

The DOT barracks building was located in the southern half of the site, north of the tower building approximately 50 m (see Map II-1), marked by a large brick chimney and a concrete foundation (Photograph III-6) forming what would have been a basement (Photograph III-7). Pairs of concrete supports extended out from the foundation to the northeast and may represent the extent of the building when it was intact. Debris was scattered extensively around the building area and included domestic items like tin cans as well as building materials including sheet metal, tar shingles, insulation, piping, wood and pressboard. Much of the debris around the building was partially or completely buried suggesting the area had been worked to some extent. In addition, there was a layer of ash on the substrate surface in the vicinity of the building, suggesting that its demolition may have included burning. The substrate in the vicinity of the barracks building consisted of fine to medium textured sand mixed with rocks and building materials like wood and pressboard. The soil also had an organic component consisting of dried leaves, roots and detritus. In many areas there was a layer of ash over the soil. Vegetation in the vicinity of the building was of moderate density and consisted primarily of early successional species including shrubs like poplars (*Populus balsamifera*, *P. tremuloides*) and willows (*Salix* spp.), and some herbs (*Solidago decumbens*, *Arctostaphylos uva-ursi*). A thin layer of soil supporting growth by moss and fireweed (*Epilobium angustifolium*) has covered the floor of the basement (Photograph III-7).

In all, 14 assessment soil samples including two field duplicates and two 1994 samples were collected in the vicinity of the barracks building (Map III-2). Three plant

samples were obtained at three of the assessment soil sampling locations near the barracks building. The analytical results for samples collected in the vicinity of the tower building appear in Appendix D.

i. Inorganic Elements

Twelve of the 14 assessment soil samples collected in the vicinity of the DOT barracks building were analyzed for inorganic contaminants. As with the tower building, mean concentrations of lead and zinc exceeded the CCME R/P Remediation Criteria. Mean concentrations of all other analytes were below the criteria, and the mean concentrations of cobalt, cadmium and arsenic in soils from around the barracks building were comparable to the means for background soils. Maximum concentrations of copper (130 ppm), nickel (230 ppm), lead (3900 ppm) and zinc (2600 ppm) however were significantly higher than the CCME R/P Remediation Criteria. The maximum concentration of arsenic was equivalent to the CCME R/P Remediation Criterion (30 ppm). Seven soil samples including two field duplicates contained at least one of these elements at concentrations exceeding the criteria. All seven samples were collected in the vicinity of the basement foundation at the south end of the area where the barracks building once stood. Three samples (G6116, G6117A/B) were collected on the west side of the basement foundation west of the base of the chimney. G6116 contained nickel at a concentration (230 ppm) exceeding the CCME R/P Remediation Criterion, while G6117A and G6117B (the field duplicate) contained an average concentration of zinc (760 ppm) which exceeded the criterion (Photograph III-8). G6117B also contained arsenic at a level equivalent to the CCME R/P Remediation Criterion (30 ppm). G6118, collected in a depression at the south end and outside of the building foundation, contained lead (1100 ppm) and zinc (660 ppm) at concentrations exceeding the criteria (Photograph III-9). Lead (ave. 1100 ppm) and zinc (ave. 2500 ppm) were also detected at elevated concentrations in the two samples of moss and debris collected from the basement floor. Sample G6119B also contained 133 ppm copper, a concentration exceeding the CCME R/P Remediation Criterion. Finally, soil sample G6120, collected on the east side of the basement foundation, contained 620 ppm zinc, a concentration exceeding the CCME R/P Remediation Criterion (500 ppm).

Leachate tests were conducted on two assessment soil samples collected in the vicinity of the DOT barracks building. None of the analytes detected were present at concentrations exceeding the Leachate Quality Standards (Regulation 347 Schedule 4, OMOE 1992). Zinc, detected at a concentration two orders of magnitude less than the Leachate Quality Standard, was the only detectable analyte in leachate from soil sample G6117B. No other analytes were present at detectable concentrations. Cadmium and zinc were detected in leachate from one of the soil samples collected from the floor of the basement (G6119B), but both were at levels at least one order of magnitude less than the concentrations outlined in the quality standards.

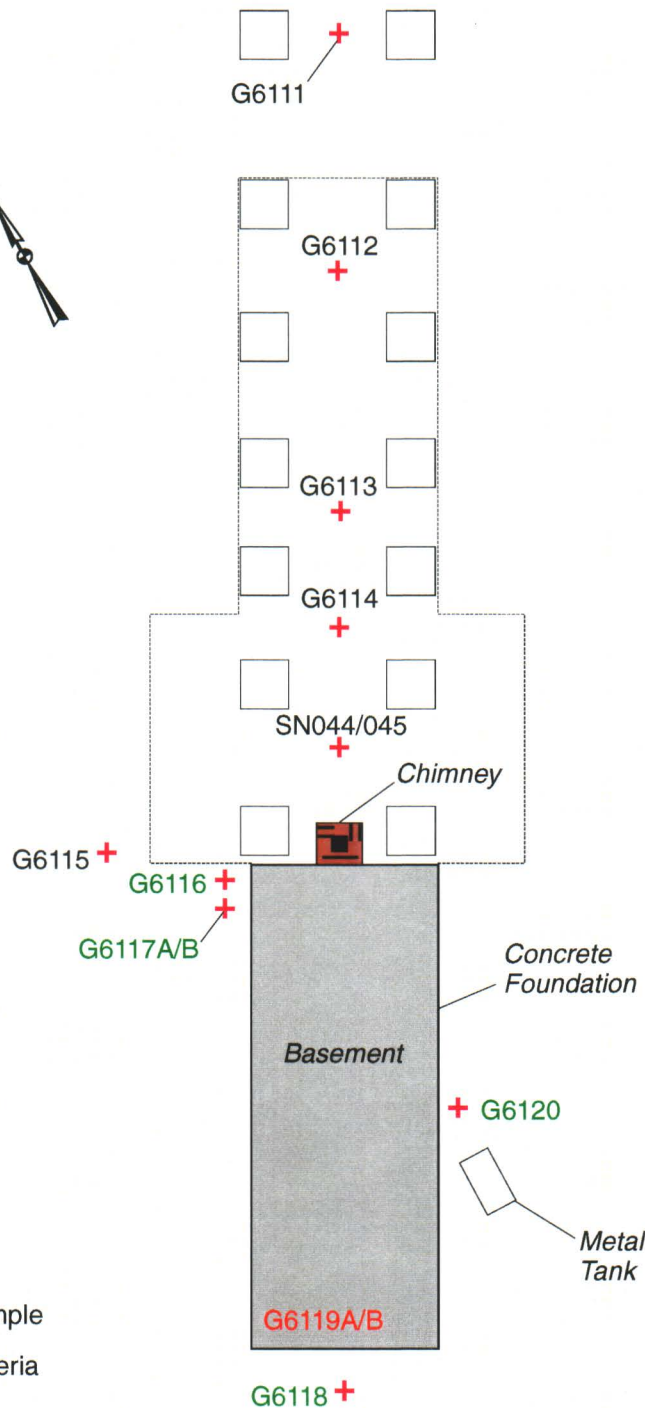


Photograph III-6: Aerial view of the concrete foundation, chimney and pairs of concrete supports marking the former site of the DOT barracks building.



Photograph III-7: DOT Barracks Building basement as viewed from the south.

Map III-2: Sample Locations at the DOT Barracks





Photograph III-8: Samples collected off the west side of the barracks building foundation (G6116, G6117A/B) contained elevated levels of nickel, zinc and arsenic.



Photograph III-9: Soil sample G6118, collected in a depression at the south end of the barracks, contained lead and zinc at concentrations exceeding the criteria.

All three plant samples collected in the vicinity of the DOT barracks were analyzed for inorganic elements. Mean concentrations of all inorganic analytes except zinc were not significantly elevated above the mean calculated for background plants. The mean concentration of zinc in plants collected near the barracks (290 ppm) was 4.5 times that calculated for background plants (64 ppm). The samples were all willow species (*Salix bebbiana*, *Salix exigua*)(G6113P, G6116P and G6118P), and contained zinc at similarly elevated concentrations. It has been shown that species of willow have a tendency to bioconcentrate zinc (ESG 1993a). Of the three associated soil samples, only two were analyzed and one contained 660 ppm zinc, a value which exceeds the CCME R/P Remediation Criterion. Soil sample G6118, collected at the south end of the barracks basement, also contained elevated concentrations of lead (1100 ppm); unlike zinc, lead levels in the soil were not reflected in the plant sample (G6118P, *Salix bebbiana*).

In summary, concentrations of inorganic elements including lead, zinc copper, nickel, and arsenic exceeded the CCME R/P Remediation Criteria in five locations (seven soil samples including two field duplicates) around and in the DOT barracks building basement. Leachate tests conducted on two assessment soil samples indicate that the inorganic soil contaminants are not leachable to a significant degree. Zinc was detected at concentrations above the Impact Criteria in all three plants collected near the building remains.

ii. Polychlorinated Biphenyls

Eleven out of the 14 assessment soil samples collected in the vicinity of the DOT barracks building, including two sets of field duplicates and both the 1994 samples, were analyzed for PCBs. A sample from one area contained PCBs at concentrations requiring remediation. The field duplicates collected at the south end of the basement portion of the building foundation (G6119A and G6119B) contained PCBs at concentrations which exceeded the level (50 ppm) regulated under the CEPA (Photograph III-10). The average concentration of PCBs in the two field duplicates (480 ppm) was 9.5 times the regulation. PCB concentrations in six of the remaining soil samples, although below the applicable

criteria, were higher than mean background soil concentrations. PCBs were not detectable in the soil sample collected at the north end of the area where the barracks building had been (G6111).

All three plant samples collected in the vicinity of the barracks building were analyzed for PCBs. Mean (3.3 ppb) and maximum (4.4 ppb) concentrations of PCBs in plants collected in this area were 33 and 15 times the mean and maximum concentrations in background plants. The lowest PCB concentration (1.6 ppb) in a plant sample collected in the vicinity was 16 times the mean background plant concentration. Although no plants were sampled from the basement where PCB concentrations were in violation of CEPA, plant samples were shown to contain increasing PCB levels with decreasing distance from the basement.

The debris and moss on the floor of the barracks building basement is contaminated with PCBs at a level exceeding that regulated by CEPA. Soil PCB concentrations in the general vicinity of the building foundation exceed background concentrations but not applicable criteria. Elevated concentrations of PCBs in vegetation collected near the barracks building suggest that the impact of soil contamination on local biota is significant and is not limited to plants growing directly in contaminated soil.

iii. Other Organic Contaminants

Two assessment soil samples collected in the vicinity of the barracks building were analyzed for polychlorinated dibenzodioxins and dibenzofurans. Dioxins were detected in both samples. The maximum concentration of dioxins (2,3,7,8-TCDD TEQs = 2600 ppt) in soils collected near the barracks building was detected in one of the samples collected in the basement (G6119A), and exceeded the CCME R/P Remediation Criteria (1000 ppt). The same soil sample contained PCBs at a concentration in violation of CEPA, and soil from this location will therefore be removed. Dioxin concentrations in the second sample (G6114) were comparable to those in background soil samples from previous studies, which have been attributed to long-range aerial transport.



Photograph III-10: PCB concentrations in violation of CEPA and high levels of dioxins were found in soils collected in the barracks basement (G6119A/B).

The assessment soil sample collected in the barracks building basement (G6119A) was analyzed for pesticides in duplicate. The high concentration of PCBs in this sample interfered significantly with the analyses, resulting in very high detection limits. Hence the presence of pesticides in soils from the barracks basement could not be confirmed. This soil will be removed, however, because it contains PCB levels in violation of CEPA.

The soil sample from the barracks building basement was also analyzed for polycyclic aromatic hydrocarbons (PAHs). None of the PAH analytes were detected at levels exceeding the CCME R/P or BCMOE Level B remediation criteria.

In summary, dioxins were detected in the debris from the barracks building basement at concentrations exceeding the CCME R/P Remediation Criteria. The substrate in this area also contains PCBs at concentrations that are in violation of CEPA.

iv. Conclusions

Samples collected in five locations at the south end of the barracks building foundation were found to contain at least one contaminant at a concentration requiring remediation, based on the CCME R/P Remediation Criteria. As was the case for the tower building, inorganic elements were the most common contaminants detected in soil near the barracks. PCBs and dioxins were detected in the debris and moss on the barracks basement floor at concentrations requiring remediation. Biota, in the form of plants growing near the barracks building, have been impacted by the presence of high concentrations of zinc and PCBs in soils in the area.

4. Warehouse

The warehouse was located between the DOT barracks building and the married quarters on the east side of Snag Road (see Map II-1, Photograph III-11). All that remained was the concrete foundation and a set of stairs extending from the southeast side of it. There was evidence of a bay door at the northwest end facing Snag Road. Debris in the area around the building included a pile of transformer plates south of the south corner of the building, and a small tin can which had a large stain associated with it near the west side of the foundation. Metal filings and a grey powdery substance were scattered over the northwest half of the foundation. There was a wooden platform just southeast of the warehouse stairs that may have been a pallet for the storage of materials (Photograph III-12). Wooden slats running southeast from the platform suggested that this area was the site of a temporary storage building like a Quonset hut, in which case, the wooden platform which was painted orange like the stairs may have served as a door stoop. The substrate in the vicinity of the warehouse consisted of medium to coarse sand with organics and rocks mixed in varying amounts. Vegetation in the vicinity of the building, as with much of the rest of the site, consisted primarily of early successional species including shrubs like poplars (*Populus balsamifera*, *P. tremuloides*) and willows (*Salix* spp.), and some herbs (e.g. *Epilobium angustifolium*, *Oxytropis campestris*).

A total of seven assessment soil samples, including one field duplicate, were collected in the vicinity of the warehouse (Map III-3). An additional assessment soil sample (SN046) was collected during the 1994 investigation. Forty-three delineation soil samples were collected from three different locations around the warehouse where it had been determined that inorganic contaminants were present at levels exceeding the CCME R/P Remediation Criteria. Two plant samples were collected near the warehouse foundation. The analytical results for samples collected in the vicinity of the warehouse can be found in Appendix D.

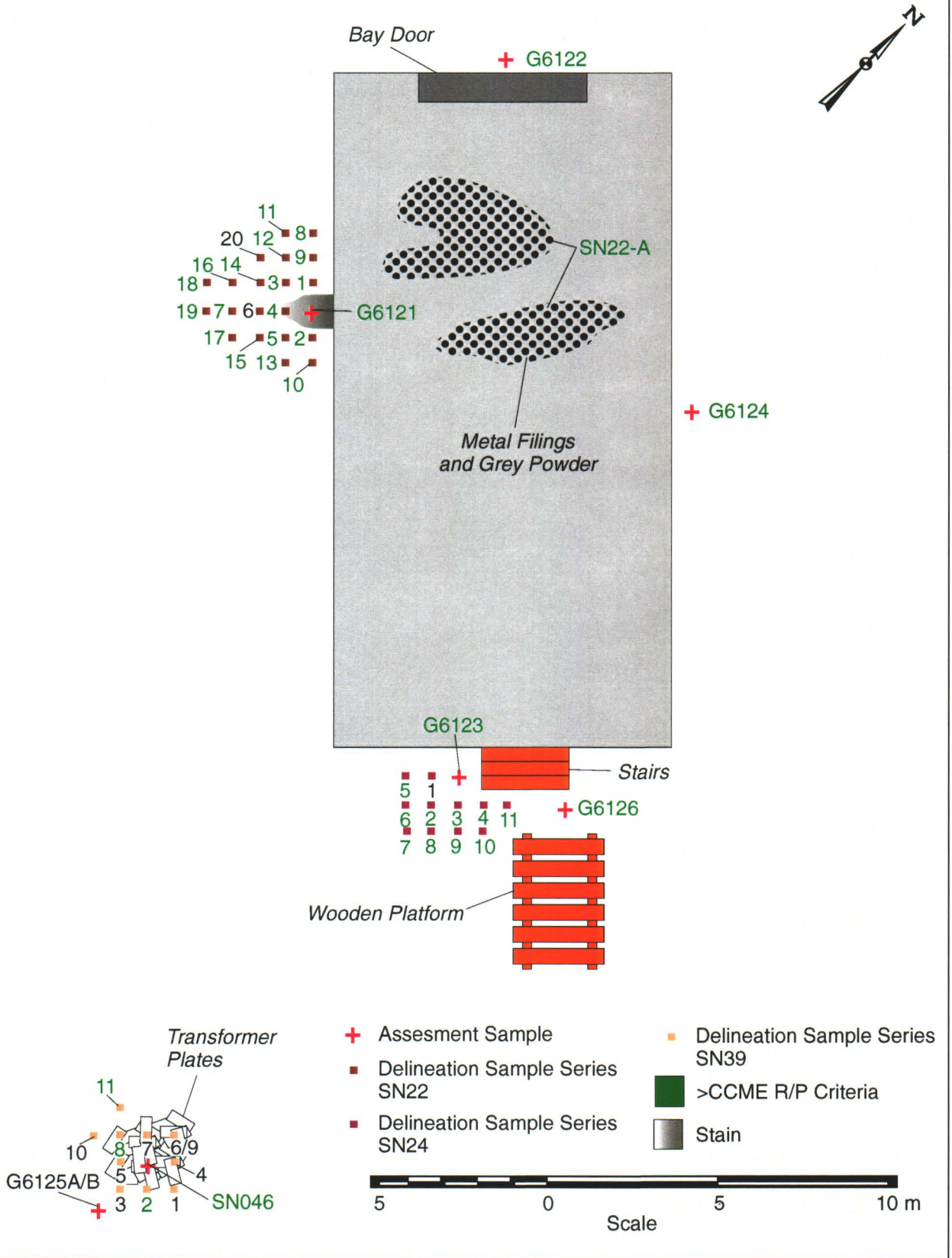


Photograph III-11: Aerial view from the north of the warehouse foundation with Snag Road in the foreground.



Photograph III-12: View from the east of the warehouse foundation with the orange wooden platform in the foreground.

Map III-3: Sample Locations at the Warehouse



i. Inorganic Elements

All seven assessment soil samples from the warehouse vicinity were analyzed for inorganic contaminants. As with samples from both the tower building and the DOT barracks, the warehouse area soil samples contained mean concentrations of lead (10,000 ppm) and zinc (900 ppm) that exceeded the CCME R/P Remediation Criteria. In contrast, though, soil samples collected around the warehouse had a mean concentration of copper (720 ppm) which far exceeded the CCME R/P Remediation Criterion (100 ppm). Mean concentrations of all other analytes were below the criteria, but most were approximately twice the means for background soils. The maximum concentration of chromium (270 ppm) detected in soil samples collected near the warehouse surpassed the CCME R/P Remediation Criterion (250 ppm).

In total, soil from five of the six locations sampled contained at least one inorganic element at a concentration which exceeded the criteria. The two field duplicates (G6125A, G6125B) which did not contain elevated levels of inorganic contaminants were collected some distance from the building, while the remaining samples came from the immediate vicinity of the warehouse foundation. Concentrations of copper, lead and zinc were all elevated in three different locations around the warehouse foundation. G6121, collected in a dark stain off the west side of the foundation, contained concentrations of lead (32,000 ppm), copper (3200 ppm) and zinc (3200 ppm), which were 64, 32 and 6.4 times their respective remediation criteria (Photograph III-13). A sample collected from the east side of the foundation (G6124) also contained lead (28,000 ppm), copper (860 ppm) and zinc (1300 ppm) at higher concentrations than observed elsewhere at the site. Concentrations of lead (5000 ppm), copper (410 ppm) and zinc (1100 ppm) detected in G6126, collected from the north side of the orange platform and adjacent the warehouse stairs, were 10, 4 and 2.2 times the criteria, respectively.

The remaining two assessment soil samples contained lead and copper at concentrations exceeding the CCME R/P Remediation Criteria. Soil collected from under the bay door at the northwest end of the building (G6122) contained concentrations of

lead (1300 ppm) and copper (210 ppm) which were 2.6 and 2.2 times the criteria, while soil sample G6123, from the opposite end of the building near the stairs, contained lead and copper at 8.6 and 2.8 times the levels targeted by the criteria.

Field testing indicated that assessment soil sample G6121 (Tag #22) contained copper, zinc and particularly, lead, at levels exceeding the CCME R/P Remediation Criteria. Therefore 21 delineation soil samples were collected at one metre intervals from a six metre by five metre grid in an attempt to determine the extent of this contamination (Photograph III-14). Twenty out of the 21 delineation soil samples contained lead at very high concentrations. The delineation samples contained as much as 3.7 percent lead (370,000 ppm, SN22-2). Only delineation soil sample SN22-20, collected 3 m west of the stained area, did not contain any of the analytes at concentrations exceeding the criteria, as determined by XRF. Delineation of the total area affected by elevated concentrations of inorganic elements will therefore require the collection of additional samples. Other contaminants detected at levels exceeding the criteria in the area around assessment soil sample G6121 included copper (max. conc. = 23,000 ppm), cadmium (max. conc.= 8.7 ppm), zinc (max. conc. = 35,000 ppm) and arsenic (32 ppm). The light powdery nature of the metal filings and grey powder on the foundation surface suggested these as a possible source of the contamination in the soil at sample location G6121. The sample of the debris from the warehouse foundation surface (SN22-A) did in fact contain highly elevated concentrations of lead (110,000 ppm), copper (23,000 ppm) and zinc (11,000). Cadmium was present in the sample at a concentration (8.7 ppm) which exceeded the CCME R/P Remediation Criterion (5 ppm) as well.

Assessment soil sample G6123 (Tag #24), collected next to the warehouse stairs, was analyzed in the field by XRF and determined to contain copper and zinc at concentrations exceeding the CCME R/P Remediation Criteria. Eleven delineation soil samples were collected in a three metre by five metre grid to determine the extent of the contamination (Photograph III-15). Ten out of 11 delineation samples were analyzed and copper was found to exceed the criterion in all but two samples. Zinc exceeded the

criterion in only one delineation sample (SN24-3), but the concentrations of lead, which was not one of the analytes triggering delineation of G6123, exceeded the criterion in all but one delineation sample (SN24-1). Further sampling will be required to complete the delineation of contamination in this area.

In the preliminary investigation of Snag Airstrip a soil sample collected in a pile of transformer plates located off the southern corner of the warehouse foundation (SN046, Tag #39) was found to contain copper (5800 ppm) and lead (24,000 ppm) at concentrations greatly exceeding the CCME R/P Remediation Criteria. Delineation of the area through the collection of 11 soil samples was undertaken during the 1995 investigation. Three of the delineation samples contained concentrations of copper and lead in excess of the criteria. One of these three (SN39-11) also contained cadmium at a level exceeding the criterion. As illustrated in Map III-3, the area affected by elevated concentrations of these contaminants was not completely outlined by the samples collected, but none of the analytes were detected at a concentration exceeding the criteria in the sample collected at depth (SN39-9), hence the contaminants should be located primarily in the top 10 cm of substrate.

Leachate tests were conducted on two assessment soil samples collected in the vicinity of the warehouse. Lead concentrations exceeded the Leachate Quality Standards in the leachate generated from both samples. Leachate from soil sample G6121 (collected in the stain on the west side of the foundation) contained concentrations of lead (24 mg/L) five times the standard (5.0 mg/L). Copper and zinc were also detected in leachate from G6121, but at levels at least one order of magnitude less than the Leachate Quality Standards. Leachate from G6124, collected on the east side of the foundation, contained lead at a level (48 mg/L) almost 10 times the standard. Cadmium, copper and zinc were the other analytes detected in the leachate from G6124. Their concentrations were all well below the quality standards.

Leachate tests were also conducted on four of the delineation soil samples collected around assessment soil sample G6121. Lead concentrations exceeded the

Leachate Quality Standard (5 mg/L) in leachate from both SN22-10 (690 mg/L) and SN22-19 (86 mg/L).

Both plant samples collected near the warehouse were analyzed for inorganic elements. Concentrations of all inorganic analytes except zinc and cadmium were not significantly elevated above the mean calculated for background plants. The concentration of zinc (190 ppm) in G6122P (*Salix brachycarpa*), collected near the warehouse bay door, was three times that calculated for background plants (64 ppm) and therefore exceeded the Impact Criteria as calculated for Snag Airstrip (128 ppm). The same plant contained 2.4 ppm cadmium, a concentration slightly above the mean background concentration. Cadmium concentrations were elevated but did not exceed the Impact Criteria. It is surprising that there was no evidence of bioconcentration in the vegetation (G6121P, *Shepherdia canadensis*); considering that inorganic analytes were so prevalent in the soil (lead, zinc and copper) at sample location G6121.

In summary, concentrations of inorganic elements including lead, zinc, copper, and chromium, exceeded the CCME R/P Remediation Criteria in six assessment soil samples collected in the vicinity of the warehouse foundation. Attempts at delineation of the areas affected by elevated levels of inorganic contaminants suggest that the entire perimeter of the building may be affected. Soil from two sample locations near the warehouse foundation was classified as hazardous waste based on tests which showed that lead in the soils was leachable to a great extent. Zinc was detected at concentrations above the Impact Criteria in one of the plants collected near the foundation.



Photograph III-13: Soil sample G6121, collected in this stain on the west side of the warehouse, contained very high levels of copper, zinc and leachable lead.



Photograph III-14: Sample pegs indicating the delineation of lead, copper and zinc contamination detected in soil sample G6121 (sample series SN22).



Photograph III-15: Sample pegs indicating the delineation of copper and zinc contamination detected at G6123 (sample series SN24). Delineation sample series SN39 is visible in the background.

ii. Polychlorinated Biphenyls

All seven assessment soil samples collected in the vicinity of the warehouse, including one field duplicate, were analyzed for PCBs. The mean concentration of PCBs in soils from this area (1900 ppb) did not exceed the CCME R/P Remediation Criterion (5000 ppb), but it was four orders of magnitude greater than the mean background soil concentration (0.60 ppb). Soil from one location near the warehouse contained PCBs at a concentration that exceeded the CCME R/P Remediation Criteria - soil sample G6123, collected next to the stairway at the east end of the warehouse foundation, contained 6500 ppb PCBs (Photograph III-16). Samples G6121 and G6124, collected on the south and north sides of the foundation, respectively, contained PCBs at concentrations of 1800 and 4000 times the mean background soil PCB concentration.

Although it was clear that the concentration of PCBs in a third sample (G6126) did not exceed the applicable criteria (5000 ppb), the detection limits for this sample were elevated significantly (<4800 ppb) due to interference from unidentified compounds (further analyses are pending). Total extractable chlorine content of this sample was significantly elevated (720 ppm) suggesting that the source of the interference may be a chlorinated organic compound (Photograph III-17).

The concentrations of PCBs in both plant samples collected in the vicinity of the warehouse foundation exceeded the Impact Criteria calculated for Snag Airstrip (0.2 ppb). G6121P (*Shepherdia canadensis*) and G6122P (*Salix brachycarpa*) contained PCBs at concentrations of respectively 36 times and 22 times the mean background plant concentration.

Soil off the east end of the warehouse foundation contained PCB concentrations exceeding the CCME R/P Remediation Criteria. In other areas around the foundation, soil PCB concentrations were greatly elevated above background concentrations but did not exceed applicable criteria. Vegetation collected near the warehouse was found to contain elevated concentrations of PCBs,

indicating that soil contamination in the general vicinity of the building has had an impact on local biota.

iii. Other Organic Contaminants

Two assessment soil samples collected in the vicinity of the warehouse were analyzed for polychlorinated dibenzodioxins and dibenzofurans. Dioxins were detected in both samples, but not at concentrations exceeding the applicable criteria. Sample G6121 collected in a stain on the south side of the warehouse foundation contained the maximum concentration of dioxins detected in the soils from this area (2,3,7,8-TCDD TEQs = 415 ppt). Dioxin concentrations in the second sample analyzed (G6123, 29 ppt) were two orders of magnitude less than the CCME R/P Remediation Criteria (1000 ppt).

One assessment soil sample collected in the vicinity of the warehouse was analyzed for pesticides. The total concentration of pesticides (230 ppb) in SN046, collected south of the warehouse foundation, did not exceed the BC (2000 ppb), Québec (2000 ppb) or Netherlands (3000 ppb) Level B remediation criteria. Twelve of the 22 pesticide analytes were detected in this sample. The widely used insecticide 2,2-bis-(*p*-chlorophenyl)-1,1,1-trichloroethane (DDT) and five of its metabolites were detected, and constituted 215 ppb of the detected pesticide compounds. The parent compound *p,p'*-DDT was the most abundant form of pesticide found in the sample (150 ppb) but did not exceed the Netherlands Level B criteria for individual chlorinated pesticides (500 ppb). Use of DDT was both common and extensive in the 1950s and 60s due to its effectiveness in killing insect pests, but it was virtually phased out in the 70s. It is likely that it was used in the general area around Snag Airstrip to control mosquitoes.

Two assessment soil samples collected in the vicinity of the warehouse foundation were analyzed for PAHs. Although most of the analytes were detected in both samples none were present at levels which approached or exceeded the applicable CCME R/P or BCMOE Level B remediation criteria.

Dioxins, pesticides and PAHs were detected in soils around the warehouse foundation, but not at levels requiring remediation.

ADDENDUM TO RESULTS SECTION - CHAPTER III¹

4. Warehouse

iii. Other Organic Contaminants (cont'd)

Two additional soil samples collected near the warehouse foundation were analyzed for pesticides. The total concentration of pesticides (860,000 ppb) in G6126, collected beside the wooden platform at the south end of the foundation, exceeded the BC (2000 ppb), Québec (2000 ppb) and Netherlands (3000 ppb) Level B remediation criteria. Seven of the 22 pesticide analytes detected in this sample exceeded the Netherlands Level B remediation criteria for individual chlorinated (500 ppb) and nonchlorinated (1000 ppb) pesticides. Predominant pesticides in this sample were from the Chlordane family of insecticides (850,000 ppb) and included Heptachlor, *trans*-Chlordane, *cis*-Chlordane, *trans*-Nonachlor, *cis*-Nonachlor and Heptachlor Epoxide. The balance of the pesticides detected in soil sample G6126 were DDT and its metabolites (8000 ppb).

Assessment soil sample G6123, collected near sample location G6126, was also analyzed for pesticides, but the total concentration of pesticides in this sample (370 ppb) did not exceed the applicable criteria. This suggests that the pesticide contamination detected in the area represented by soil sample G6126 may be localized.

An open scan qualitative investigation was also made of the fraction 1 extract from soil sample G6126. The results of these analyses suggest a mixture of compounds similar to technical Chlordane were present in the soil sample. Petroleum hydrocarbons (aliphatics and PAHs) were also detected, but at very low levels compared to the pesticide levels.

¹ The following section was added on 11 April 1996 subsequent to the receipt of additional analytical results which were pending at the time of publication of this report (31 March 1996). A total of four addenda have been inserted following pages III-40, IV-4, VI-120 and VI-134.



Photograph III-16: Soil sample G6123 contained PCBs, copper and zinc at concentrations exceeding the criteria.



Photograph III-17: Soil sample G6126 contained unidentified chlorinated organic compounds which interfered with PCB analyses.

iv. Conclusions

Lead, copper and zinc were the most common contaminants detected in the vicinity of the warehouse and were found in soils there at particularly high levels. A total of six areas were found to require remediation based solely on inorganic contaminant levels. Delineation of three of the affected areas was only partly successful, and further sampling will be required to provide a full delineation of the areas. Soil in only one area of this building contained PCBs at a concentration requiring remediation, and the same area also contained inorganic elements at a level exceeding the CCME R/P Remediation Criteria. Local biota have been impacted by elevated levels of zinc and PCBs in the general area of the site as indicated by analyses of plant tissues.

5. Powerhouse and Pump House

The powerhouse and pump house had stood together at the north end of the site on the west side of Snag Road across from the warehouse foundation (see Map II-1). The structures were no longer intact above their foundations (Photograph III-18). The powerhouse foundation was east of the pump house foundation, and characterized by a darkly oil stained generator pad which occupied the southern half of the foundation (Photograph III-19). Part of one of the generators was found just south of the powerhouse, lying next to Snag Road (Photograph III-20). The remnants of a felled chimney lay across the northern half of the foundation. The surface of the concrete foundation was littered with building materials including insulation, pressboard, wood, nails and crumbled concrete. Cement stairs at the southeast corner of the powerhouse marked an entrance to the building. A short extension on the north side of the foundation suggested the former location of a bay door. A low triangular wooden structure which protruded off the west side of the foundation appeared to have provided cover and possibly access to pipes which would have passed between the powerhouse and the pump house.

The pump house consisted of a cement foundation including a basement and a ground-level floor (Photograph III-21). The remnants of some stairs on the north side of

the foundation appeared to have led to a doorway into the pump house. A wooden rectangular box protruding from the north side of the pump house may have served as a utility corridor ('utilidor') for the site's water system. There was a cistern immediately west of the pump house remains, the interior of which was accessible via a man-hole. The pump house basement floor was covered with a layer of moss and a thin layer of soil. Debris including burnt wood, piping, wiring and crumbled cement was also found in the basement. Staining was not evident in the immediate area around the pump house.

The substrate in the vicinity of the remains of the two buildings consisted of medium to coarse sand with many rocks and some organics including roots and detritus mixed in.

Vegetation in the vicinity of the power and pump houses was similar to that around the rest of the site - early successional species consisting of poplars and willows (*Populus* spp. and *Salix* spp.), soap berry (*Shepherdia canadensis*), and herbs (*Oxytropis campestris*, *Epilobium angustifolium*, *Arctostaphylos uva-ursi*). Some plants were even growing directly in the powerhouse foundation. The shrubs around the powerhouse appeared somewhat stunted, but further to the north and northwest they were quite thick and lush.

A total of 31 assessment soil samples, including two field duplicates, were collected in the vicinity of the power and pump houses (Map III-5). Two of the samples (SN047 and SN049) were collected, one at each building, during the 1994 investigation. Thirty-three delineation soil samples were collected from two different locations around the buildings where organic contaminants were present at levels exceeding the CCME R/P Remediation Criteria. A black oily filter was collected from the vicinity of the powerhouse. Four plant samples were collected near the powerhouse foundation. Two water samples were collected in the immediate vicinity of the pump house: one from the cistern (GW6102) and the other from the bottom of the manhole at the end of the 'utilidor' extending north out of the side of the pump house. The analytical results for samples collected in the vicinity of the powerhouse and pump house can be found in Appendix D.



Photograph III-18: Aerial view from the west of the powerhouse and pump house foundations.



Photograph III-19: The oil-stained south half of the powerhouse foundation as viewed from the east.

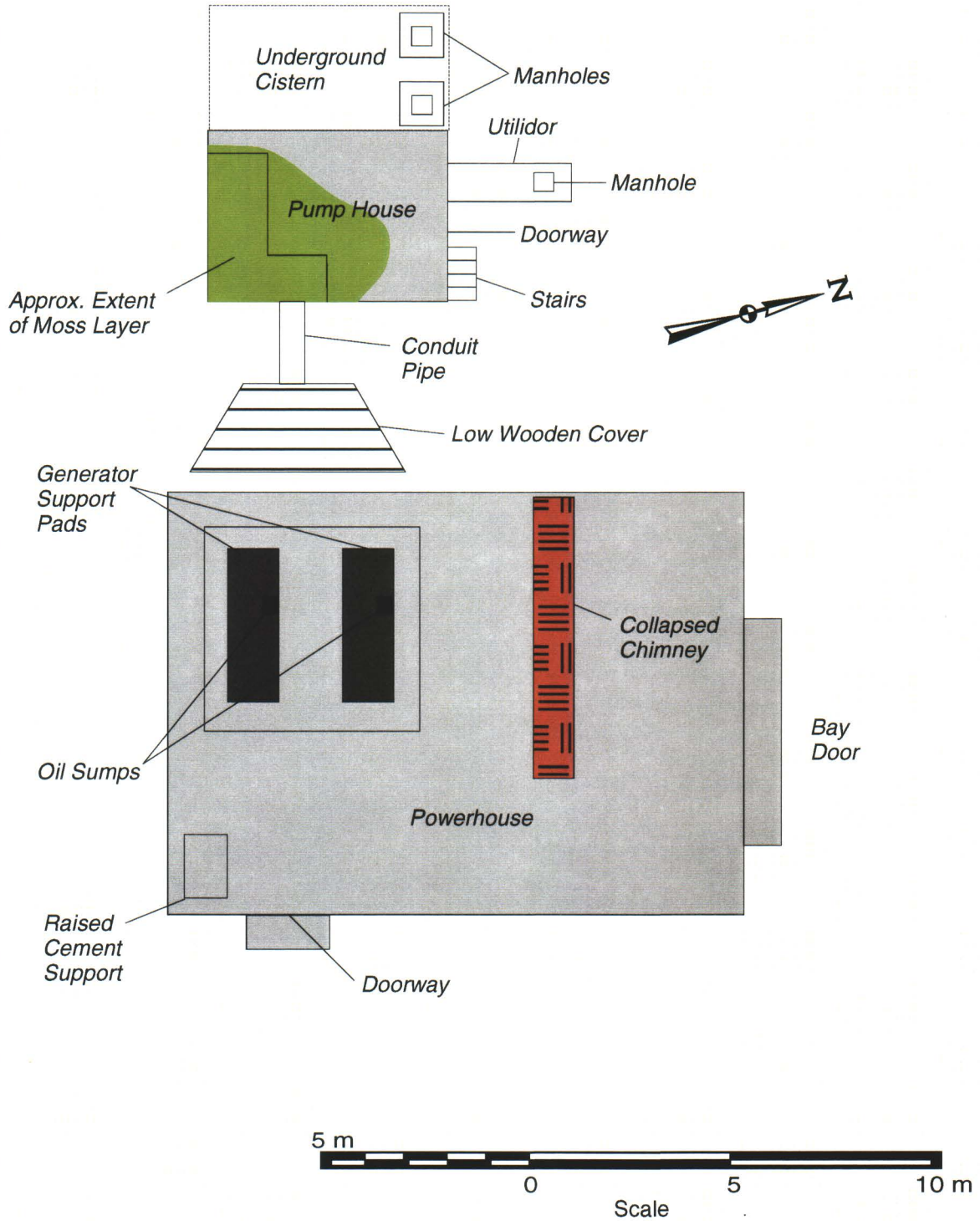


Photograph III-20: Part of one of the generators was found lying on the side of Snag Road just south of the powerhouse.

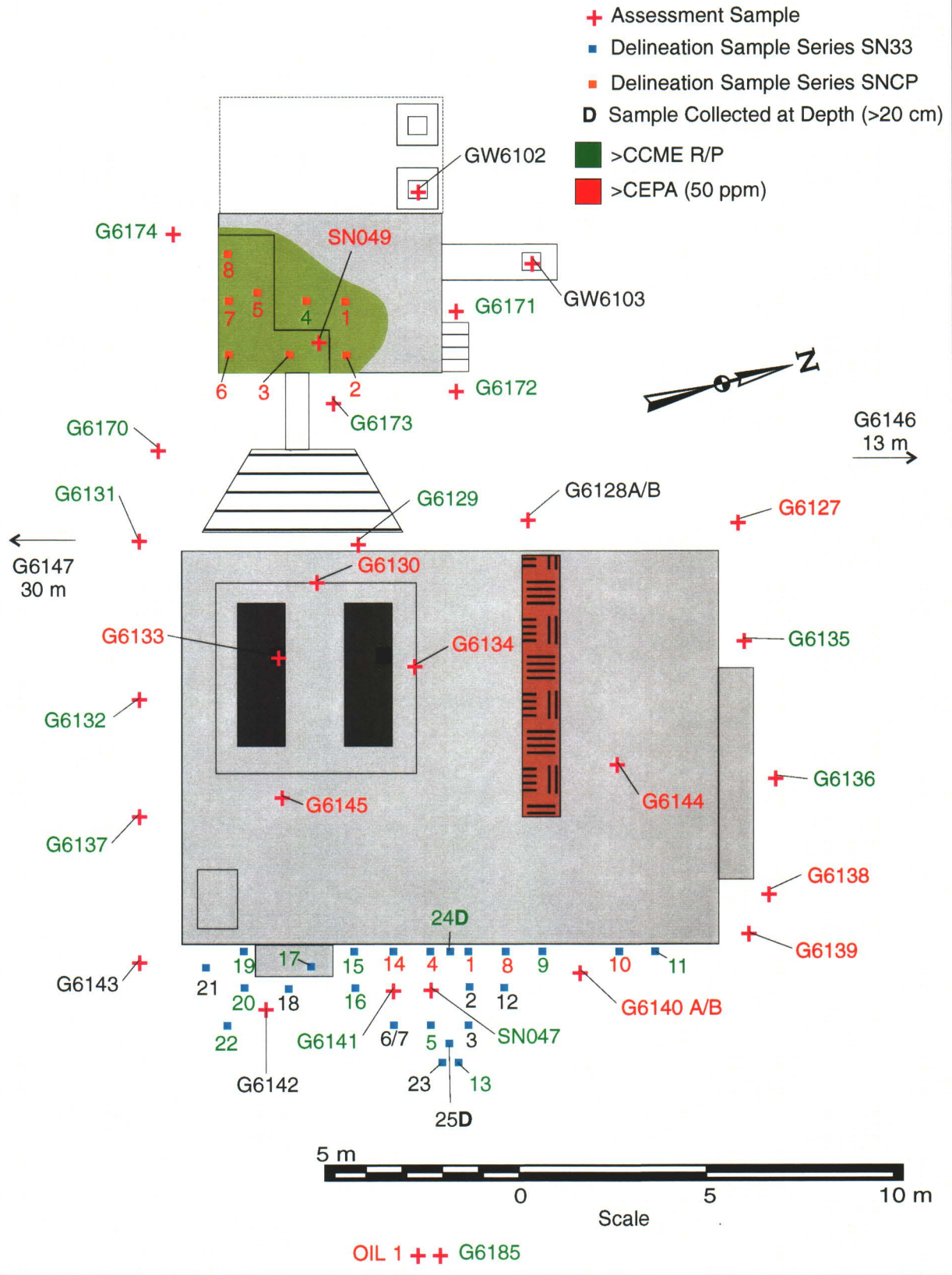


Photograph III-21: The pump house foundation as viewed from the southwest with the opening to its basement visible.

Map III-4: General Layout of the Powerhouse and Pump House



Map III-5: Sample Locations at the Powerhouse and Pump House



i. Inorganic Elements

Twenty-nine of the 31 assessment soil samples collected in the vicinity of the power and pump houses were analyzed for inorganic contaminants. Mean concentrations of zinc (660 ppm) and copper (130 ppm) in soils collected near these buildings exceeded the CCME R/P Remediation Criteria. Mean concentrations of all other analytes were lower than the criteria, but most were significantly higher than the means for background soils. In addition to those elements whose mean concentrations exceeded the CCME R/P Remediation Criteria, cadmium (13 ppm), lead (1800 ppm) and chromium (460 ppm) were also found at concentrations exceeding the criteria in soil samples from this area.

In total, soil from eleven locations sampled contained at least one inorganic element at a concentration which exceeded the criteria. Samples of the black oily sludge around the generator support pads (G6130, G6133 and G6134) contained concentrations of zinc (ave. 2500 ppm), copper (ave. 490 ppm), lead (ave. 1600 ppm) and cadmium (ave. 9.6 ppm) which were 5, 4.9, 3.2 and 2 times their respective remediation criteria. In addition, the sludge collected from the oil-collection pits (G6133 and G6134) contained chromium at concentrations (460 and 320 ppm, respectively) which were 1.8 and 1.3 times the CCME R/P Remediation Criterion. The loose debris scattered on the surface of the powerhouse foundation contained concentrations of lead, zinc and copper which exceeded the criteria. Six soil samples from the north and east sides of the powerhouse (G6135, G6136, G6139, G6140A&B, G6141) contained elevated concentrations of zinc, lead, copper and nickel.

Assessment soil samples collected from around the pump house were not contaminated by inorganic elements to the same degree as those collected in the vicinity of the powerhouse. One assessment sample, G6172, collected from the top of the stairs to the pump house door, contained copper at a concentration (130 ppm) that exceeded the CCME R/P Remediation Criterion (100 ppm). Concentrations of all other elements were below the criteria in the assessment soils collected from this area.

One of the two assessment soil samples from the previous year's investigation contained elevated levels of inorganic elements. Assessment soil sample SN049 contained copper (220 ppm), nickel (420 ppm), lead (640 ppm), zinc (2100 ppm) and chromium (710 ppm) at levels exceeding the CCME R/P Remediation Criteria. Due to the added presence of highly elevated levels of PCBs in soil sample SN049, delineation of this sample was done using PCBs as an indicator. Delineation of the area around assessment soil sample SN047 (Tag #33), collected on the east side of the powerhouse foundation, was undertaken because the sample contained high levels of PCBs. Out of 25 delineation soil samples, 10 were analyzed for inorganic elements as well as PCBs. Fifty percent of the samples were found to contain levels of lead, copper or zinc exceeding the CCME R/P Remediation Criteria.

Ten of the 33 delineation soil samples were analyzed for inorganic elements in addition to PCBs. Half of the analyzed samples contained at least one inorganic analyte at a concentration exceeding the criteria. All but one sample (SN33-13) also contained PCBs at concentrations exceeding the criteria.

Leachate tests were conducted on three assessment soil samples collected in the vicinity of the powerhouse. None of the analytes were detected at concentrations exceeding the Leachate Quality Standards.

A used engine oil filter found off the east side of the powerhouse foundation was collected for oil analysis. Lead (29 ppm) and cadmium (0.6 ppm) were detected in the extracted oil.

All four plant samples collected near the powerhouse were analyzed for inorganic elements. Concentrations of all inorganic analytes except zinc were not significantly elevated from the mean calculated for background plants. The mean concentration of zinc calculated for the plants from around the powerhouse (220 ppm) was 3.4 times that detected in background plants. Zinc concentrations were higher than the Impact Criteria in three out of the four plant samples. Only one of the corresponding soil samples

contained zinc at a concentration comparable to the CCME R/P Remediation Criterion. The zinc content in all the other corresponding soils was much lower than the criterion.

One of the water samples collected in the vicinity of the pump house - GW6103, collected from the manhole at the end of the utilidor - was analyzed for inorganic elements. Zinc was the only analyte detected and its concentration (2.4 ppm) did not approach the CCME Assessment Criterion (50 ppm).

In summary, concentrations of inorganic elements including zinc, lead, copper, cadmium and chromium, exceeded the CCME R/P Remediation Criteria in eleven locations around the powerhouse and pump house foundations. Leachate from three soil samples collected near the powerhouse did not contain elevated concentrations of any of the inorganic analytes. Zinc was detected at concentrations above the Impact Criteria in three of the plants collected near the powerhouse foundation.

ii. Polychlorinated Biphenyls

All 31 assessment soil samples collected in the vicinity of the power and pump houses, including two field duplicates and two 1994 samples, were analyzed for PCBs. The mean concentration of PCBs in soils from this area (200,000 ppb) exceeded both the CCME R/P Remediation Criterion (5000 ppb) and the level regulated under CEPA (50,000 ppb). Ten assessment soil samples were found to contain PCBs in violation of the CEPA regulation; these were scattered over the entire area formerly occupied by the two buildings (see Map III-5). CEPA level PCBs were detected in both debris on the powerhouse foundation surface and soils around it as well as in the pump house basement (Photograph III-22). Twelve assessment soil samples collected around the two buildings contained concentrations of PCBs exceeding the CCME R/P Remediation Criterion but less than the level regulated under CEPA.

All 33 delineation soil samples were analyzed for PCBs. Eight of these (SNCP delineation sample series) were collected to characterize the PCB contamination found in

1994 in the pump house basement (sample SN049, 450,000 ppb). Virtually all of the debris and moss in the basement contained PCBs at a level in violation of CEPA. Seven of the pump house delineation soil samples contained greater than 50,000 ppb PCBs and the concentration of PCBs in the remaining sample (SNCP-4) exceeded the CCME R/P Remediation Criterion (5000 ppb).

PCB results for the 1994 assessment soil sample SN047 exceeded the CCME R/P Remediation Criterion. Twenty-five delineation soil samples (SN33 delineation sample series) were collected in this area in an attempt to delineate the total area affected by the elevated PCB concentrations (Photograph III-23). PCB concentrations decreased with increasing distance from the edge of the foundation and with depth. Five of the 25 delineation soil samples collected immediately next to and in the middle of the east side of the powerhouse foundation contained PCBs at concentrations in violation of CEPA. Ten of the delineation soil samples contained concentrations of PCBs above the CCME R/P Remediation Criterion. The bulk of these were collected between one and two metres from the foundation or at either end of the east side of the foundation. SN33-24D, collected at depth from the area affected by levels of PCBs violating CEPA contained PCBs at a concentration which only exceeded the CCME R/P Criteria. PCBs were not detected (detection limit of 1.0 ppm) in the sample collected at depth further out from the foundation (SN33-25D).

All four plant samples collected in the vicinity of the powerhouse foundation were analyzed for PCBs. The mean concentration of PCBs (120 ppb) in plants collected in this area was 1200 times the mean background plant concentration. The maximum concentration of PCBs (230 ppb) detected in a plant sample from the powerhouse area (G6135P, *Epilobium angustifolium*) was 767 times that detected in a background plant (0.30 ppb). The minimum concentration of PCBs detected in a plant sample from this area (44 ppb) was 440 times greater than the minimum background plant concentration, and was detected in some soapberry (*Shepherdia canadensis*, G6131P) collected off the southwest corner of the foundation. Three of the four soil samples collected in the same location as the plant samples contained PCBs at concentrations exceeding the CCME R/P Remediation Criterion, while PCB concentrations in the fourth soil sample violated CEPA (G6139).



Photograph III-22: Oily sludge on the powerhouse foundation contained PCBs at concentrations exceeding the level regulated by CEPA.



Photograph III-23: Pegs indicating the delineation of contamination on the eastern side of the powerhouse foundation (sample series SN33).

Both water samples collected in the vicinity of the powerhouse and pump house were analyzed for PCBs. Although the concentration of PCBs in GW6103 (340 ppt), collected from the manhole at the end of the utilidor, exceeded the CCME Assessment Criterion for PCBs in water (100 ppt), it did not exceed the Canadian Drinking Water Quality Criterion (3000 ppt). The concentration of PCBs in GW6102 (2.9 ppt), collected in the cistern behind and west of the pump house, was two orders of magnitude less than the CCME Assessment Criterion for PCBs in water (100 ppt).

The area around the power and pump houses is highly contaminated with PCBs. Concentrations of PCBs exceeding the level regulated by CEPA were detected in 12 of the delineation soil samples and ten of the assessment soil samples. Soils containing PCBs in violation of CEPA were generally located closer to the building foundations. Soil PCB concentrations exceeding the CCME R/P Remediation Criteria were found in 12 each of the delineation and assessment soil samples around both the buildings. Vegetation collected near the powerhouse was found to contain elevated concentrations of PCBs which indicates that soil contamination in the general vicinity of the building has had an impact on local biota.

iii. Other Organic Contaminants

Two assessment soil samples collected in the vicinity of the powerhouse were analyzed for polychlorinated dibenzodioxins and dibenzofurans. Dioxins in both cases were proportional to PCBs. The first, a sludge sample G6133 taken from an oil drainage pit in the generator support pad, contained 200,000 ppb PCBs, and in addition contained dioxins at a concentration (2,3,7,8-TCDD TEQs =1068 ppt) which exceeded the CCME R/P Remediation Criterion for dioxins in soil (1000 ppt). The second, a soil sample (G6141) in which only 120 ppb PCBs were detected, contained dioxins at a correspondingly low concentration - not significantly elevated from the level expected to be present in a background soil sample (2,3,7,8-TCDD TEQs =6.1 ppt).

Two assessment soil samples collected in the vicinity of the power and pump houses were analyzed for pesticides. The total concentration of pesticides (505 ppb) in

SN049, collected in the pump house basement, did not exceed the BC (2000 ppb), Québec (2000 ppb) or Netherlands (3000 ppb) Level B remediation criteria. Four of the 22 pesticide analytes were detected in this sample. The most abundant of these was *trans*-Nonachlor, one of the compounds in the commercial mixture Chlordane. G6133 was also analyzed for pesticides, but interference likely caused by the high concentration of PCBs in this sample (200,000 ppb) resulted in very high detection limits for most of the pesticide analytes. Any pesticides present in this area will be effectively removed when the soils violating CEPA are removed.

G6133 was also analyzed for PAHs. Although the concentrations of most of the analytes were above that expected for a background soil, none exceeded the applicable CCME R/P or BCMOE Level B remediation criteria.

In summary, dioxins were detected at a concentration exceeding the CCME R/P Remediation Criterion in the PCB-contaminated sludge collected from the oil collection pit in the generator support pad. A second soil sample containing much lower concentrations of PCBs did not contain elevated concentrations of dioxins. Pesticides were detected in a soil sample collected in the pump house basement, but not at levels requiring remediation.

iv. Conclusions

PCBs are the main contaminant of concern detected in the vicinity of the powerhouse and pump house and are present at concentrations in violation of the Canadian Environmental Protection Act near both buildings. Soil in four different areas around the powerhouse contained PCBs in excess of the level regulated by CEPA. Zinc, lead and copper were also very common contaminants detected in the vicinity of these two buildings. Their distribution in the area was more ubiquitous than that of PCBs. Concentrations of PCBs and zinc were elevated in vegetation in the area suggesting that local biota have been impacted by their presence in soils in this area.

6. Fire Hall

The fire hall, one of three buildings still standing at Snag Airstrip, was located on the western side of the site, immediately north of the garage foundation (Photograph III-24). It was one of the smaller buildings at the site with dimensions approximately 12 m by 12 m, built with wooden planks under white slate shingles, and a wooden tar shingled roof. There were two doorways, one large and one regularly sized, on the east side of the building. The interior had been partially gutted with only a wooden shelf on the west wall remaining. The interior walls were of painted pressboard, with insulation between them and the wooden exterior wall. The substrate in the vicinity of the fire hall differed from much of the rest of the site in that it was of coarse sand and rocks. Some staining was evident in the area surrounding the building, but the oily sheen present on the rocks around the building was evidently caused by balsam dripped from the poplars in the area (Photograph III-25). Vegetation in the vicinity of the building was of moderate density and consisted primarily of early successional species including shrubs like poplars (*Populus balsamifera*, *P. tremuloides*) and soapberry (*Shepherdia canadensis*) and some herbs (for example, *Oxytropis campestris*, *Epilobium angustifolium*).

A total of six assessment soil samples, including one field duplicate, were collected in the vicinity of the fire hall (Map III-6). In addition, three hexane swabs were taken from part of the interior north wall of the building. Samples each of pressboard and insulation were collected from the interior of the fire hall for asbestos analysis. The analytical results for samples collected in the vicinity of the fire hall appear in Appendix D.

i. Inorganic Elements

Five of the six assessment soil samples collected in the vicinity of the fire hall were analyzed for inorganic contaminants. Mean concentrations of all inorganic analytes were below the CCME R/P Remediation Criteria, but the mean concentrations of nickel, lead, zinc and chromium were 2, 20 and 4 times their respective mean background soil concentrations. Only the maximum concentration of zinc (960 ppm) was significantly

elevated above the CCME R/P Remediation Criterion (500 ppm) and this occurred in only one sample (G6152) collected in a burn stain located approximately 12 m east of the front of the fire hall.

Leachate tests were conducted on assessment soil sample G6152. No analytes were present at concentrations exceeding the Leachate Quality Standards (Regulation 347 Schedule 4).

In summary, in the fire hall area, zinc was the only element that exceeded the CCME R/P Remediation Criteria and was detected above this level in only one sample some distance (12 m) from the building. Leachate tests on this soil sample indicated that neither the zinc nor any of the other inorganic analytes are leachable to a significant degree.

ii. Polychlorinated Biphenyls

Four of the five assessment soil samples collected in the vicinity of the fire hall, including one field duplicate, were analyzed for PCBs. The mean concentration of PCBs (22 ppb) did not approach the CCME R/P Remediation Criterion (5000 ppb). The mean was however 37 times greater than the mean background soil concentration. None of the soil samples collected at the fire hall contained PCBs at a concentration which exceeded the criterion.

The PCB concentration in leachate collected from assessment soil sample G6152 was below the level of detection (0.001 mg/L).

One of the three swabs (SN-04) taken in the fire hall was analyzed for PCBs. There were no detectable PCBs in the sample.

Concentrations of PCBs in soils collected around the fire hall did not exceed the CCME R/P Remediation Criterion, but were higher than background soil concentrations. The interior surface of the building walls did not contain detectable extractable amounts of PCBs.

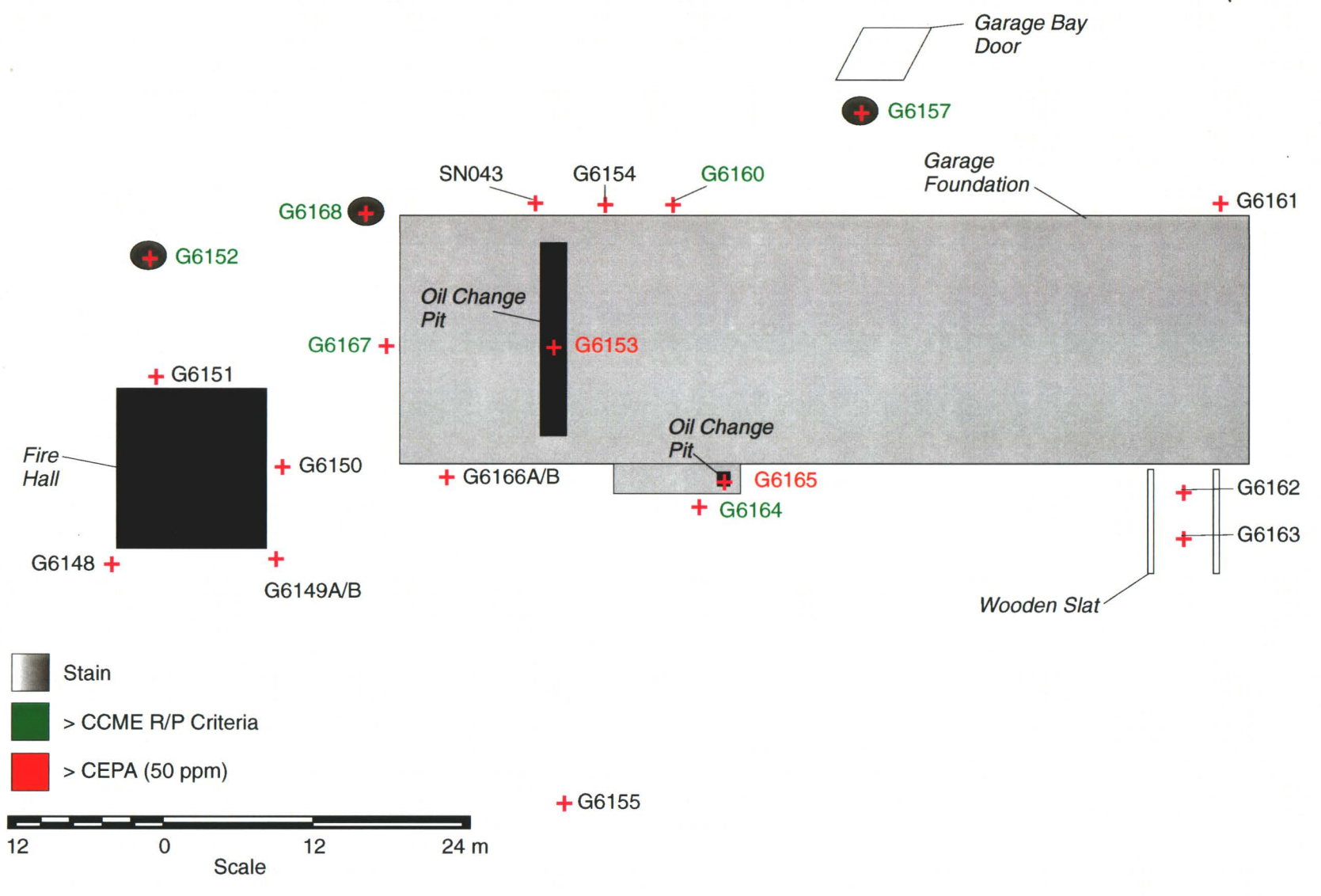


Photograph III-24: Aerial view from the east of the fire hall next to the garage foundation.

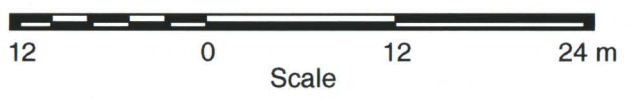


Photograph III-25: The oily sheen on the rocks around the fire hall was evidently caused by balsam dripping off the poplars growing in the area.

Map III-6: Sample Locations at the Garage and Fire Hall



-  Stain
-  > CCME R/P Criteria
-  > CEPA (50 ppm)



iii. Other Organic Contaminants

One soil sample collected in the vicinity of the fire hall (G6150) was analyzed for polycyclic aromatic hydrocarbons (PAHs). The sample did not contain any of the PAH analytes at levels exceeding the applicable criteria.

In summary, PAH concentrations near the fire hall did not exceed the applicable criteria.

iv. Asbestos

Two samples of building materials were collected for asbestos analysis from the interior of the fire hall. Levels of asbestos in the samples of insulation and pressboard were below the limit of detection (0.5%).

v. Conclusions

Soil samples collected from the area around the fire hall are comparatively unimpacted by human activities undertaken at the site. Only one soil sample collected in a burn stain contained zinc at a concentration which exceeded the CCME R/P Remediation Criterion. Concentrations of all other analytes, inorganic and organic, were well below the applicable criteria.

7. Garage

The garage was situated adjacent to the fire hall north of the Alaska Highway access road (see Map II-1). The only remaining evidence of the building's presence was its concrete foundation and a wooden garage door which lay just east of the foundation. A large oil-change pit at the north end of the foundation provided further evidence of the function of the building while this site was active. The building appeared to have had a number of bay doors on both its east and west sides, and a second smaller oil-change pit in a concrete extension to the west side of the building. Debris in the area included sheet metal fan hoods, bolts, nails, electrical equipment, and wood, as well as a large number of small circular pieces of rusted metal that were scattered all over the surface of the foundation. The substrate in the vicinity of the garage consisted of fine sand with roots and rocks mixed with varying amounts of organic material. Large patches of soapberry (*Shepherdia canadensis*) had become well established on the edges of the foundation and were beginning to cover it. Much of the vegetation in the area comprised shrubs like poplars (*Populus balsamifera*, *P. tremuloides*), and early successional herbaceous species like broad-leaved willow herb (*Epilobium angustifolium*), yellow oxytrope (*Oxytropis campestris*) and cinquefoils (*Potentilla* spp.).

A total of 14 assessment soil samples, including one field duplicate, were collected in the vicinity of the garage (Map III-6). An additional assessment soil sample (SN043) was collected during the 1994 investigation. Four plant samples were collected near the garage foundation. The analytical results for samples collected in the vicinity of the warehouse can be found in Appendix D.

i. Inorganic Elements

All 15 assessment soil samples collected from the vicinity of the garage were analyzed for inorganic contaminants. Mean concentrations of lead (760 ppm) and zinc (1400 ppm) in soils collected in 1995 were above the CCME R/P Remediation Criteria. Soil samples collected around the garage had a mean concentration of copper (98 ppm)

which approached the CCME R/P Remediation Criterion for that element (100 ppm). Although mean concentrations of all other analytes were below the criteria, most were at least twice the means for background soils. The maximum concentrations of copper (410 ppm), nickel (120 ppm), cadmium (19 ppm) and chromium (900 ppm) detected in soil samples collected near the garage surpassed the CCME R/P Remediation Criteria, and the maximum concentration of arsenic (29 ppm) approached the CCME R/P Remediation Criterion (30 ppm). Inorganic element concentrations in the assessment soil sample collected during the previous year's investigation (SN043) did not exceed the CCME R/P Remediation Criteria.

Soil from a total of six locations around the garage foundation contained at least one inorganic element at a concentration which exceeded the CCME R/P Remediation Criteria. All six soil samples contained zinc at concentrations which exceeded the criterion (500 ppm). Lead was elevated above the criterion in five samples, and copper in four. Cadmium and chromium were detected at concentrations exceeding the CCME criteria in only one sample (G6165). Both the samples collected from the oil-change pits (G6153 and G6165) contained elevated levels of zinc, lead and copper. The smaller of the two pits on the west side of the foundation also contained cadmium and chromium at concentrations requiring remediation. The pile of ash found next to the garage bay door on the east side of the garage (G6157) also contained lead (1700 ppm), zinc (1600 ppm), nickel (120 ppm) and copper (110 ppm) at concentrations exceeding the criteria (Photograph III-26). The three remaining soil samples containing elevated concentrations of inorganic elements (G6160, G6164 and G6167) were located midway along the east, west and north sides of the foundation, respectively.

Assessment soil samples G6153 and G6164 were tested for leachability of the contaminants they contained. None of the inorganic analytes were present at levels exceeding the Leachate Quality Standards.

All four plant samples collected near the garage were analyzed for inorganic elements. None of the inorganic analytes had mean concentrations significantly higher

than the mean calculated for background plants, with the exception of lead and zinc. The mean concentrations of lead (26 ppm) and zinc (360 ppm) were 6.5 and 5.6 those of background plants, respectively. Plant samples from two locations in the vicinity of the garage foundation contained inorganic elements at concentrations which exceeded the Impact Criteria calculated for Snag Airstrip. The first sample G6153P (*Salix brachycarpa*), collected in the large oil-change pit situated within the foundation, contained both lead (83 ppm) and zinc (1100 ppm) at concentrations exceeding the Impact Criteria. The soil sample collected in the same location contained lead, zinc and copper at concentrations exceeding the CCME R/P Remediation Criteria for soils. The second, a plant sample collected at the south end of the garage foundation (G6161P, *Populus balsamifera*), was found to contain zinc at a concentration (310 ppm), 2.4 times the Impact Criteria, although the soil collected at the same location (G6161) did not contain any inorganic analytes at concentrations exceeding the CCME R/P Remediation Criteria.

In summary, concentrations of inorganic elements including zinc, lead, copper, cadmium and chromium exceeded the CCME R/P Remediation Criteria in six out of 15 assessment soil samples collected in the vicinity of the garage foundation. Zinc and lead were detected at concentrations above the Impact Criteria in two plants collected near the foundation.



Photograph III-26: A sample of ash and soil collected from beside the garage bay door (G6157) contained lead, zinc, nickel and copper at levels exceeding the criteria.

ii. Polychlorinated Biphenyls

All 15 assessment soil samples collected in the vicinity of the garage, including one field duplicate and one 1994 sample, were analyzed for PCBs. Five assessment soil samples contained PCBs in excess of the CCME R/P Remediation Criterion (5000 ppb), and two of these contained PCBs in violation of the CEPA regulation (see Map III-6). Assessment soil sample G6153, a composite sample of debris and moss collected from the large oil-change pit at the north end of the garage foundation, contained a PCB concentration (2,800,000 ppb) 56 times the level regulated by CEPA (Photograph III-27). Soil sample G6165, collected in a second smaller oil-change pit on the west side of the garage foundation, contained a concentration of PCBs of 1,300,000 ppb, which was 26 times the CEPA regulation. The three samples containing PCBs in excess of the CCME R/P Remediation Criterion were located on the west and north sides of the garage foundation. One was collected from a black stain off the northeast corner of the foundation (G6168).

Two assessment soil samples (G6153 and G6164) were tested for the leachability of the contaminants they contained. PCBs were below the limit of detection (0.001 mg/L) in both leachate samples.

All four plant samples collected in the vicinity of the garage foundation were analyzed for PCBs. All contained PCBs at concentrations exceeding the Impact Criterion calculated for Snag Airstrip (0.2 ppb). The maximum concentration of PCBs (7000 ppb) detected in a plant sample from the vicinity of the garage (G6153P, *Salix brachycarpa*) was extremely high. This sample was collected from within the larger oil-change pit where it was growing in PCB-contaminated moss-covered debris. G6164P (*Shepherdia canadensis*) was growing in soil contaminated by PCBs at a level exceeding the CCME R/P Remediation Criterion, and contained the second highest concentration of PCBs in a plant collected near the garage (30 ppb). The remaining two plant samples exceeding the Impact Criteria (G6161P and G6162P) were collected from areas where the soil PCB concentrations did not exceed any of the applicable criteria.

The two garage oil-change pits are highly contaminated with PCBs. Both soil samples collected from these locations contained PCB concentrations exceeding the level regulated by CEPA. Soil PCB concentrations exceeding the CCME R/P Remediation Criteria were found in three assessment soil samples collected from around the garage foundation. Leachate tests confirmed that the PCBs in the soils were not leachable to a significant extent. Vegetation collected near the garage was found to contain elevated concentrations of PCBs. PCB concentrations in vegetation from two locations where soils were not significantly contaminated with PCBs exceeded the Impact Criteria, indicating that soil contamination in the general vicinity of the site has had an impact on local biota.

iii. Other Organic Contaminants

One assessment soil sample (G6153) collected in the vicinity of the garage was analyzed for polychlorinated dibenzodioxins and dibenzofurans. The concentration of dioxins in this sample, a composite from an oil-change pit in the garage foundation containing 2800 ppm PCBs, contained dioxins at a concentration (2,3,7,8-TCDD TEQs = 7182 ppt) which exceeded the CCME R/P Remediation Criterion for dioxins in soil (1000 ppt).

The same sample analyzed for dioxins (G6153) was also analyzed for pesticides. The total concentration of pesticides (5700 ppb) in the sample of material from the bottom of the oil-change pit exceeded the BC (2000 ppb), Québec (2000 ppb) and Netherlands (3000 ppb) Level B remediation criteria. Six of the 22 pesticide analytes were detected in this sample. Five out of six of the compounds detected were part of the DDT family of compounds and constituted 4800 ppb of the detected pesticide compounds. The parent compound *p,p'*-DDT was the most abundant form of pesticide found in the sample (2900 ppb), and its concentration exceeded the Netherlands Level B criterion for individual chlorinated pesticides (500 ppb). The concentration of the DDT metabolic product *p,p'*-DDE (1300 ppb) was 2.6 times the Netherlands criterion.



Photograph III-27: Debris from the larger oil-change pit at the garage (G6153) contained high levels of PCBs, dioxins, pesticides, PAHs and inorganic elements.

One other pesticide analyte, oxychlordane of the chlordane pesticide mixture, was identified in G6153, but because the sample contained very high concentrations of PCBs, these were not possible to quantify precisely. The concentration of oxychlordane in the sample was reported as NDR (950) ppb, and likely exceeded the Netherlands criterion, but the precision of the result was reduced by analytical interference. The detection limit for the pesticide heptachlor (>1000 ppb) was higher than the applicable criterion (500 ppb) which made it impossible to confirm whether or not the criterion was exceeded.

Assessment soil sample G6153, collected in the larger oil-change pit, was also analyzed for PAHs. As expected for a sample with these origins the concentrations of 11 of the PAH compounds exceeded the applicable CCME R/P or BCMOE Level B remediation criteria.

In summary, dioxins were detected at a concentration exceeding the CCME R/P Remediation Criterion in the highly PCB-contaminated debris collected from the oil-change pit in the garage foundation. Pesticides and PAHs were also detected in the same sample at concentrations requiring remediation.

iv. Conclusions

The oil-change pits at the garage contain PCBs, dioxins, pesticides, PAHs and inorganic contaminants at concentrations exceeding, in some cases by several orders of magnitude, the applicable criteria. PCBs are present in the pits at concentrations violating the Canadian Environmental Protection Act. There are isolated areas of PCB and inorganic contamination at levels exceeding the CCME R/P Remediation Criteria around the periphery of the building foundations. Concentrations of PCBs, zinc and lead were elevated in vegetation in the area suggesting that local biota have been impacted by the presence of contaminants in soils in this area.

8. Dump

The dump was located approximately 1 km southwest of the building facilities associated with Snag Airstrip at the end of a short access road (see Map II-1). The area was situated on a south-facing moderate slope and appeared to have covered approximately 900 m² (Photograph III-28). In spring of 1995 most of the metallic debris from the dump was removed and the area was regraded through a project supported by the *Action on Waste* division of DIAND (Photograph III-29). As a result very little debris was evident in the area at the time of the current investigation. The slope had been regraded and no staining was evident on the newly worked surface. Some debris could be seen poking out of the substrate outside the worked area - this included domestic debris, electrical equipment, vehicle bodies and parts. There were two vehicles at the top of the slope, and a number of vehicle tires piled at the bottom.

The substrate in the area which had been recently reworked consisted of medium to coarse sand with many rocks mixed in. Outside the worked area at the base of the slope it consisted of a thick moss layer on top of organic materials under which medium sand and organics including roots and detritus were found.

No vegetation was growing in the dump at the time of the site visit because of the recent work there. On the periphery of the worked area however, vegetation consisted of an overstory of poplars and willows (*Populus* spp. and *Salix* spp.), and a thick understory of herbs including broad-leaved willow herb (*Epilobium angustifolium*), strawberry (*Fragaria virginiana*), bearberry (*Arctostaphylos uva-ursi*) and blue bells (*Mertensia paniculata*).

A total of 12 assessment soil samples, including one field duplicate and a sample collected at depth (40-50 cm), were collected along the edge of the worked area of the dump (Map III-7). Six plant samples were collected in the vicinity of the dump. The analytical results for samples collected in the vicinity of the dump can be found in Appendix D.

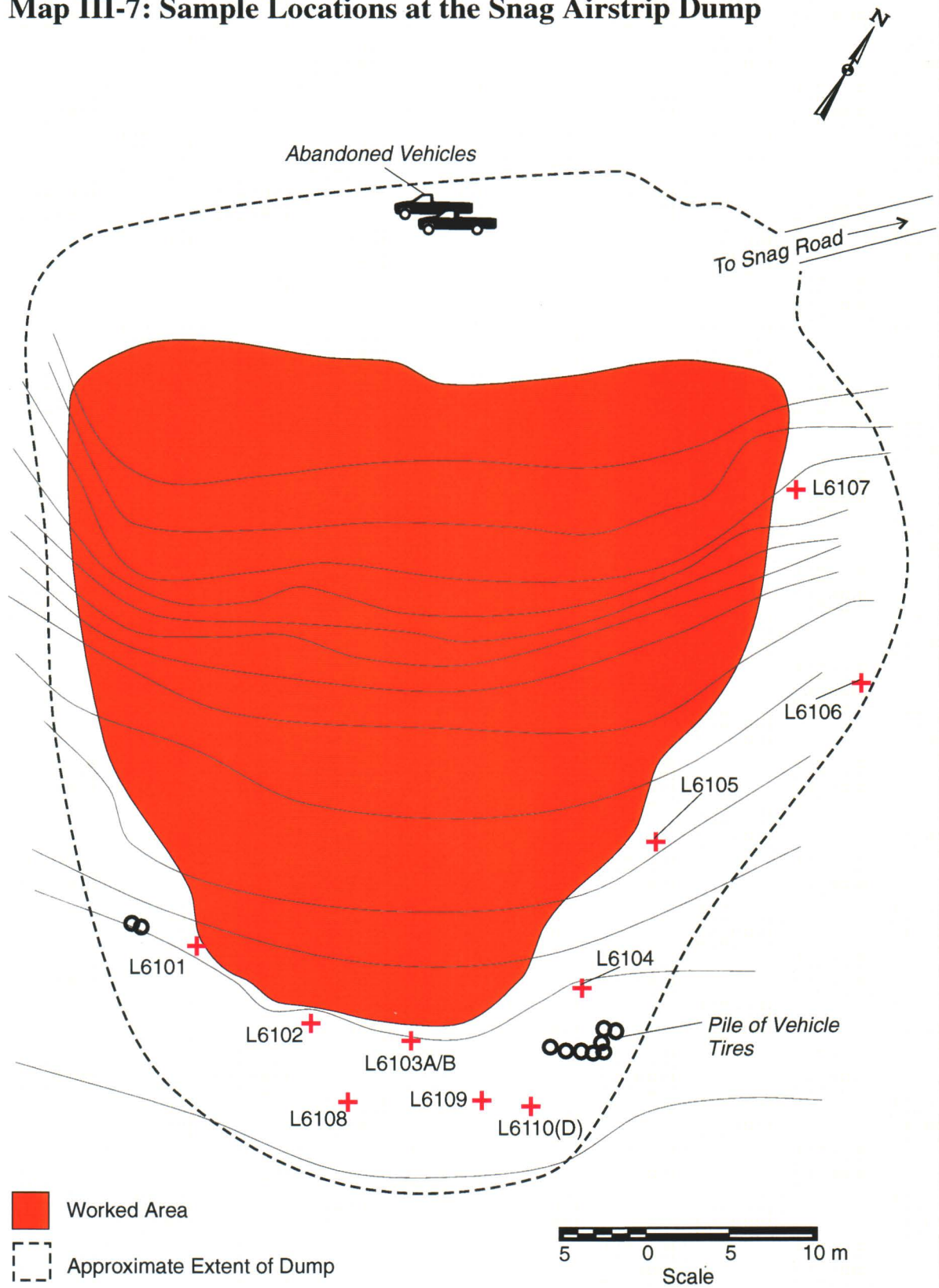


Photograph III-28: Aerial view from the southwest of the Snag Airstrip Dump showing the recently worked dump face.



Photograph III-29: View of the recently graded dump face from the toe of the dump.

Map III-7: Sample Locations at the Snag Airstrip Dump



i. Inorganic Elements

Eight of the 12 assessment soil samples collected in the vicinity of the Snag Airstrip dump were analyzed for inorganic contaminants. Mean and maximum concentrations of all inorganic analytes were below the CCME R/P Remediation Criteria, although the mean concentrations of lead and zinc were 13 and 3.2 times their respective mean background soil concentrations. The maximum concentration of zinc (420 ppm) approached the criterion but did not surpass it. This sample (L6105) was collected in a depression off the east side of the worked area.

Four of the six plant samples collected in the vicinity of the dump were analyzed for inorganic elements. Mean concentrations of all inorganic analytes, except zinc, were not significantly elevated above the mean calculated for background plants. The mean concentration of zinc calculated for the plants from the dump (180 ppm) was 2.8 times that detected in background plants. Zinc concentrations exceeded the Impact Criteria in two of the plant samples, but both were members of the willow family (L6101P *Populus balsamifera*, L6110P *Salix myricoides*) which tends to bioaccumulate zinc. Both the corresponding soil samples contained zinc at concentrations well below the CCME R/P Remediation Criterion.

In summary, none of the inorganic analytes were found to be elevated above the CCME R/P Remediation Criteria in soils from the dump, although concentrations of lead and zinc were significantly elevated above levels observed in background soils. Zinc concentrations in two plant samples from the dump exceeded the Impact Criteria calculated for Snag Airstrip.

ii. Polychlorinated Biphenyls

Seven of the 12 assessment soil samples collected in the Snag Airstrip dump, including one field duplicate and one sample collected at depth, were analyzed for PCBs. The mean concentration of PCBs in soil samples from the dump (24 ppb) did not approach the CCME R/P Remediation Criterion. However, the mean concentration of

PCBs in soils collected from the dump was 40 times greater than the mean background soil concentration. None of the assessment soil samples from the dump were found to contain PCBs in excess of the CCME R/P Remediation Criterion. The maximum concentration of PCBs detected in a soil sample from the dump (43 ppb) was two orders of magnitude less than the criterion and was found in assessment sample L6105 collected in a depression on the southeast side of the dump.

Five out of the six plant samples collected at the toe of the dump were analyzed for PCBs. The concentration of PCBs was below the limit of detection in all five samples.

Concentrations of PCBs in soils collected at the Snag Airstrip dump did not exceed the CCME R/P Remediation Criterion. PCBs were not detected in any of the five plant samples analyzed.

iii. Other Organic Contaminants

Two assessment soil samples collected in the dump were analyzed for polychlorinated dibenzodioxins and dibenzofurans. Dioxin levels in both samples were three orders of magnitude lower than the CCME R/P Remediation Criterion (1000 ppt) and were comparable to background soil concentrations observed in previous studies.

One assessment soil sample from the dump was analyzed for pesticides. The total concentration of pesticides (7.9 ppb) in the sample collected at depth at the toe of the dump (L6110-D) did not approach any of the applicable criteria. Two of the 22 pesticide analytes were detected in this sample and both were part of the DDT family of pesticide compounds.

Three assessment soil samples from the dump were analyzed for PAHs. None of the PAH analytes were detected at concentrations exceeding the applicable CCME R/P or BCMOE Level B remediation criteria.

Concentrations of dioxins, pesticides and PAHs in soil samples collected at the Snag Airstrip dump did not exceed any applicable criteria.

iv. Conclusions

None of the analytes considered in the current investigation of the Snag Airstrip dump were present in the soils from this area at concentrations which require remediation. The recent nature of work undertaken at the dump site may have contributed to the low levels of contaminants detected there, although the generally low levels of inorganic contaminants and absence of PCBs in plant samples from the dump suggest that waste disposed of at the site was generally non-hazardous.

9. Septic Field

The septic field may have been located at the northeastern end of the site, immediately northeast of the married quarters (see Map II-1). Its location was suggested by the presence of an underground system of pipes which ran through this area and which was accessible via manholes. The substrate in the vicinity of the septic field consisted of fine sand and rocks, dried to a crust on top. Vegetation in the area was notably less dense, and in fact much of the substrate surface remained bare (Photograph III-30). The sparse vegetation consisted of very early successional species including poplars (*Populus balsamifera*, *P. tremuloides*) and some herbs (for example, *Epilobium angustifolium*, *Solidago decumbens*, *Potentilla* spp.).

A total of six assessment soil samples, including one field duplicate, were collected in the septic field area (Map III-8). The analytical results for samples collected in the vicinity of the septic field appear in Appendix D.

i. Inorganic Elements

All six assessment soil samples collected in the septic field were analyzed for inorganic contaminants. Mean concentrations of all inorganic analytes were below the CCME R/P Remediation Criteria, but most were between two and four times the mean background soil concentrations. The maximum concentrations of zinc (800 ppm) and copper (350 ppm) were significantly elevated above the CCME R/P Remediation

Criteria, with both maxima detected in the same sample (O6104) collected from the northern-most manhole (Photograph III-31). This was the only sample from the septic field determined to contain any inorganic analyte at a concentration requiring remediation.

Leachate tests were conducted on assessment soil sample O6104. Zinc, the only analyte detected in the leachate from this sample, is not one of the inorganic parameters included in the Leachate Quality Standards.

In summary, zinc and copper were detected at concentrations exceeding the CCME R/P Remediation Criteria in one sample collected in the vicinity of the septic field. Leachate tests conducted this soil sample indicated that none of the inorganic analytes detected in the soil are leachable to a significant degree.

ii. Polychlorinated Biphenyls

Five of the six assessment soil samples including one field duplicate, collected in what is believed to have been the septic field, were analyzed for PCBs. In four out of five of the analyzed samples the concentrations of PCBs were below the limits of detection. The fifth sample which was collected from the bottom of a manhole associated with the septic system (O6104) contained detectable PCBs, but they were present at a concentration (670 ppb) that did not approach the CCME R/P Remediation Criterion (5000 ppb).

PCBs were below the limit of detection (0.001 mg/L) in leachate generated from assessment soil sample (O6104).

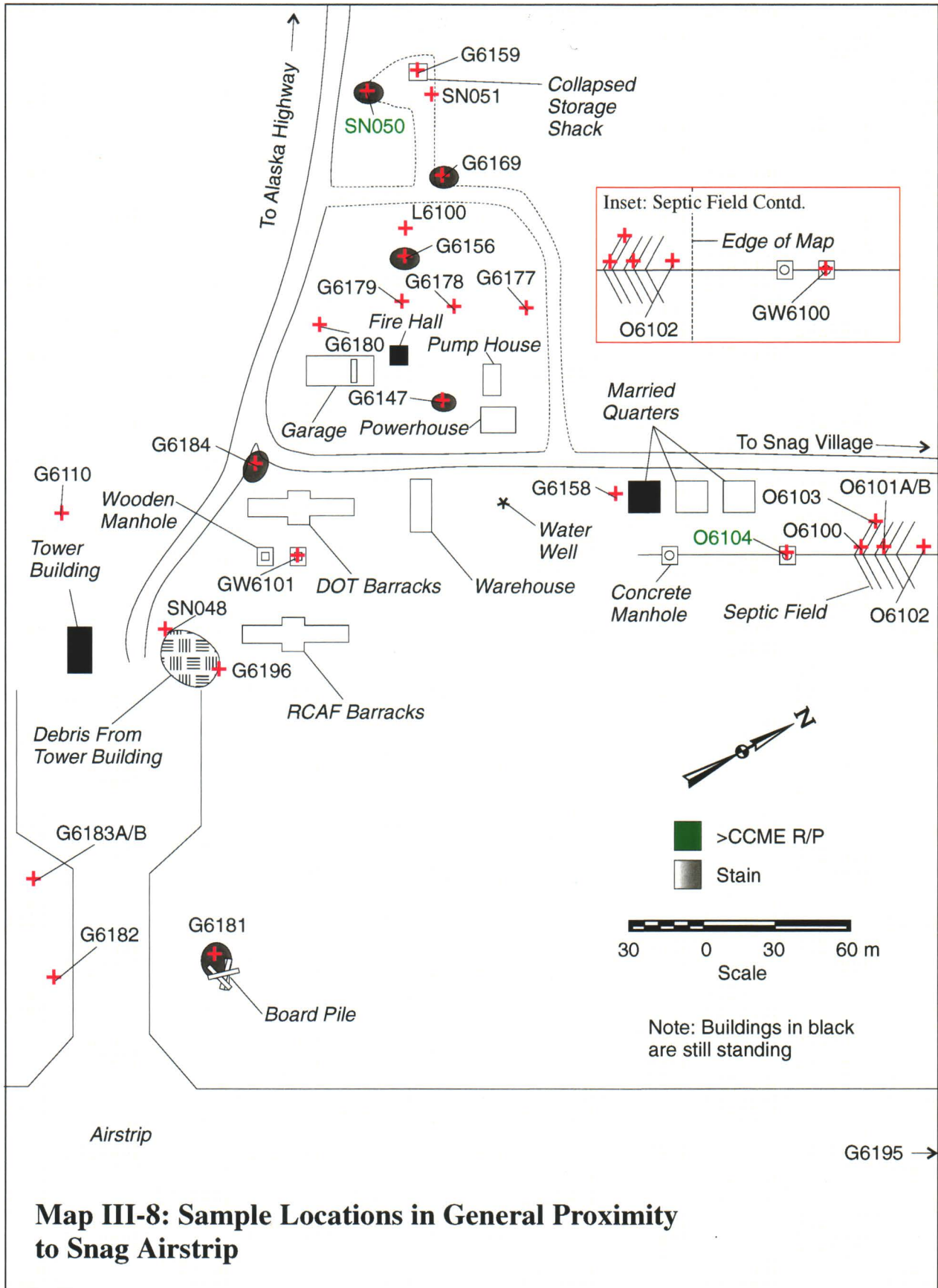
Concentrations of PCBs in soils collected in the septic field did not exceed the CCME R/P Remediation Criterion. PCBs, present at low levels in one soil sample from the septic field, were not leachable.



Photograph III-30: Vegetation in the area that may have been the septic field was sparse.



Photograph III-31: Debris collected from the bottom of this manhole (O6104) contained concentrations of copper and zinc which exceeded the criteria.



iii. Other Organic Contaminants

One assessment soil sample from the septic field was analyzed for pesticides. The total concentration of pesticides (1300 ppb) in the sample collected in the manhole (O6104) did not exceed any of the applicable criteria. Nineteen of the 22 pesticide analytes were detected in this sample. All of the DDT family of compounds were detected and constituted 1100 ppb of the detected pesticide compounds. The parent compound *p,p'*-DDT was the most common form of pesticide found in the sample (590 ppb), its concentration exceeding the Netherlands Level B criteria for individual chlorinated pesticides (500 ppb).

The concentration the pesticide *p,p'*-DDT in a soil sample collected in the manhole associated with the septic field exceeded the Netherlands criteria for individual chlorinated pesticides.

iv. Conclusions

Although soils in the septic field itself did not contain elevated concentrations of any of the analytes, the debris collected from the bottom of the manhole contained copper, zinc and DDT at concentrations requiring remediation. The concentration of PCBs in the same sample was significantly elevated above background concentrations.

10. General Site Proximity

The general site proximity comprises those areas not previously discussed in this chapter, excluding the beacon site. The only buildings included in this area are the collapsed storage shack (Photograph III-32) at the northwest end of the site and the married quarters at the north end of the site (Photograph III-33). A total of 19 assessment soil samples, including one field duplicate and three 1994 samples, were collected in general proximity to Snag Airstrip (Map III-8). Four plant samples were collected from three locations in general proximity to the site. Two samples from one location were root and shoot subsamples of the same plant species. Three wall swab samples and one

insulation sample were collected in the married quarters. Two water samples were collected in manholes which were part of either the water or septic system. A third sample was collected at the Beaver Creek DIAND office where the plant samples were washed before packaging. Two barrel samples were collected in 1994 at the northwest end of the site, before the barrels and other metallic debris were cleaned up by a local contractor. The analytical results for samples collected in these areas can be found in Appendix D.

i. Inorganic Elements

Seventeen of the 19 assessment soil samples collected in general proximity to the site were analyzed for inorganic contaminants. Although mean concentrations of all inorganic analytes were below the CCME R/P Remediation Criteria, most were approximately twice the mean background soil concentrations. The maximum concentrations of all inorganic analytes were also well below the CCME R/P Remediation Criteria.

All four plant samples collected in general proximity to the site were analyzed for inorganic contaminants. Mean concentrations of arsenic (0.29 ppm), zinc (160 ppm) and cobalt (3.4 ppm) were 2.9, 2.5 and 2.1 times their respective mean concentrations in background plants. Three out of the four samples contained zinc at concentrations which exceeded the Impact Criteria calculated for Snag Airstrip. All three samples containing elevated concentrations of zinc were members of the willow family which is known to bioconcentrate zinc. The remaining sample (G6181PR, *Populus balsamifera* roots) contained arsenic at a concentration 2.1 times the Impact Criterion for that element.

One of the two water samples collected in the general site proximity was analyzed for inorganic contaminants. Zinc was the only analyte detected in water sample GW6100 collected from the northernmost wooden manhole. The concentration of zinc (0.034 ppb) detected in the sample was three orders of magnitude lower than the CCME Assessment Criterion (50 ppb).



Photograph III-32: The remains of the collapsed storage shack with sample location G6159 in the foreground.



Photograph III-33: The log building which served as one of three married quarters.

The potable water sample collected from a tap in the Beaver Creek DIAND office was also analyzed for inorganic contaminants. Although zinc (0.063 ppb), copper (0.030 ppb) and cadmium (0.0020 ppb) were all detected in the sample (WP6100), the concentrations were orders of magnitude less than their respective CCME Assessment Criteria.

Both the barrel oil samples were analyzed for total chlorine content. The concentrations of chlorine in both were below the limits of detection.

In summary, no inorganic analytes were detected at concentrations exceeding the CCME R/P Remediation Criteria in soils collected in general proximity to Snag Airstrip. Zinc and arsenic were detected in plant samples at concentrations exceeding the Impact Criteria calculated for Snag Airstrip.

ii. Polychlorinated Biphenyls

Seventeen out of the 19 assessment soil samples collected in the general vicinity of Snag Airstrip, including one field duplicate and three samples collected in 1994, were analyzed for PCBs. None of the assessment soil samples contained PCBs in excess of the CCME R/P Remediation Criterion (5000 ppb). The mean concentration of PCBs in 1995 samples (9.1 ppb) was three orders of magnitude less than the criterion, but was 15 times greater than the mean background soil concentration. The concentrations of PCBs in seven of the samples were below the limits of detection. The two samples collected in 1994 from a barrel cache area that has since been cleaned up of all metallic debris (SN050 and SN051) contained the highest concentrations of PCBs (780 and 270 ppb, respectively) in soils collected in the general site proximity.

Two of the four plant samples collected in the general site proximity were analyzed for PCBs. The concentrations of PCBs in both samples were below the limits of detection.

Both the water samples collected in the general vicinity of Snag Airstrip were analyzed for PCBs. Although PCBs were detected in both samples, the concentrations detected in both samples were at least three orders of magnitude less than the CCME Assessment Criterion (100 ppt).

The potable water sample from the Beaver Creek DIAND office (WP6100) was analyzed for PCBs. The concentration of PCBs detected in the sample (0.70 ppt) was 143 times less than the CCME Assessment Criterion.

One of the three swab samples collected in the married quarters was analyzed for PCBs. The concentration of PCBs in the sample (SN-07, 12 ng/100 cm²) did not exceed the US EPA guideline for interior solid surface contamination (10,000 ng/100 cm²).

Both barrel oil samples were analyzed for PCBs. The concentrations of PCBs in both samples were below the limit of detection (2.0 ppm).

PCB concentrations in soils collected from the general vicinity of Snag Airstrip were not significantly elevated and in many cases were below the limits of detection. Vegetation in the general area of the site did not appear to be impacted by elevated concentrations of PCBs in other areas of the site: there was no evidence of PCBs in plant tissues. Water samples collected from two manholes did not contain PCBs at a significantly elevated level. The interior walls of the married quarters were not contaminated by PCBs.

iii. Other Organic Contaminants

One assessment soil sample collected in the general site vicinity was analyzed for polychlorinated dibenzodioxins and dibenzofurans. The concentration of dioxins in sample G6184 collected in a stain just off the fork in the Snag Village Road was 1.3 ppt, which was three orders of magnitude less than the CCME R/P Remediation Criterion for dioxins in soil (1000 ppt).

Four assessment soil samples were analyzed for pesticides. The total concentrations of pesticides in all four samples were all significantly less than any of the applicable criteria. None of the samples contained individual pesticide compounds which exceeded the Netherlands Level B criteria for individual chlorinated (500 ppb) or non-chlorinated (1000 ppb) pesticides.

Four assessment soil samples collected in the general site proximity were analyzed for PAHs. The levels of PAHs detected in all four samples were very low and none exceeded the applicable criteria.

In summary, dioxins, pesticides and PAHs were not detected at concentrations requiring remediation in soils from the general vicinity of Snag Airstrip.

iv. Asbestos

One sample of wall insulation was collected from the married quarters and was analyzed for asbestos content. Levels of asbestos in the sample were below the limit of detection (0.5%).

v. Conclusions

Levels of contaminants are generally low in the areas not immediately surrounding the main buildings at the site. Although contaminant concentrations were generally elevated above background concentrations throughout the site, they did not exceed any of the applicable criteria in areas away from the buildings. Vegetation in the general area of the site has been impacted to a certain extent by elevated levels of inorganic contaminants present in other areas of the site.

11. Beacon Site

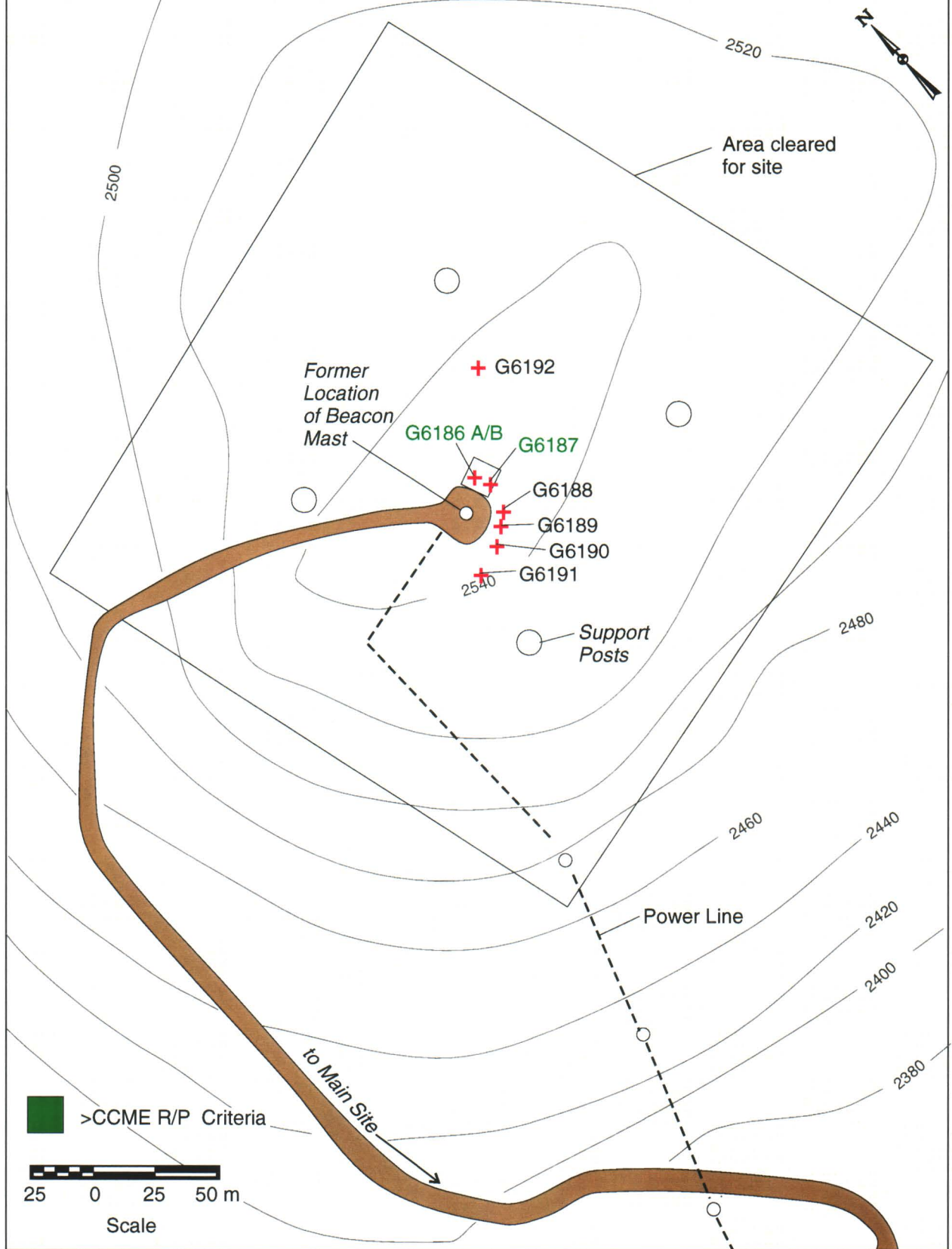
The beacon site was located approximately 7.5 km northeast of the Snag Airstrip building facilities (see Map II-1). The location of the site was indicated by the remains of the road which ascends the hill to the site, the charred remains of the building, a single downed telegraph pole and some dismantled wooden antenna towers. At the time of the ESG's investigation the road to the beacon site was impassable and the site was accessed via helicopter. The substrate in the immediate vicinity of the beacon site building consisted of medium sand and rocks. In drainage away from the building the substrate comprised silt and fewer rocks with a small organic component. Vegetation in the area was somewhat different from that in the vicinity of the airstrip, consisting of many young white spruce trees (*Picea glauca*). In addition to spruce, poplars (*Populus* spp.), willows (*Salix* spp.) and soapberry (*Shepherdia canadensis*) were common at the site. Herbaceous species at the site included broad-leaved willow herb (*Epilobium angustifolium*), pink pussy-toes (*Antennaria rosea*), and twin-flower (*Linnaea borealis*).

A total of eight assessment soil samples, including one field duplicate, were collected in the vicinity of the beacon site (Map III-9). Two samples of vegetation were collected. One sample of paint chips was obtained from the remains of the antenna towers which were piled together at the site. The analytical results for samples collected in this vicinity can be found in Appendix D.

i. Inorganic Elements

Six out of the eight assessment soil samples collected at the beacon site were analyzed for inorganic contaminants. Mean concentrations of copper (180 ppm), zinc (840 ppm) and arsenic (32 ppm) exceeded the CCME R/P Remediation Criteria. Although below the criteria, mean concentrations of nickel (73 ppm), cobalt (20 ppm), lead (170 ppm) and chromium (100 ppm) were all substantially elevated above their respective mean concentrations in background soils. The mean concentration of cadmium in soils collected at the beacon site was (0.5 ppm), equivalent to the mean background soil concentration.

Map III-9: Sample Locations at the Snag Airstrip Beacon Site



Three of the six samples analyzed, including one field duplicate, contained inorganic elements at concentrations requiring remediation. The three samples were collected at two locations within the burnt area of the site where the building once stood. Duplicate soil samples G6186A & G6186B contained copper (ave. = 335 ppm), nickel (ave. = 145 ppm), zinc (ave. = 1900 ppm) and arsenic (ave. = 80 ppm) at concentrations exceeding the CCME R/P Remediation Criteria. G6187, collected just 4 m SE of G6185 contained only copper (310 ppm) and zinc (1100 ppm) in excess of the criteria (Photograph III-34). Concentrations of inorganic elements in the three samples collected in areas other than the building remains were not significantly elevated above background soil concentrations.

Leachate tests were conducted on assessment soil sample G6186A. None of the analytes were detected in the leachate at concentrations exceeding Leachate Quality Standards.

Both plant samples collected at the beacon site were analyzed for inorganic elements. Concentrations of inorganic analytes in the sample of soapberry (G6187P, *Shepherdia canadensis*) collected within the building remains where soils were found to be contaminated were comparable to the mean concentrations calculated for background plants. The plant sample collected in an area where soil inorganic element concentrations were not significantly above background soil concentrations was found to contain nickel (16 ppm) and zinc (130 ppm) at concentrations equivalent to the Snag Airstrip Impact Criteria. The same sample contained chromium at 2.1 times the level calculated for the Impact Criteria.

The paint chip sample collected from the antennae remains piled at the beacon site (SNPC-2) was analyzed for inorganic elements and found to contain lead (220,000 ppm), zinc (6900 ppm), chromium (31,000 ppm) and cobalt (150 ppm) at concentrations which may pose a significant health hazard to individuals during the cleanup of these materials.

In summary, copper, nickel, zinc and arsenic were detected at concentrations exceeding the CCME R/P Remediation Criteria in samples collected in the vicinity

of the beacon site building remains. Leachate tests conducted on one of the soil samples from the beacon site indicated that none of the inorganic analytes detected in the soil are leachable to a significant degree. One plant sample collected outside of the area of contaminated soil was found to contain inorganic elements at concentrations exceeding the Impact Criteria. Paint used on the antenna towers at the beacon site contained high levels of lead, zinc, chromium and cobalt.

ii. Polychlorinated Biphenyls

Six out of the eight assessment soil samples collected at the beacon site, including one field duplicate, were analyzed for PCBs. None of the assessment soil samples contained PCBs at concentrations in excess of the CCME R/P Remediation Criterion (5000 ppb). The mean concentration of PCBs in samples from the beacon site (7.8 ppb) was three orders of magnitude less than the criterion, and was only 13 times greater than the mean background soil concentration. The maximum concentration of PCBs detected in a sample from the beacon site (3.3 ppb) was also several orders of magnitude less than the criterion. The concentrations of PCBs in four of the samples were below the limits of detection.

Both of the plant samples collected at the beacon site were analyzed for PCBs. The concentrations of PCBs in both samples were below the limits of detection.

PCB concentrations in soils collected at the beacon site were not significantly elevated and in many cases were below the limits of detection. Vegetation collected at the beacon site did not contain detectable concentrations of PCBs.

iii. Other Organic Contaminants

Three assessment soil samples collected at the beacon site were analyzed for polychlorinated dibenzodioxins and dibenzofurans. The concentrations of dioxins (2,3,7,8-TCDD TEQs concentration range = 0.07 - 0.12 ppt) in all three samples were comparable to those observed in previous studies to be typical of background soils.



Photograph III-34: Soil sample G6187 and G6186, collected amongst the burnt building remains at the beacon site, contained inorganic elements at concentrations exceeding the criteria.

One assessment soil sample collected at the beacon site (G6186A) was analyzed for pesticides. None of the 22 pesticide analytes were present at concentrations above the limits of detection.

Two assessment soil samples collected at the beacon site were analyzed for PAHs. The levels of PAHs in both were very low and none exceeded the applicable criteria.

Dioxin and PAH concentrations in soil samples collected at the beacon site were comparable to levels expected for background soil samples. Pesticide concentrations were below the limits of detection for all analytes.

iv. Conclusions

Zinc, copper, nickel and arsenic were the only contaminants detected at levels exceeding the applicable criteria at the beacon site. The only area where these were found at elevated concentrations was in the immediate vicinity of the building remains. Elevated concentrations of inorganic elements found in a plant sample collected some distance from the area of soil contamination may have been indicative of natural bioconcentration.

C. Summary

1. Sampling Program

A summary of the sampling program is given in Table III-5. A total of 137 assessment soils and 100 delineation soils were collected at Snag Airstrip and form the basis of the assessment of the site. Thirty-four plant samples were collected to assess whether contaminants detected in the soil samples were migrating into the food chain.

Table III-5: Sampling Program by Sample Type

Type	Number of Samples	
	Locations	Field Replicates
<i>Soil:</i>		
Site Background (G/AA)	8	2
General (G/SN)	96	12
Delineation (SN##)	100	0
Landfill/Dump (L)	12	1
Outfall	5	1
Total	221	16
<i>Other:</i>		
Water (GW, PW)	5	-
Plant	34	-
Surface Swab (SW) ^a	3	6
Insulation (ASB)	4	-
Paint Chip (SNPC)	3	1
Barrel (SN-BS)	2	-
Oil Filter (OIL)	1	-

a All wall swabs were collected in triplicate.

2. Analytical Program

Soil samples were screened for polychlorinated biphenyls (PCBs), inorganic elements, polycyclic aromatic hydrocarbons (PAHs), pesticides, and dioxins. Plant, water and paint chip samples were analyzed for inorganic elements and PCBs. Wall swabs were analyzed for PCBs only, and the barrel samples and the oil filter were analyzed for PCBs, total chlorine and the inorganic elements lead, chromium and cadmium. The asbestos content of insulation materials was also determined. Substances found at elevated levels were mostly PCBs and inorganic elements.

High level PCB contamination at the powerhouse and pump house was delineated using field test kits, with 25 and eight samples, respectively. High level inorganic element contamination at the tower building and warehouse was delineated using an XRF (x-ray florescence) field test kit on 22 and 41 soil samples, respectively. Field test kit results were confirmed by standard laboratory methods for 100 percent of PCB tested samples and 46 percent of samples analyzed for inorganic elements. A summary of the overall analytical program is given in Table III-6. The plant analytical program is summarized in Table III-7.

Table III-6: Analytical Program by Sample Type

Type	Total ^a		Type of Analysis & Number Analyzed ^a				
	Number Collected	Inorganic Elements	PCBs	Leachate ^b	PCDDs/ PCDFs ^c	Pesticides ^d	PAHs ^e
<i>Soil/Sediment:</i>							
Site Background (G)	10	9	10	-	-	-	-
General (G/SN)	108	103	104	13	10	11	14
Delineation (SN##)	100	78	33	4	-	-	-
Outfall (O)	6	6	5	1	-	1	-
Landfill/Dump (L)	13	9	8	-	1	1	3
Total	237	158	160	18	11	13	17
<i>Other:</i>							
Water (GW, PW)	5	3	5	-	-	-	-
Plant (P)	34	31	30	-	-	-	-
Surface Swab (SW)	9	-	3	-	-	-	-
Insulation Material (ASB) ^f	4	-	-	-	-	-	-
Paint Chip (SNPC)	3	3	1	-	-	-	-
Barrel (BS-SN) ^g	2	1	2	-	-	-	-
Engine Oil Filter (OIL) ^g	1	1	1	-	-	-	-

a Including field duplicates.

b Leachate from soil samples was analyzed for arsenic, barium, cadmium, chromium, lead, mercury, selenium, silver, boron, cyanide, fluoride, copper, nickel, cobalt, zinc and PCBs.

c PCDDs = polychlorinated dibenzodioxins and dibenzofurans: concentrations of compound totals (5) and individual dioxin isomers (6) were determined; concentrations of compound totals (5) and individual furan isomers (9) were determined, for each sample.

d Concentrations of 22 individual pesticides and pesticide metabolites were determined for each sample.

e PAH = polycyclic aromatic hydrocarbons: concentrations of 36 individual compounds and metabolites were determined for each sample.

f Analyzed for asbestos only.

g Analyzed for chlorine, chromium, lead and cadmium only.

Table III-7: Vegetation Collected for Analysis

Species	Family/Group	n	Common Name	Habit	Area(s) Sampled ^a
<i>Salix bebbiana</i>	Willow	5	Bebb's Willow	Medium shrub	1,3,7,8
<i>Salix brachycarpa</i>	Willow	7	-	Medium shrub	1,4,5,6,8
<i>Salix exigua</i>	Willow	1	Sandbar Willow	Medium shrub	3
<i>Salix myricoides</i>	Willow	1	Blue-leaved Willow	Medium shrub	7
<i>Salix myrtillifolia</i>	Willow	1	-	Medium shrub	7
<i>Populus balsamifera</i>	Willow	6	Balsam Poplar	Tall shrub	2,6,7,8,9
<i>Lupinus arcticus</i>	Pea	1	Arctic Lupine	Herb	1
<i>Oxytropis campestris</i>	Pea	2	Oxytrope	Herb	2
<i>Epilobium angustifolium</i>	Evening Primrose	3	Broad-Leaved Willow-Herb	Herb	5,7
<i>Shepherdia canadensis</i>	Oleaster	5	Soapberry	Low shrub	4,5,6,9
<i>Arctostaphylos uva-ursi</i>	Heath	1	Kinnikinnik	Low shrub	5
<i>Ledum decumbens</i>	Heath	1	Labrador Tea	Low shrub	1

^a 1: Background
 2: Tower Building
 3: DOT Barracks Building
 4: Warehouse
 5: Powerhouse
 6: Garage
 7: Landfill
 8: General Site Proximity
 9: Beacon Site

3. Results

A summary of contaminants detected in each area of the site in excess of the applicable criteria appears in Table III-8. A total of 55 (40%) out of the 127 assessment soil samples collected at Snag Airstrip (137 minus the 10 backgrounds) contained at least one analyte at a concentration exceeding the applicable criteria. Zinc was detected at concentrations above the CCME R/P Remediation Criterion in 36 (65%) of those 55 assessment samples and was the most common contaminant detected in these samples. Lead was also prevalent among the contaminants detected and was present in 30 (55%) of the samples exceeding the criteria. PCBs were also very prevalent in soil samples collected at Snag Airstrip. The CCME R/P Remediation Criterion for PCBs in soil was exceeded in a total of 32 (25%) of the assessment soil samples collected. PCB concentrations exceeded the level regulated by the Canadian Environmental Protection Act in 13 assessment soil samples collected in 12 separate locations around the site.

Of the 33 delineation soil samples collected in high PCB areas, 23 (70%) exceeded the CCME R/P Remediation Criterion and of these 12 (52%) violated the CEPA regulation. In delineation soil samples analyzed for inorganic elements, 52 (69%) out of the 75 collected contained at least one element in excess of the CCME R/P Remediation Criteria. Lead, present in 45 (87%) out of the 52 delineation samples exceeding the criteria, was the most prevalent contaminant detected in these samples and was detected at concentrations as high as 370,000 ppm in one sample. Lead was also found to be significantly leachable in two areas of the site.

The environmental status of Snag Airstrip was also assessed using plant samples as indicators of ecosystem impact. This can be done by comparing plants collected at the site to those collected in similar areas well away from human influences. Of the 29 plant samples collected at the site, 22 (76%) contained at least one inorganic element or PCBs in excess of the Impact Criteria. The most common contaminant exceeding the Impact Criterion was zinc which was elevated in 17 plant samples, and reflected the trends observed in the assessment soil samples. PCBs were also highly elevated above

background levels in plant samples collected in the vicinity of Snag Airstrip (16 samples exceeded the Impact Criterion).

The screen conducted for dioxins, pesticides and PAHs suggested that pesticides were widely used at Snag Airstrip. Due to the elevated levels of PCBs and inorganic elements in so many areas of the site, it is expected that much of this contamination will be remediated concomitantly. Dioxins, detected at significantly elevated concentrations in three assessment soil samples, were present at concentrations proportional to PCB concentrations. All three samples for which dioxins exceeded the CCME R/P Remediation Criterion also contained PCBs in violation of CEPA. PAHs were only detected in one sample collected at Snag Airstrip (out of 17 soils analyzed) and this sample was from the CEPA contaminated larger oil-change pit at the garage.

Paint from the interior walls of the tower building was found to contain very high concentrations of lead, zinc, chromium, copper and PCBs. The paint scraped from the pile of wood beams at the beacon site also contained very high concentrations of inorganic elements. This sample was not analyzed for PCBs.

Table III-8: Environmental Summary

Area	Contaminants Exceeding the Applicable Criteria ^a	Criteria/Regulation Exceeded	Total Volume of Soil Affected (m ³)
Tower Building	Pb, Zn, Cu, Cd, PCBs, Pesticides	CCME R/P	65
DOT Barracks Building	PCBs, PCDDs/PCDFs, Zn, Pb, Cu, Ni	CEPA CCME R/P	10 40
Warehouse	Pb, Cu, Zn, Cr, PCBs	LQS ^b CCME R/P	15 55
Powerhouse & Pump House	PCBs, Zn, Pb, Cu, Cd, Ni, Cr	CEPA CCME R/P	20 47
Fire Hall	Zn	CCME R/P	4.5
Garage	PCBs, PCDDs/PCDFs, Pesticides, PAHs, Zn, Pb, Cu, Ni, Cd, Cr	CEPA CCME R/P	4 40
Dump	-	-	-
Septic Field	Cu, Zn, Pesticides	CCME R/P	Manholes to be backfilled
General Site Proximity	Zn	CCME R/P	10
Beacon Site	Zn, Cu, As, Ni	CCME R/P	31

a. Listed in order of degree

b. Leachate Quality Standards

IV. RECOMMENDATIONS

The following chapter outlines recommendations for the cleanup of Snag Airstrip based on the results of the current environmental assessment. Recommendations have been made in consideration of the degree of ecosystem impact incurred, through comparison of analytical results to the applicable criteria (see Chapter II), the use of plants as indicators, and visual inspection of the site. Cleanup recommendations have been divided into three categories: (1) cleanup of chemical hazards as outlined by federal regulations; (2) cleanup of chemical contamination as defined by the CCME criteria (residential/parkland level); and (3) removal of physical hazards and restoration of the site to a condition which will allow its eventual return to a natural state. Federally regulated chemical hazards existing at Snag Airstrip include both media contaminated with PCBs at a level in excess of that regulated by CEPA (hereafter referred to as CEPA soils), and soils containing significant concentrations of leachable contaminants. A detailed conceptual engineering design and cost estimate for the cleanup of the site has been prepared by UMA Engineering Ltd. based on the results presented in this report.

A. Cleanup of Soil Violating CEPA

Soils in a total of five areas at Snag Airstrip are contaminated with PCBs above the level regulated by CEPA (50 ppm). These include the barracks building and pump house basements, the two oil-change pits at the garage and the general vicinity of the powerhouse foundation. These soils must be excavated and containerized under the regulations arising from the Canadian Environmental Protection Act. The total volume of affected soils is estimated to be 34 m³. Following excavation, confirmatory sampling and testing should be conducted to ensure that all CEPA soils are removed. Installation of monitoring wells down gradient from areas with CEPA soils should be considered if high levels of contamination are detected at depths suggesting the possibility of ground water contamination.

It must be ensured that the concrete foundations of each of the affected buildings are tested for PCBs. If they are found to be contaminated above 50 ppm, then measures must be put in place to prevent the PCBs from moving into the food chain. This may be achieved by solvent washing the surface of the concrete, then encapsulating it using a synthetic liner. All solvent resulting from washing requires testing and appropriately disposal. A further option is the removal of any contaminated concrete using mechanical means, containerization and shipment to an appropriate PCB storage or treatment facility along with the CEPA soils. Due to the potential for exposure to contaminated dust this option represents a greater potential threat to workers and therefore the encapsulation option is more favourable. Removal of CEPA level contamination should be confirmed by the collection and testing of concrete samples after either measure is employed.

B. Cleanup of Leachate Toxic Soils

Ontario Ministry of the Environment Leachate Quality Standards were surpassed by lead from soils collected on the south and east sides of the warehouse. Leachate toxic soils are considered hazardous materials and hence must be shipped to an appropriate disposal facility. The total volume of soil containing leachable lead and therefore requiring excavation, containerization and shipment off site is estimated to be 15 m³. Confirmatory testing should be conducted to ensure that all leachate toxic soils have been excavated.

C. Cleanup of Media Exceeding the CCME R/P Remediation Criteria

Soils exceeding the CCME R/P Remediation Criteria were detected in the vicinity of every building associated with the operation of Snag Airstrip and the beacon site except the married quarters and the storage shack. Further delineation of the areas affected by concentrations of contaminants elevated above the CCME criteria is required to determine the volumes of soil requiring excavation. A total of 282 m³ of soil was estimated to contain contaminants above the criteria. Disposal options for CCME soils

include shipment to a southern landfill facility or construction of an engineered landfill at Snag Airstrip in which the soils could be placed.

Any concrete foundations contaminated by PCBs above the CCME R/P Remediation Criterion, but below 50 ppm, should be covered with sufficient granular fill material to preclude water infiltration and hence the potential for migration of contaminants away from the foundations.

D. Site Closure

Following the removal of all chemically contaminated media, the condition of the physical structures located at Snag Airstrip should be addressed. Most of the buildings have already been demolished and removed, and only their foundations remain. The three remaining buildings should be demolished as they represent a liability to the land owners. Materials with painted surfaces contain high concentrations of inorganic elements and PCBs and therefore cannot be burned. The degree of leachability of the paint contaminants is in the process of being tested and will determine the options for its disposal. None of the building materials tested contained detectable concentrations of asbestos, and therefore demolition of the buildings can be undertaken without completing the steps necessary for asbestos abatement. Non-hazardous demolition materials can be landfilled on site in a location suitable to all parties concerned. The existing dump may serve as the appropriate location for these materials prior to its closure as outlined below.

Other non-hazardous wastes located at the site included steel, unpainted wood, uncontaminated concrete, pipes and domestic refuse. These can be disposed of on site in the same manner as uncontaminated building materials. Partially buried wastes should be collected and removed for landfilling only if the surrounding substrate will not be disturbed extensively in the process. In those cases where the removal of partially buried waste is not practical, it should be covered with an ample quantity of granular fill material. Any hazardous materials found during the cleanup of debris should be sorted and shipped off site to an appropriate facility as outlined for contaminated soils.

Although soils collected at the Snag Airstrip dump were not contaminated above the applicable criteria, the dump requires additional attention before it can be considered environmentally safe. A minimum of one metre of additional granular fill should be placed over the dump and compacted to avoid erosion. In addition it is recommended that a short-term groundwater monitoring program be considered for the dump, with concomitant collection of soil samples at depth to characterize further the nature of contamination which may have been obscured by the recent work conducted at the site.

A number of manholes, cisterns, wells, oil collection pits and basements are scattered about the vicinity of Snag Airstrip. Due to the liability that these represent to the land owner it is recommended that all open pits of this type be backfilled with an ample amount of granular material.

In each area of the site where granular fill has been added, regrading should be done to complement the surrounding topography and to ensure proper drainage without the creation of erosion channels or drainage catchments.

ADDENDUM TO CHAPTER V: RECOMMENDATIONS¹

E. Cleanup of Pesticide-Contaminated Soil (cont'd)

The four soil samples containing pesticides at concentrations exceeding the applicable remediation criteria also contained inorganic elements or PCBs at levels requiring remediation. Therefore the pesticide-contaminated soils can be removed using PCBs or the inorganic parameters as indicators of the area of soil to be excavated, and handled according to the procedure for soils exceeding the CCME R/P criteria. One exception is the soil sample collected beside the wooden platform at the south end of the warehouse foundation. Because the concentration of pesticides in this area was particularly high, delineation of the affected soils should be determined by pesticide concentrations in the soil and not by the levels of the inorganic elements which were also detected in this sample. Cleanup should be to a total pesticide concentration of less than 2000 ppb (BC MOE and MENVIQ Level B Remediation Criteria). Due to the high levels of pesticides detected in this area, the excavated soil should be handled in the same manner as for leachate toxic soils.

¹ The following section was added on 11 April 1996 subsequent to the receipt of additional analytical results which were pending at the time of publication of this report (31 March 1996). A total of four addenda have been inserted following pages III-40, IV-4, VI-120 and VI-134.

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APPENDIX A. METHODS

A. Sampling

1. Approach

Two standard techniques for sampling large areas were employed at Snag Airstrip. The preferred of the two, the geostatistical, or random field approach, involves sampling at the randomly chosen coordinates of a gridded area. However, when there are localized areas of contamination at a site, this method may not be sufficient alone. The second technique, the deterministic random approach, concentrates on areas likely to be contaminated: samples are collected near the contamination sources and in drainage pathways leading away from them. At Snag Airstrip the deterministic approach was used to obtain samples from the site as a whole while the extent of previously detected contamination was determined by geostatistical sampling.

This approach was designed to obtain samples that would:

- be representative of the status of the site - samples were obtained from all areas of the site;
- determine the nature and distribution of the main chemical contaminants - samples were collected from both stained and unstained soils; and
- indicate any contaminant migration within the ecosystem - soil samples from drainage courses and plant samples (to indicate uptake into the food chain) were collected.

The number of samples collected from each area was dependent on the topography and the extent of dump and spill activity. Background samples were obtained from locations remote from the sites and free of any local inputs. Sediments from freshwater locations were also taken.

The sampling approach was also guided by results obtained in previous investigations at military sites (ESG 1991, 1992 and 1993b and 1993c, 1994); the analytical data indicated a common waste disposal pattern at these sites.

2. General Soil/Sediment and Water

On arrival at the site, the team members familiarized themselves with the area and selected sampling locations. Two types of soil samples were collected at most locations. The one designated for inorganic analyses was obtained using a plastic scoop and stored in a Whirl Pak™ bag. The other, for organic analyses, was collected using a stainless steel scoop (which had been pre-washed, baked and stored in baked aluminum foil to preclude organic contamination) and placed in a 1 litre amber jar fitted with a Teflon-lined lid. These jars were obtained commercially (I-CHEM Ltd.) and were certified free of organic materials. Soil samples were generally restricted to the upper 10 cm and care was taken to obtain representative material.

Soil samples were kept at ambient temperatures. The samples were shipped by guaranteed air freight to labs in Sidney, British Columbia (for organic analysis) and Queen's University, Kingston, Ontario (for inorganic analysis). Upon receipt in the laboratory, the samples were kept at approximately 4°C while awaiting analysis.

Water samples were collected in acid-washed 1 litre polyethylene bottles for inorganic element and PCB analyses. Upon receipt in the laboratory, they were stored at 4°C until analysis.

Each sample collection was witnessed by at least two team members and in all cases a photographic record was made. The sample location and description were independently recorded by at least two team members. Each sample was given two code numbers: an ESG coding which was designed to facilitate subsequent data handling and a blind number which was the only number provided on the labels of samples submitted for analyses. ESG codes have been used for the presentation of results; an explanation of the coding used to describe samples is provided in Chapter III, Table III-1. It should be noted

that the analytical results may indicate that a sample initially designated, for example, as "L" series (landfill/dump) has been influenced by factors other than those initially suspected.

3. Delineation Soil Samples

A probabilistic approach, which involved laying out a grid and sampling at some chosen coordinates, was used. Soil samples were generally restricted to the upper 10 cm and were collected using plastic scoops and placed in Whirl Pak™ bags.

In order to determine the depth of contamination, test pits were also dug and samples collected at specific intervals. Sample locations were marked using yellow tent pegs. Samples were designated SN for Snag Airstrip and the tag number of the assessment sample which triggered the delineation (e.g., 33) followed by a number in the series of samples collected around the affected area (SN33-3 would therefore be the third in a series of delineation samples collected around tag #33 at Snag Airstrip).

4. Swabs

Surface swab samples were obtained from smooth non-porous surfaces. An absorbent gauze pad was dampened with hexane using stainless steel forceps which had been washed, baked and stored in aluminum foil. This pad was then used to wipe a 10 x 10 cm surface a single time. The wipe sample was placed in a 125 mL glass jar, sealed with an aluminum foil-lined lid, labeled, and stored in the dark until analysis (Environment Canada, 1987).

5. Potentially Asbestos-Containing Materials

Samples of insulation material were collected from the tower building, the fire hall and the accommodations cabin and one sample of wall pressboard was collected from the fire hall. The samples were stored in polyethylene bags which were sealed, labeled and shipped to the laboratory for asbestos analysis.

6. *Plant Samples*

i. Collection of Vegetation

Plants were collected from the same locations as soil samples wherever sufficient material could be obtained. These plants, which included shrubs, grasses and sedges, provided a representative cross-section of the vegetation potentially grazed by herbivores. The plants were collected within a one metre square area surrounding the soil sample and included leaves, stems and root tissue (where possible). A sufficient quantity was collected both for chemical analysis and for later identification and/or verification. All plant samples were placed in air-tight Ziploc™ bags and stored until they could be processed.

ii. Processing and Identification of Plants

Samples were rinsed in potable water from the Beaver Creek office of Indian and Northern Affairs, Canada, and patted dry with analytical grade paper towels before packaging. One representative sample of each plant species collected at a site was subdivided into root and shoot sub-samples (where possible). All processed samples were divided into two homogeneous sub-samples for inorganic and organic analysis. Samples designated for inorganic element analysis were placed in plastic Ziploc™ bags which were sealed with tape. Samples for organic analysis were wrapped in aluminum foil and placed in Ziploc™ bags. After processing, all samples were frozen for later chemical analysis.

Samples for identification/verification were pressed (preserved) on-site for future reference. Identification of species was conducted in the South and follows the taxonomy of Scoggan (1979).

7. *Chain of Custody*

A rigorous chain-of-custody was maintained for sample control. 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.

8. *Quality Assurance/Quality Control (QA/QC)*

At least one soil field duplicate sample was collected from each of the geographic areas of site. The soil sample was homogenized in the field and split into two containers which were labeled with consecutive numbers.

The analytical work was contracted out to carefully selected analytical laboratories. QA/QC procedures were carried out by means of the standard techniques of blind replicates and spiked samples. A detailed discussion is given in Appendix B of this chapter.

B. Analysis of Inorganic Elements

1. Method for Sediment Samples

Samples were analyzed by the Analytical Services Unit of Queen's University. The concentrations of arsenic (As), cadmium (Cd), chromium (Cr), cobalt (Co), copper (Cu), lead (Pb), nickel (Ni), and zinc (Zn) were measured. The samples collected in 1994 were analyzed for Mercury (Hg).

The analyses were carried out using the following procedure. Samples were air-dried and ground to a fine powder with a mortar and pestle; large stones were removed as they would not be expected to contain any anthropogenic environmental contaminants. Approximately 0.5 g of this dried material was heated with 2 mL HNO₃ and 6 mL HCl overnight so that the volume was reduced to 1-2 mL. This solution was then made up to 25 mL with distilled, deionized water and analyzed by atomic absorption spectrophotometry (AAS). While it is recognized that the digestion procedure used may not bring all metals into solution (some metals may be locked into silicate minerals), it was felt that the metals released into solution are of greater environmental significance than absolute total metals. Analyses were done in batches of ≤ 36 , which comprised ≤ 28 samples, 2 blanks, 4 duplicates and 2 samples of reference material (NRC MESS-1).

2. Method for Plant and Tissue Samples

Plant or tissue samples were dried in an oven overnight at 70°C and ground in a mill to pass through a 1 mm sieve. Approximately 1.0 g of dried sample was then weighed into a 100 mL beaker; 20 mL of nitric acid was added, and the mixture was heated for 1 hour. Perchloric acid (10 mL) was added and heating continued until the volume was reduced to about 1-2 mL. The digest was then made up to 25 mL and analyzed by AAS as for soils.

3. Method for Water Samples

A water sample (400 mL) was placed in a beaker on a hot plate together with 3 mL of nitric acid and slowly boiled to dryness. Twenty millilitres of 2% nitric acid was then added, the samples heated to boiling, cooled, and made up to 25 mL. The resulting solutions were then analyzed for the selected eight elements by AAS.

4. Method for Wall Press Board and Insulation Materials

Asbestos content of the bulk material was determined by polarized light microscopy dispersion staining. The analysis was carried out at the Occupational Health and Safety Resource Centre, University of Western Ontario, London, Ontario.

C. Analysis of Delineation Soil Samples

1. Polychlorinated Biphenyl (PCB) Field Analysis

Field analyses of polychlorinated biphenyls (PCBs) were performed with Millipore EnviroGardTM PCB Test Kits. These utilize the enzyme-linked immunoabsorbent assay (ELISA) technique which is based on antibodies that are specifically designed to bind to PCB molecules. These antibodies are bonded onto polystyrene test tubes. When solutions containing PCBs are incubated in the tube, the PCBs bind to the antibodies. After incubation, the test tubes are washed thoroughly with water and an enzyme-PCB conjugate is added. The conjugate then binds to the unoccupied antibody binding sites. After a short incubation time, the unbound conjugate is decanted and the tubes washed thoroughly again. Other reagents, substrate and chromogen, are then added which interact with the bound enzyme conjugate to form a coloured product. The amount of coloured product, which can be quantified by its intensity, is inversely proportional to the PCB concentration in the original sample in the test tube.

The immunoassay was carried out according to the manufacturer's instructions 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; in some cases more methanol was added until a liquid phase was present. The soil-methanol mixture was filtered and an aliquot of the extract used for subsequent analysis. Aliquots of 25 μ l were used and the colour intensity recorded on a portable spectrometer. 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 supplied by Supelco. Since the samples are extracted for only two minutes and no correction is made for incomplete extraction efficiency, the results of this method are generally multiplied by two before interpretation. In this study it was found that samples that contained a high content of oil and grease gave very low results as compared to the reference GC/ECD method. Therefore, all samples which were visibly contaminated with oil and grease were analyzed in the laboratory as described below and the test kit results were not used.

2. *Polychlorinated Biphenyl (PCB) Laboratory Analysis*

PCBs were analyzed using the standard analytical procedure of gas chromatography with an electron capture detector (GC/ECD). The analyses were performed at the Analytical Services Unit, Queen's University, Kingston, Ontario.

A 5 g sample was taken for the determination of wet weight/dry weight ratio. Soils were analyzed by taking approximately 10 g (dry weight equivalent), spiking with internal standard solution (decachlorobiphenyl) and extracting with approximately 300 mL dichloromethane in a soxhlet extractor for six hours. The sample was concentrated to 1-2 mL and the solvent exchanged for hexane. This was then applied to a Florisil column (Supelco SPE tube) and the resulting eluent analyzed using an HP 5890 gas chromatograph equipped with electron capture detector. A 30 mm DB5 capillary column was used and the instrument was calibrated with Aroclor 1260 standards.

3. Inorganic Element Field Analysis

A TN Technologies, Inc. Spectrace 9000 Field Portable X-Ray Fluorescence Analyzer (FPXRF) was used for field inorganic element analysis at Snag Airstrip. This FPXRF is equipped with a high resolution solid state (mercuric iodide) detector and fundamental parameters quantitative analysis software. Fundamental parameters quantitative analysis involves measuring the main elements present and compensating for the effects of the interferences on one another by computer calculations. This allows a good estimate of inorganic element concentrations for all soil matrix types without requiring several standard samples with the same general concentrations and matrix; pure elements or standard reference materials are used for calibration standards.

The FPXRF employs three radioactive sources for X-ray generation; the sources and acquisition times used for analysis are given in Table VI-1. As recommended by the manufacturer, the operation of the instrument was monitored periodically during analysis with pure element and teflon standards.

Table VI-1: Count Times for FPXRF Sources

Source	Measurement Time (sec)	
	Calibration	Analysis
Fe-55	50	100
Cd-109	50	300
Am-241	50	50
Total Time	150	450

The soil samples were analyzed as follows. Subsamples were spread out on absorbent paper towels and allowed to air dry overnight. Large stones and pebbles were removed and each sample ground with a pestle and mortar. The ground sample was placed in the sample cup and covered with a Mylar film and ring. The filled sample cup was inverted (Mylar side down), tapped gently to settle and compact the contents, placed on the probe and analyzed. Detailed results are given in Chapter III.

The limits of detection for each element - defined as the analyte concentration giving a signal equal to the blank, plus two standard deviations of the blank - was determined by using the standard deviations of analyte samples which gave concentrations close to the blank. Lower detection limits were obtained for copper when a longer count time was used (Table VI-2).

Table VI-2: Detection Limits for the Determination of Copper, Lead and Zinc by FPXRF

Element	Detection Limits (ppm or $\mu\text{g/g}$)
Copper	50
Lead	20
Zinc	30

4. Inorganic Element Laboratory Analysis

The method used for the inorganic analysis of delineation soil samples was the same as that used for assessment soil samples (see section B above).

D. Analysis of Polychlorinated Biphenyls (PCBs) and Pesticides in Assessment Soil, Tissue and Water Samples

1. Summary

Analysis for PCBs, pesticides, polycyclic aromatic hydrocarbons (PAHs, see below), polychlorinated dibenzodioxins and dibenzofurans (PCDDs and PCDFs, see below) were conducted by Axys Analytical Services Ltd. of Sidney, B.C. Each sample was clearly labeled and locked in a secure frozen storage area until retrieved by the analyst.

All samples for PCB and/or pesticide analysis were spiked with an aliquot of surrogate standard (2,4,5,6-tetrachloro-m-xylene, PCB 209 and d₄-alpha endosulphan) prior to analysis by gas chromatography with electron capture detection (GC/ECD); for gas chromatography with mass spectrometry (GC/MS), the samples were spiked with aliquots of ¹³C labeled surrogate standard (PCB 101, PCB 180, PCB 209, gamma-BHC, Mirex, p,p'-DDE, p,p'-DDT and d₄-alpha endosulphan). Sediments were extracted with a solvent on a shaker table. Tissues were ground with sodium sulphate, packed in a glass chromatographic column and eluted with solvent. Water was liquid/liquid extracted with dichloromethane. Sample extracts were separated into three fractions on a Florisil column. The first fraction was also analyzed for PCBs as Aroclors and chlorinated pesticides by GC/ECD or GC/MS. The second and third fractions were analyzed for chlorinated pesticides by GC/ECD.

2. Extraction Methods

i. Soils and Swabs

The soil sample was thoroughly homogenized and a subsample taken for the determination of wet weight/dry weight ratio.

Wet soil or a swab sample (10 - 15 g), to which an aliquot of surrogate standard had been added, was extracted once with 80 mL of 1:1 dichloromethane/methanol by shaking on a shaker table for 30 minutes. The extraction procedure was repeated using 80 mL of dichloromethane. The extracts were combined, washed with solvent-extracted water, dried over anhydrous sodium sulphate and concentrated by Kuderna-Danish techniques. After the addition of activated copper to remove sulphur, the extract was separated on a Florisil column.

ii. Tissues

The wet tissue was homogenized and a subsample was dried for moisture determination.

Homogenized wet tissue (5 - 10 g), anhydrous sodium sulphate and an aliquot of surrogate standard were ground with a glass mortar and pestle to a free-flowing powder. This powder was transferred to a glass chromatographic column containing 1:1 dichloromethane/hexane and eluted with additional solvent at 3 - 5 mL/min. The eluent was concentrated and subsampled for gravimetric lipid analysis.

The remaining extract was placed on a calibrated Biobead SX-3 gel permeation column and eluted with 1:1 dichloromethane/hexane. The 150 - 300 mL fraction was collected, evaporated to a small volume, and fractionated on a Florisil column.

iii. Water

A 1 litre sample was placed in a separatory funnel and spiked with aliquots of surrogate standard solution and methanol. The sample was extracted with three 100 mL portions of dichloromethane. The combined portions were dried over anhydrous sodium sulphate, spiked with hexane, reduced by rotary evaporation, and fractionated on a Florisil column.

3. *Sample Cleanup and Separation*

i. Cleanup for GC/ECD

The extract was quantitatively transferred to a Florisil column and eluted with three solvent systems consisting of hexane (Fraction-1), 85:15 dichloromethane/hexane (Fraction-2) and 50:50 dichloromethane/hexane (Fraction-3).

An aliquot of surrogate standard was added to each Fraction-2 to allow quantification, since the surrogate standard added at the beginning of the procedure eluted into Fraction-1 and Fraction-3. Each fraction was concentrated, transferred to a microvial, and an aliquot of recovery standard (4,4'-dibromooctafluorobiphenyl and PCB 204 to Fraction-1 and Fraction-2 and ¹³C-PCB 153 to Fraction-3) was added prior to analysis by GC/ECD.

Fraction-1 was analyzed by GC/ECD for PCBs as Aroclors and mildly polar chlorinated pesticides.

Fraction-2 was analyzed by GC/ECD for moderately polar chlorinated pesticides.

Fraction-3 was analyzed by GC/ECD for the most polar chlorinated pesticides.

ii. Cleanup for GC/MS

The extract was quantitatively transferred to a Florisil column. The column was eluted with hexane followed by 85:15 dichloromethane/hexane. The eluates were combined (Fraction-1). The column was eluted with 50:50 dichloromethane/hexane (Fraction-2).

Each fraction was concentrated, transferred to a microvial and spiked with an aliquot of recovery standard (¹³C-PCB 153) prior to instrumental analysis.

Fraction-1 was analyzed by GC/MS for PCBs as Aroclors and non-polar and moderately polar chlorinated pesticides.

Fraction-2 was analyzed by GC/ECD for the most polar chlorinated pesticides.

4. *Instrumental Analysis*

i. GC/ECD Analysis

Each fraction was analyzed for pesticides by using an HP 5830A gas chromatograph equipped with a ⁶³Ni electron capture detector (GC/ECD), a 60 m DB-5 column (0.25 mm i.d. x 0.1 μm film thickness) and HP 3392 integrator. Fraction-1 was simultaneously analyzed for PCBs as Aroclors. Chromatographic conditions were as follows - Initial temp: 100 °C; Injection: splitless, 1 min; Initial time: 2 min; Ramp: 10°C/min to 150°C, 3 °C/min to 300 °C; Final time: 5 min. Column conditions were: Carrier gas, helium; Pressure, 21 psi; Flow rate, 60 mL/min; and Split ratio, 15:1.

The instrument was calibrated daily using a solvent blank and standards of Aroclor 1242, Aroclor 1254 and Aroclor 1260. For each Aroclor, the sum of the areas of three characteristic peaks was used to calculate its response factor against the internal standard. The area of the same three peaks was used to determine the concentration of each Aroclor in the sample.

All values reported in the tables are in ppb (ng/g) on a dry weight basis for soil samples and on a wet weight basis for plant samples. Procedural blank information is given in Chapter III; the levels obtained demonstrated no blank interferences with the sample results.

ii. Low Resolution GC/MS

Fraction-1 was analyzed for Aroclors and non-polar and moderately polar chlorinated pesticides using a Finnigan INCOS 50 mass spectrometer equipped with a Varian 3400 GC, a CTC autosampler and a DG 10 data system running INCOS 50 (Rev 9) software. Chromatographic separation of pesticides was achieved with a 60 m DB-5 column (0.25 mm i.d. and 0.10 μm film thickness). The mass spectrometer was operated in the electron impact (EI) mode at unit mass resolution in the multiple ion detection (MID) mode acquiring two characteristic ions for each target analyte and surrogate standard.

(MID) mode acquiring two characteristic ions for each target analyte and surrogate standard.

iii. High Resolution GC/MS

For high resolution GC/MS analysis, a VG 70 SE mass spectrometer, equipped with a Hewlett Packard 5890 GC, a 60 m DB-5 chromatographic column (0.25 mm i.d. and 0.10 μm film thickness) and a CTC autosampler was used. Data was acquired in the MID mode to enhance sensitivity. Two characteristic ions for each target analyte and surrogate standard were monitored.

E. Analysis of Polycyclic Aromatic Hydrocarbons (PAHs) in Soils

1. Summary

All samples were spiked with an aliquot of perdeuterated PAH surrogate standards (acenaphthene, chrysene, naphthalene, perylene, phenanthrene, pyrene, dibenz(a,h)anthracene, benzo(a)pyrene, and benzo(g,h,i)perylene) prior to analysis. Soil/sediment samples were extracted using a base digestion procedure. The extracts were cleaned on a silica gel column and analyzed for PAHs by GC/MS.

2. Extraction

The sediment sample was thoroughly homogenized and a subsample dried for moisture determination.

A portion of the sediment sample (10 - 15 g wet weight), an aliquot of surrogate standard, methanol and potassium hydroxide solution were heated together under reflux for 1 hour. Solvent-extracted water was added and heating continued for an additional 30 minutes. The resulting digest and aqueous phase were cooled and extracted three times with pentane. The pentane phases were combined, backwashed with solvent-extracted water, dried over anhydrous sodium sulphate, concentrated in a Kuderna-Danish flask to a small volume and cleaned on a silica gel column.

3. Column Cleanup

The sample extract was loaded onto a silica gel column and eluted with pentane (discarded) followed by dichloromethane. The dichloromethane fraction was concentrated in a Kuderna-Danish flask and an aliquot of recovery standard (containing benzo(b)fluoranthene d-12, fluoranthene d-10, and acenaphthylene d-8) was added. The extract was then transferred to a microvial, concentrated under a stream of nitrogen and analyzed by GC/MS.

4. Instrumental Analysis

The concentrated extracts were analyzed for PAHs by gas chromatography with detection by quadrupole mass spectrometer (GC/MS). The GC/MS system consisted of a Finnigan INCOS 50 mass spectrometer equipped with a Varian 3400 gas chromatograph which had a CTC autosampler and a DG 10 Data system. Chromatographic separation was carried out using a DB-5 column (30 m, 0.25 mm i.d. x 0.25 µm film thickness). The mass spectrometer was operated in the electron impact (EI) mode (70 eV) using Multiple Ion Detection (MID) to enhance sensitivity, acquiring two characteristic ions for each target analyte and surrogate standard. A split/splitless injection sequence was used.

F. Analysis of Polychlorinated Dibenzodioxins and Polychlorinated Dibenzofurans in Soil Samples

1. Summary

All samples were spiked with an aliquot of ¹³C-labelled surrogate standard solution (tetrachlorodioxin, tetrachlorofuran, pentachlorodioxin, pentachlorofuran, hexachlorodioxin, hexachlorofuran, heptachlorodioxin, heptachlorofuran, and octachlorodioxin) prior to analysis. Each soil sample was ground with sodium sulphate and soxhlet extracted. The extracts were subjected to a series of cleanup steps and then analyzed by high resolution gas chromatography with high resolution mass spectrometric detection (HRGC/HRMS).

2. Extraction

Soil samples were homogenized and subsamples dried for moisture determination. A wet sample (15 g) was ground with anhydrous sodium sulphate to a free-flowing powder, and loaded into a soxhlet thimble. An aliquot of surrogate standard solution was added and the soxhlet refluxed with toluene and acetone for 16 to 20 hours. The cooled extract was sequentially washed with potassium hydroxide solution, distilled water, concentrated sulphuric acid and distilled water. The organic layer was dried over anhydrous sodium sulphate.

3. Column Chromatography

i. Silica Gel Column

The extract was transferred to 10 gram layered silica gel columns (layers: neutral silica gel, basic silica gel, neutral silica gel, acidic silica gel; neutral silica gel) and eluted with hexane.

ii. Alumina Column

The extract from the silica gel column was loaded onto a 10 gram basic alumina column. The first fraction, eluted with 3% dichloromethane:hexane was discarded. The next fraction, eluted with 1:1 dichloromethane:hexane was retained.

iii. Carbon/Celite Column

The extract from the alumina column was loaded onto a carbon celite column. The first fraction (F1), which eluted with 1:1 cyclohexane:dichloromethane followed by 1:1 toluene:ethyl acetate was discarded. The column was then inverted and eluted with toluene. This fraction (F2) was evaporated to near dryness and redissolved in hexanes.

iv. Alumina Column

The extract from the carbon celite column procedure was loaded onto a second alumina column. The first fraction, eluted with 3% dichloromethane:hexane was discarded. The next fraction, eluted with 1:1 dichloromethane:hexane was retained and concentrated to 1 mL.

4. Preparation for GC/MS Analysis

The extract was evaporated just to dryness and an aliquot of recovery standard solution (^{13}C -labelled 1,2,3,4-tetrachlorodibenzodioxin and 1,2,3,7,8,9-hexachloro-dibenzodioxin) was added.

5. GC/MS Analysis

High resolution analysis of polychlorinated dibenzodioxins (PCDD) and dibenzofurans (PCDF) was conducted on a VG 70SE mass spectrometer equipped with a Hewlett Packard 5890 GC, a 60 m DB-5 chromatography column (0.25 mm i.d. \times 0.1 μ m film thickness) and a CTC autosampler. Data were acquired in the voltage selected ion recording mode (SIR) to enhance sensitivity. At least three ions were monitored for each group of isomers. Two were from the parent cluster while the third was from the loss of COCl (i.e. M-COCl or M-63). Two ions were used to monitor each of the ^{13}C -labelled surrogate standards and five additional ions were monitored to check for interference from chlorinated diphenyl ethers.

G. Barrel Sampling

1. Field Sampling

Barrels were sampled in 1994. Barrels to be sampled were set in an upright position, provided that this did not cause them to leak and that it was physically possible. All of the barrels were either already open or were easily opened using a bung wrench. This was performed slowly to allow excess pressure that may have been present in the barrel to be released without endangering the sampler. Barrels were identified with pre-labeled magnets and each sample was given a number using a letter/number code indicating the site from which the sample was collected (SN for Snag), a letter code indicating it was a barrel sample (BS) and a number (SN-BS1 etc.).

The barrels were sampled by means of a 25 mL glass sampling tube (Drum Thief, Lab Safety Supply Inc.). The glass tube was inserted slowly into the barrel, to just above the bottom, to ensure a vertically integrated sample. By placing a finger over the end of the tube, the sampler was able to remove a representative portion of the contents. Approximately 20 mL of the sample was placed in a labeled 30 mL vial equipped with a Teflon lined lid (QorpakTM, VWR Scientific). After the sample had been taken the barrels were closed and left in a vertical position.

2. Laboratory Analysis

Chemical analyses were carried out on the samples obtained from the barrels in order to identify the contents (e.g., fuel oil, lubricating oil and grease, antifreeze, etc.) and to determine the PCB, chlorine, cadmium, chromium and lead concentrations. Quality control was maintained through the analysis of standards, controls and reference materials.

i. Identity of Liquid Phases

The infra-red spectra of many of the liquid phases were recorded. Samples shown by infra-red spectrometry to contain hydrocarbons were extracted with hexane and the extracts subjected to gas chromatographic (GC) analysis in order to establish the kind of hydrocarbons present. Hewlett Packard 5890 and Perkin Elmer Sigma 2000 chromatographs were employed with FID detectors and DB-5 30 m capillary columns. All oils and other organic liquids were diluted with carbon disulfide and treated similarly. This enabled the petroleum product mixtures to be classified as either gasoline, fuel oil or lubricating oil. Some organic liquids were analyzed by GC/FID using either a 3 m 60/80 Carbowax B / 1% SP-1000, a 6 m 100/120 Supelcoport / 10% FFAP, a 1 m Chromosorb 101 / 3% Carbowax 20M, or 30 m DB5 capillary column; identity was confirmed by using two of these columns, particularly for chlorinated compounds.

ii. Analysis for Polychlorinated Biphenyls (PCBs) in Liquid Phase

The PCB content of the oil samples was determined by weighing approximately 0.2 g of material on to a LC-Florisil solid phase extraction tube (SupelcoTM) and eluting with hexane. The resulting solutions were run on an HP 5890 Series II Plus gas chromatograph with ECD detector to determine the concentration of PCBs present; further clean up was required in some cases prior to running the eluent on the GC.

Aqueous samples were extracted with dichloromethane and after concentration were analyzed as above for PCBs; in some cases, cleanup with a Florisil column after

changing solvent from dichloromethane to hexane was required. Some samples containing a thin surface film of oil on water were similarly treated.

iii. Analysis for Chlorine in Liquid Phase

The concentration of chlorine in samples was determined by neutron activation analysis (NAA) using the Slowpoke reactor at Royal Military College, Kingston, Ontario. Samples of oil were weighed (0.3 g approximately) into a polyethylene vial and heat sealed. They were then irradiated with neutrons ($5 \times 10^{11} \text{ n cm}^{-2} \text{ s}^{-1}$) for 1.0 minute. 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 using EPAA software.

iv. Analysis for Metals in Liquid Phase

Metal concentrations were determined by one of two methods: spark source atomic emission spectrophotometry (AES) or atomic absorption spectrophotometry (AAS). The preferred method, AES, however was not suitable for highly volatile samples which had the tendency to pre-ignite with a flash; therefore volatile samples were analyzed by AAS.

The AES method employed a Baird FAS-2C spectrophotometer which was calibrated with standards in an oil matrix. Samples were introduced into the instrument as submitted using a rotating disc electrode. Volatile samples were analyzed by AAS using a Perkin Elmer 2380 instrument. Samples, analyzed by AAS, were diluted with methyl isobutyl ketone (MIBK) and run along with standards prepared in MIBK.

APPENDIX B. QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)

An internal quality assurance/quality control program was implemented to allow the monitoring of data quality on an ongoing basis. All samples were given sequential, numerical codings before submission to the analytical firm; these codings masked any information concerning the site location, sample type (for instance, whether it came from an outfall, a landfill, etc.) or possible concentration. Aspects of the QA/QC program and the results are discussed below.

A. QA/QC for Inorganic Analysis

1. Accuracy

Accuracy was monitored externally by the ESG using three blind mixtures of NRC Canada Marine Reference Sediments MESS-1 and BCSS-1, which were submitted to Queen's University Analytical Services Unit (ASU). Each of these was analyzed in triplicate; the results are presented in Table VI-3. Good agreement with the certified values was found for most elements with the exception of chromium, which was consistently lower than the certified values; nickel was also slightly low in 2 of 3 cases. The discrepancy was most likely due to differences in the digestion methods used.

The ASU at Queen's University monitored accuracy internally using 20 replicates of NRC Canada Marine Reference Sediment MESS-2. (Table VI-4). These were run concurrently with sample batches throughout the analytical program. Good agreement with the certified values was obtained for all elements, with the exception of chromium. Results for the reference material were, again, consistently low for chromium and nickel relative to the certified values; this discrepancy was also attributed to differences in the digestion methods.

A similar internal monitoring program was employed by the ASU for the analysis of plants using certified reference material NBS 1547 Peach Leaves and NBS 1515 Apple Leaves. These reference materials have been certified for copper, nickel, lead, zinc and

arsenic, and were each analyzed twice during the analytical program (Table VI-5). Only copper and zinc, however, were present in these standards at concentrations which were detectable by the analytical methods employed by ASU; good agreement with the certified values was obtained in both cases. The concentrations of nickel, lead and arsenic in the leaf standards are lower than ASU's detection limits for these elements. Values determined by ASU for these elements were below the certified detection limits which was the best possible agreement obtainable.

2. Precision/Repeatability

Precision was monitored externally by the ESG using 14 pairs of soil sample duplicates; these were homogenized in the field and submitted blind as separate samples to ASU for analysis. The results are presented in Table VI-6. Average relative standard deviations or coefficients of variation (standard deviation divided by the mean) for sample pairs were expressed as percentages and used to evaluate laboratory precision. Acceptable limits are generally considered to be less than 30% relative standard deviation, with 20% or less considered good agreement. The average relative standard deviations for all inorganic elements in soil field duplicates were well below 20% with the exception of lead; values ranged from 6.9 to 18.3% indicating good analytical precision through the analytical program. The average relative standard deviation for lead was 29% which is still below the acceptable level of 30%. This is most likely due to the nature of lead when found in high concentrations; the lead tends to clump together, making a non-homogeneous mixture in the duplicates.

Internal monitoring of precision was also carried out by ASU through the use of analytical replicates. Thirty soil and sediment samples and five plant sample were analyzed in duplicate (Table VI-7 and Table VI-8). Precision for analytical duplicates is generally anticipated to be better than that for field duplicates due to errors resulting from unavoidable sample heterogeneity in the latter. Average relative standard deviations for copper (14.1%), nickel (5.2%), cobalt (6.2%), cadmium (10.4%), zinc (11.2%), chromium (10.2%) and arsenic (15.6%) in the soil replicates were less than 20%

indicating good to excellent analytical precision for soil analysis (Table VI-7). Again, lead is slightly higher but well within acceptable levels at 22%. Average relative standard deviations for the plant analytical duplicates were extremely low, with Cu (1.2%), Cd (0.1%) and Zn (2.2%) indicating excellent precision for the plant analytical replicates.

B. QA/QC for PCB Analysis

The QA/QC protocol utilized by Axys Analytical Services Ltd. (Axys) for PCBs consisted of the batch method, whereby samples were worked up in batches with associated quality control samples. Each batch consisted of nine or fewer samples, along with one QA/QC sample (certified or internal spiked reference material), one analytical duplicate and a procedural blank. Spiked material was also used in cases where analytical results were anticipated to be outside of the concentration ranges of the available certified reference materials. Each batch was carried through sample workup, instrumentation and interpretation as a unit, and the sample results were interpreted in relation to the associated QA/QC results. All QA/QC data from each batch were considered together in order to evaluate the overall quality of the analytical program. The results of the organic QA/QC program are discussed below, and the QA/QC data from Axys is summarized in Table VI-9 through 26.

1. Accuracy

Accuracy was monitored externally by the ESG using three blind mixtures of NRC Reference Sediment HS-1 and HS-2, for PCB Aroclor 1254 equivalents (Table VI-9). Concentrations determined for the mixtures were consistently lower (25 to 30%) than the certified values. Since this discrepancy was probably attributed to differences in analytical methodologies, the results were considered to be acceptable.

Axys monitored the accuracy of PCB analysis of soils internally using spiked soil reference materials (for Aroclors 1242, 1254 and 1260) which were analyzed 23 times during the analytical program (Table VI-10). Excellent agreement was found between determined and expected values for all three Aroclors (within 20% of the expected value),

indicating that analytical accuracy throughout the soil Aroclor analysis program was good.

Accuracy for water PCB Aroclor analyses was also monitored internally by Axys using spiked reference materials (Table VI-10). One water spike sample was analyzed with the batch of water samples. The determined value for Aroclor 1242 was slightly high at 150% of the expected recovery while Aroclors 1254 and 1260 were within the acceptable limit of $\pm 20\%$. In the absence of more than one spiked water reference sample, and since values obtained in the water samples were quite low, these are acceptable. Accuracy for plant tissue sample Aroclor analysis was monitored by Axys using N.I.S.T. Certified Reference Material 1588 (Cod Liver Oil). Three samples were analyzed in total with good agreement found between determined and certified values for all three Aroclors (Table VI-11).

Interferences for PCB analysis as Aroclors were monitored internally throughout the program using 25 soil blanks, two water blanks and five plant tissue blanks (Table VI-12). One of the soil blanks contained a small amount of quantifiable Aroclors, but the Aroclors detected in the soil samples in this batch were in the order of 170 to 1900 ppb so that the interference noted in the blank was insignificant. The two water blanks and one of the plant blanks also showed some quantifiable Aroclors but the levels are extremely low and close to the detection limits.

2. Precision/Repeatability

Precision was monitored externally by the ESG using 14 pairs of soil sample duplicates which were homogenized in the field during collection and submitted blind to Axys for analysis. Results for these sample replicates are presented in Table VI-13. The average relative standard deviations, expressed as a percentage, for soil samples were 7.8% and were considered very good repeatability.

Precision was also monitored internally by Axys, through the use of 16 soil and sediment analytical replicates (Table VI-14) and three plant analytical replicates (Table

VI-15). All were analyzed in duplicate with the exception of one soil sample which was analyzed in triplicate. The average relative standard deviation, or coefficient of variation (standard deviation divided by the mean), for soil and sediment samples was 5.5%, and 3.7% for plant samples. The accuracy of pesticide analysis was monitored internally by Axys using a spiked soil reference material which was analyzed three times during the analytical program (Table VI-20). These indicate excellent correlation between duplicates. One sample, G6140A, showed the highest relative standard deviation at 26%. This sample was analyzed several times and is described as fluffy, dry brown-grey soil with lots of organic matter (roots and moss). The variation between duplicates most likely represents sample heterogeneity. The variabilities for the remaining soil samples and the plant samples are well within acceptable limits.

C. QA/QC for Polycyclic Aromatic Hydrocarbons (PAHs)

1. Accuracy

The analytical accuracy for PAHs in soils was checked externally by the ESG using two blind mixtures of certified NRC reference sediment materials (Table VI-16). Reasonable agreement with the certified values was obtained for the majority of the PAH compounds; many of the results tended to be lower than the certified values.

Axys also monitored accuracy for the PAH analysis of soils internally using Certified N.I.S.T. Marine Reference Sediment HS-6 (Table VI-17). This reference material was analyzed four times during the analytical program. Good agreement with the available certified values was found for most of the compounds analyzed. Results for naphthalene tended to be slightly higher than the certified values.

Interferences for PAHs in soils were monitored internally by Axys throughout the analytical program using five analytical blanks (Table VI-18). Interferences were found in each of the blanks; a majority of these, however, were close to the detection limits found in other compounds and were considered relatively minor.

2. Precision/Repeatability

The precision of the PAH analyses was monitored internally by Axys using two pairs of soil analytical duplicates (Table VI-19). Average relative standard deviations for those compounds which were reliably quantified ranged from 0.1 to 11%, indicating excellent analytical precision for PAH analysis.

D. QA/QC for Chlorinated Pesticides

1. Accuracy

The accuracy of pesticide analysis was monitored internally by Axys using a spiked soil reference material which was analyzed three times during the analytical program (Table VI-20). Recoveries for most of the chlorinated pesticides were within 20% of the spiked value, indicating good analytical accuracy.

Interferences were also checked internally by Axys through the use of analytical blanks for soils (Table VI-21). Four soil blanks were analyzed; values for almost all chlorinated pesticide concentrations were below the detection limits except for a very few not-readily-quantifiable interferences.

2. Precision/Repeatability

Precision for pesticide analysis was monitored internally by Axys through the analysis of two soil samples in duplicate (Table VI-22). Relative standard deviations for those compounds which could be reliably quantified ranged from 6.8 to 11%, indicating acceptable analytical precision. The detection limits for one of the duplicate samples, G6119A are quite high due to the large concentrations of PCB Aroclors in the sample which co-elute with the pesticide fractions and interfere in the pesticide analyses. This sample will be discussed in the results section.

E. QA/QC for Polychlorinated Dibenzo-P-Dioxins/Furans

1. Accuracy

Internal monitoring for accuracy was conducted by Axys using four samples of spiked sediment (Table VI-23). Average percent recoveries for dioxin/furan compounds ranged from 94 to 110%, indicating very good analytical accuracy.

Interferences were also checked internally using four soil blanks (Table VI-24); concentrations for all compounds were below detection, and detection limits were low.

2. Precision/Repeatability

Monitoring for analytical precision was conducted by Axys using two soil samples, one of which was analyzed in triplicate.(Table VI-25). Relative standard deviations ranged from 0 to 15% with most being well below 10% indicating good analytical precision for dioxin and furan compound analysis.

Surrogate standard recovery results for the spiked materials, analytical blanks and sample duplicates discussed above are presented in Table VI-26. These results conform well to internal specifications (30 - 130% recovery) followed by Axys.

F. QA/QC for Field Portable X-Ray Fluorescence Analyses

1. Inorganic Elements

i. Field Analyses

For field measurements, the operation of the FPXRF was monitored with pure metal and Teflon standards in accordance with the manufacturer's instructions. As recommended by the manufacturer, analyses were only performed upon obtaining manganese and cobalt intensities of <0.003 when pure iron was used as the standard. In order to review the precision/reproducibility of the data, eight samples were analyzed in duplicate. The average relative standard deviation or coefficient of variation expressed as

a percentage for all replicate soil samples was 5.4% for copper, 9.4% for zinc and 13.7% for lead. (Table VI-27)

ii. Laboratory Analyses

Twenty soil samples were re-analyzed in the laboratory by using atomic absorption spectroscopy. Analysis was run concurrently with other soil samples and the precision/ accuracy of the laboratory method is discussed in the previous section.

iii. Comparison of Field and Laboratory Results

The concentrations of copper, zinc and lead in soil samples analyzed by FPXRF in the field are compared to those obtained by laboratory AAS in Table VI-28. Good agreement was obtained between the field data and the laboratory results. Average relative standard deviations were well within the 30% allowed for field duplicates, with copper at 7.7%, lead at 21% and zinc at 15.5%. Lead again showed the greatest difference between duplicates as seen with the analytical and field duplicates analysed by atomic absorption spectrometry (AAS). This is probably due to the nature of lead when found in sediments; it is usually a heterogeneous mixture as the lead tends to clump together, making it difficult to obtain close duplicate results.

2. PCB Analysis

i. Field Analysis

Precision/reproducibility of the immunoassay field test kits was monitored by analyzing 11 samples in duplicate. Good agreement was obtained between replicate analyses (Table VI-29); the average relative standard deviation obtained was 2.4%.

ii. Comparison of Field and Laboratory Results

The concentrations of PCBs in 21 confirmatory samples determined by laboratory GC/ECD and immunoassay field test kits are shown in Table VI-30. Acceptable agreement was obtained between the field results and the laboratory data with the average relative

standard deviation at 21%. The test kit results are generally lower than the values obtained in the laboratory but usually do indicate when confirmatory testing is required. Interferences such as high hydrocarbons in the samples can mask the concentration of PCBs in the samples analyzed by XRF. Lower readings will also be seen if the samples are mossy or high in organic material since effective extraction is not possible.

Table VI-3: Inorganic Element Analysis Results for Blind Mixture Replicates of NRC Canada Certified Reference Materials

Sample/Composition	Replicate	Cu	Ni	Co	Cd	Pb	Zn	Cr	As
ppm ($\mu\text{g/g}$)									
ESG SRM17 75% MESS-1 / 25% BCSS-1 7.50 g / 2.51 g	1	22.4	26	11.8	<1.0	28	175	49	10.2
	2	27.2	27	11.5	<1.0	32	188	47	8.2
	3	24.7	30	12.1	<1.0	30	187	47	9.6
	Average	25	27	11.8	<1.0	30	184	48	9.3
	Std. Dev.	2.4	2.2	0.3	-	2.3	7.2	1.3	1.0
	Certified Value	23.4	35.9	11.0	0.5	31.2	167	84	10.7
		± 3.5	± 2.9	± 1.9	± 0.1	± 5.4	± 16	± 12	± 1.3
ESG SRM18 50% MESS-1 / 50% BCSS-1 5.0 g / 5.0 g	1	18.3	36	12.0	<1.0	25	166	53	9.5
	2	19.6	40	11.4	<1.0	25	160	63	10.1
	3	18.5	36	12.0	<1.0	22	153	64	9.5
	Average	18.8	38	11.8	<1.0	24	160	60	9.7
	Std. Dev.	0.7	1.8	0.3	-	1.9	6.4	6.0	0.3
	Certified Value	21.8	42.4	11.1	0.4	28	155	97	10.9
		± 3.3	± 3.2	± 2	± 0.07	± 4.8	± 15	± 13	± 1.3
ESG SRM19 100% BCSS-1 10 g	1	16.1	50	12.6	<1.0	22	121	80	10.4
	2	17.5	50	12.2	<1.0	18	116	84	10.2
	3	15.1	49	11.4	<1.0	19	118	86	10.0
	Average	16.2	50	12.1	<1	19.4	118	83	10.2
	Std. Dev.	1.2	0.2	0.6	-	2.1	2.1	3.1	0.2
	Certified Value	18.5	55.3	11.4	0.25	22.7	119	123	11.1
		± 2.7	± 3.6	± 2.1	± 0.04	± 3.4	± 12	± 14	± 1.4

Table VI-4: Summary of Inorganic Analysis Results for Soil Internal Standards

Element	MESS-2	
	Certified Value ppm ($\mu\text{g/g}$)	Mean (n=20)
Cu	39.3 \pm 2.0	38 \pm 1.8
Ni	49.3 \pm 1.8	42 \pm 1.9
Co	13.8 \pm 1.4	13.9 \pm 0.87
Cd	0.24 \pm 0.01	<1.0
Pb	21.9 \pm 1.2	17.6 \pm 1.5
Zn	172 \pm 16	169 \pm 10.9
Cr	106 \pm 8	65 \pm 10
As	20.7 \pm 0.8	18.6 \pm 1.1

Table VI-5: Summary of Inorganic Analysis Results for Plant Tissue Standards

Element	1. NBS 1515 Apple Leaves		2. NBS 1547 Peach Leaves	
	Certified Value ppm ($\mu\text{g/g}$)	Mean (n=2)	Certified Value ppm ($\mu\text{g/g}$)	Mean (n=2)
Cu	5.64 \pm 0.24	5.9 \pm 0.35	3.7 \pm 0.4	3.8 \pm 0.32
Ni	0.91 \pm 0.12	<5	0.69 \pm 0.09	<5
Co	-	<5	-	<5
Cd	-	<0.5	-	<0.5
Pb	0.47 \pm 0.024	<15	0.87 \pm 0.03	<15
Zn	12.5 \pm 0.3	12 \pm 0.34	17.9 \pm 0.4	17.6 \pm 1.4
Cr	-	<10	-	<10
As	0.038 \pm 0.007	<0.2	0.06 \pm 0.018	<0.2

Table VI-6: Inorganic Element Results for Duplicate Soil and Sediment Samples Collected in the Field

Sample	Cu	Ni	Co	Cd	Pb	Zn	Cr	As	Location
ppm (ug/g)									
G6193A	39	25	9.4	<1.0	<10	85	39	3.2	~ 10 km N of the airstrip
G6193B	42	25	10.5	<1.0	<10	81	44	3.6	
Std Dev	2.1	0	0.78	-	-	2.8	3.5	0.28	
Rel Std Dev	5.2	0	7.8	-	-	3.4	8.5	8.3	
G6101A	87	33	15.1	<1.0	640	283	45	5.1	2.5 m SW of SW corner of tower building
G6101B	93	39	12.3	<1.0	640	266	56	6.3	
Std Dev	4.2	4.2	2	-	0	12	7.8	0.85	
Rel Std Dev	4.7	11.8	14.5	-	0	4.4	15.4	14.9	
G6104A	31	27	15.4	1.3	2060	1780	46	5.3	1.5 m N of N side of tower building, at doorway
G6104B	34	26	13.7	<1.0	329	580	56	6.5	
Std Dev	2.1	0.71	1.2	-	1220	840	7.1	0.85	
Rel Std Dev	6.5	2.7	8.3	-	102	72	13.9	14.4	
G6117A	93	30	11.7	<1.0	405	820	64	5.8	~ 3 m S of G6116
G6117B	80	32	15.4	<1.0	3940	700	59	30	
Std Dev	9.2	1.4	2.6	-	2500	85	3.5	17.1	
Rel Std Dev	10.6	4.6	19.3	-	115	11.2	5.7	96	
G6119A	42	81	22	<1.0	1060	2480	169	4.1	S end of barracks building basement
G6119B	133	57	18	2	1120	2580	144	4.7	
Std Dev	64	17	2.8	-	42	71	17.7	0.42	
Rel Std Dev	74	25	14.1	-	3.9	2.8	11.3	9.6	
G6125A	57	33	12.9	<1.0	63	61	47	5.7	In pile of transformer plates SE of foundation
G6125B	67	32	15.2	<1.0	71	83	59	5.1	
Std Dev	7.1	0.71	1.6	-	5.7	15.6	8.5	0.42	
Rel Std Dev	11.4	2.2	11.6	-	8.4	22	16	7.9	
G6128A	90	32	14.1	<1.0	149	408	65	4.6	1 m SW of chimney - W side of powerhouse foundation
G6128B	81	33	16.2	<1.0	165	420	66	5.3	
Std Dev	6.4	0.71	1.5	-	11.3	8.5	0.71	0.49	
Rel Std Dev	7.4	2.2	9.8	-	7.2	2	1.1	10	

Table VI-6: Inorganic Element Results for Duplicate Soil and Sediment Samples Collected in the Field (cont'd)

Sample	Cu	Ni	Co	Cd	Pb	Zn	Cr	As	Location
ppm (ug/g)									
G6140A	74	124	24	2.9	820	1860	182	3.7	0.5 m E of E side of powerhouse foundation
G6140B	64	118	23	2.2	900	1620	186	2.7	
Std Dev	7.1	4.2	0.71	0.49	57	170	2.8	0.71	
Rel Std Dev	10.2	3.5	3	19.4	6.6	9.8	1.5	22	
G6149A	28	27	16.7	<1.0	<10	50	55	2.7	1.5 m SW of S corner of fire hall
G6149B	30	32	16.8	<1.0	<10	45	52	2.9	
Std Dev	1.4	3.5	0.07	-	-	3.5	2.1	0.14	
Rel Std Dev	4.9	12	0.42	-	-	7.4	4	5.1	
G6166A	27	23	14.6	<1.0	15.3	93	52	6.7	~ 5 m SE of NW corner of garage foundation
G6166B	28	22	13.4	<1.0	17.6	93	44	7.1	
Std Dev	0.71	0.71	0.85	-	1.6	0	5.7	0.28	
Rel Std Dev	2.6	3.1	6.1	-	9.9	0	11.8	4.1	
L6103A	58	39	17.6	<1.0	81	247	60	9.4	6 m SE of L6102, 1 m from edge of worked area
L6103B	51	35	17.1	<1.0	50	180	56	8	
Std Dev	4.9	2.8	0.35	-	22	47	2.8	0.99	
Rel Std Dev	9.1	7.6	2	-	33	22	4.9	11.4	
O6101A	40	44	18.6	<1.0	<10	106	63	3.9	12 m N of O6100
O6101B	36	35	16.2	<1.0	<10	96	65	7.3	
Std Dev	2.8	6.4	1.7	-	-	7.1	1.4	2.4	
Rel Std Dev	7.4	16.1	9.8	-	-	7	2.2	43	
G6183A	38	45	17	<1.0	<10	60	62	8.4	20 m S of road over airstrip ~100 m E of tower building
G6183B	35	43	13.9	<1.0	<10	74	65	9.1	
Std Dev	2.1	1.4	2.2	-	-	9.9	2.1	0.49	
Rel Std Dev	5.8	3.2	14.2	-	-	14.8	3.3	5.7	
G6186A	406	140	26	<1.0	332	2240	151	83	Burn stain located where building previously stood
G6186B	259	146	27	<1.0	355	1500	163	79	
Std Dev	104	4.2	0.71	-	16.3	520	8.5	2.8	
Rel Std Dev	31	3	2.7	-	4.7	28	5.4	3.5	
Average Rel Std Dev (n=14)	13.6	6.9	8.8	-	29	14.8	7.5	18.3	
Std Dev	± 18.7	± 7.0	± 5.6	-	± 43	± 18.5	± 5.3	± 25	

Table VI-7: Inorganic Element Results for Soil and Sediment Analytical Replicates

Sample	Cu	Ni	Co	Cd	Pb	Zn	Cr	As	Location
ppm									
G6101B	102	41	12.8	<1.0	600	252	56	6.6	2.5 m SW of SW corner of tower building
	87	38	12.4	<1.0	660	282	59	6.6	
	90	37	11.8	<1.0	680	266	54	5.8	
Std Dev.	7.9	2.1	0.5	-	42	15	2.5	0.46	
Rel Std Dev.	8.5	5.4	4.1	-	6.4	5.6	4.5	7.3	
G6107	39	27	13.4	<1.0	67	112	46	5.4	~ 6 m N of G6103, ~8 m from NW end of tower building
	37	29	13.8	<1.0	55	105	48	5.4	
Std Dev.	1.4	1.4	0.28	-	8.5	4.9	1.4	0	
Rel Std Dev.	3.7	5.1	2.1	-	13.9	4.6	3.0	0	
G6119A	39	79	23	<1.0	1040	2320	166	4.6	S end of barracks building basement
	44	82	22	0.97	1100	2620	173	3.5	
Std Dev.	3.5	2.1	0.71	-	42	212	4.9	0.78	
Rel Std Dev.	8.5	2.6	3.1	-	4.0	8.6	2.9	19.2	
G6123	266	29	14.8	<1.0	4600	346	67	7.5	~ 0.3 m S of stairs on E side of foundation
	285	33	14.7	<1.0	4020	347	61	6.1	
Std Dev.	13.4	2.8	0.07	-	410	0.71	4.2	0.99	
Rel Std Dev.	4.9	9.1	0.48	-	9.5	0.2	6.6	14.6	
G6131	43	34	17.1	<1.0	61	211	72	8	1 m off SW corner of powerhouse foundation
	50	34	16.3	<1.0	61	191	73	5.7	
Std Dev.	4.9	0	0.57	-	0	14.1	0.71	1.6	
Rel Std Dev.	10.6	0	3.4	-	0	7.0	0.98	24	
G6134	283	23	16.3	7	1280	2280	89	3.9	Comp.of contents of N side of pit around generator pad
	600	30	27	8.7	1500	2960	560	4.6	
Std Dev.	224	4.9	7.6	1.2	156	481	333	0.49	
Rel Std Dev.	51	18.7	35	15.3	11.2	18.4	103	11.6	
G6140B	66	120	23	2.3	780	1940	185	2.2	0.5 m E of E side of powerhouse foundation
	63	117	23	2	1020	1280	187	3.2	
Std Dev.	2.1	2.1	0	0.21	170	467	1.4	0.71	
Rel Std Dev.	3.3	1.8	0	9.9	18.9	29	0.76	26	

Table VI-7: Inorganic Element Results for Soil and Sediment Analytical Replicates (cont'd)

Sample	Cu	Ni	Co	Cd	Pb	Zn	Cr	As	Location
ppm									
G6158	36	30	18.2	<1.0	65	194	54	7.4	Depression beside pile of debris S side of married quarters
	34	30	16.6	<1.0	105	237	57	8.1	
Std Dev.	1.4	0	1.1	-	28	30	2.1	0.49	
Rel Std Dev.	4.0	0	6.5	-	33	14.1	3.8	6.4	
O6100	40	34	16.5	<1.0	<10	104	62	7.8	~ 50 m N of married quarters, S end of septic field
	35	26	14.3	<1.0	<10	110	48	7	
Std Dev.	3.5	5.7	1.6	-	-	4.2	9.9	0.57	
Rel Std Dev.	9.4	18.9	10.1	-	-	4.0	18	7.6	
G6159	38	15.7	11.6	<1.0	28	3.0	42	4.9	Stain ~50m SW of garage foundation., ~40mS of fire hall
	38	16.8	15.6	1.3	19.6	4.0	39	4.8	
Std Dev.	0	0.78	2.8	-	5.9	0.71	2.1	0.07	
Rel Std Dev.	0	4.8	21	-	25	20	5.2	1.5	
G6185	216	38	15.8	<1.0	136	431	69	6.1	Stain 8 m E of E side of powerhouse foundation
	254	41	15.4	<1.0	147	447	65	5.6	
Std Dev.	27	2.1	0.28	-	7.8	11.3	2.8	0.35	
Rel Std Dev.	11.4	5.4	1.8	-	5.5	2.6	4.2	6.0	
G6169	44	28	14.7	<1.0	<10	292	88	6.5	Composite of black stains on road to storage shack
	46	34	17.8	<1.0	<10	292	102	6.1	
Std Dev.	1.4	4.2	2.2	-	-	0	9.9	0.28	
Rel Std Dev.	3.1	13.7	13.5	-	-	0	10.4	4.5	
G6171	56	28	15.8	<1.0	38	166	59	5	1 m S of previous location of pump house door
	51	29	14.6	<1.0	29	144	66	5.4	
Std Dev.	3.5	0.71	0.85	-	6.4	15.6	4.9	0.28	
Rel Std Dev.	6.6	2.5	5.6	-	19	10	7.9	5.4	
G6182	37	39	19.3	<1.0	<10	70	75	9.9	S side of apron half way between airstrip and tower building
	34	38	18.5	<1.0	<10	65	68	7.6	
Std Dev.	2.1	0.71	0.57	-	-	3.5	4.9	1.6	
Rel Std Dev.	6.0	1.8	3.0	-	-	5.2	6.9	18.6	

Table VI-7: Inorganic Element Results for Soil and Sediment Analytical Replicates (cont'd)

Sample	Cu	Ni	Co	Cd	Pb	Zn	Cr	As	Location
	ppm								
G6186A	560	144	25	<1.0	307	1420	149	104	Burn stain located where building previously stood
	256	136	27	<1.0	357	3060	153	62	
Std Dev.	215	5.7	1.4	-	35	1160	2.8	30	
Rel Std Dev.	53	4.0	5.4	-	10.6	52	1.9	36	
G6193B	44	24	10.9	<1.0	<10	77	37	3.1	~ 10 km N of the airstrip
	40	25	10.2	<1.0	<10	85	50	4.0	
Std Dev.	2.8	0.71	0.49	-	-	5.7	9.2	0.64	
Rel Std Dev.	6.7	2.9	4.7	-	-	7.0	21	17.9	
SN 043	89.1	32.9	12.8	1.1	205	240	78	5.1	~ 2 m from S side of garage
	84.5	30.8	14.7	1.3	232	257	77	3.8	
Std Dev.	3.3	1.5	1.3	0.14	19.1	12	0.71	0.92	
Rel Std Dev.	3.7	4.7	9.8	11.8	8.7	4.8	0.91	21	
SN 045	24.7	16.6	12.1	1.3	348	372	38	1.1	In middle of barracks building
	14.9	12	10.5	1.7	339	254	25	0.4	
Std Dev.	6.9	3.3	1.1	0.28	6.4	83	9.2	0.49	
Rel Std Dev.	35	23	10	18.9	1.9	27	29	66	
SN 050	34.7	32.9	14.4	<1.0	125	564	66	5.0	Large black stain in barrel cache, W side of site
	36.3	33	14.9	<1.0	113	547	70	4.0	
Std Dev.	1.1	0.07	0.35	-	8.5	12	2.8	0.71	
Rel Std Dev.	3.2	0.21	2.4	-	7.1	2.2	4.2	15.7	
SN 051	12.9	41.9	18.4	<1.0	45	154	77	5.4	In barrel cache, W side of site
	14.2	41.9	19.4	<1.0	43	146	85	6.3	
Std Dev.	0.92	0	0.71	-	1.4	5.7	5.7	0.64	
Rel Std Dev.	6.8	0	3.7	-	3.2	3.8	7.0	10.9	

Table VI-7: Inorganic Element Results for Soil and Sediment Analytical Replicates (cont'd)

Sample	Cu	Ni	Co	Cd	Pb	Zn	Cr	As	Delineation Soil
	ppm								Corresponding Assessment Sample
SN1-14	468	33	16	1.6	800	492	64	5.1	G6100
	230	32	15.4	<1.0	860	492	72	3.5	
Std Dev.	168	0.71	0.42	-	42	0	5.7	1.1	
Rel Std Dev.	48	2.2	2.7	-	5.1	0	8.3	26	
SN1-7	54	32	14.6	<1.0	375	222	73	4.9	G6100
	55	30	16.2	<1.0	1140	458	72	5.5	
Std Dev.	0.71	1.4	1.1	-	540	167	0.71	0.42	
Rel Std Dev.	1.3	4.6	7.3	-	71	49	0.98	8.2	
SN22-13	205	35	15.5	<1.0	540	216	84	5.7	G6121
	195	36	15.9	<1.0	2320	226	67	7	
Std Dev.	7.1	0.71	0.28	-	1260	7.1	12	0.92	
Rel Std Dev.	3.5	2.0	1.8	-	88	3.2	15.9	14.5	
SN22-19	75	17.4	6.4	1.0	223580	160	39	58	G6121
	72	16.5	6.1	0.97	171280	174	40	95	
Std Dev.	2.1	0.64	0.21	0.02	36980	9.9	0.71	26	
Rel Std Dev.	2.9	3.8	3.4	2.2	18.7	5.9	1.8	34	
SN22-6	187	32	14.8	<1.0	660	169	67	6.5	G6121
	194	31	13.8	<1.0	1460	209	73	6.5	
Std Dev.	4.9	0.71	0.71	-	560	28	4.2	0	
Rel Std Dev.	2.6	2.2	4.9	-	53	15	6.1	0	
SN22-7	154	30	15.2	<1.0	74640	258	43	64	G6121
	121	34	16.2	1.2	105080	304	44	64	
	0	0	0						
Std Dev.	23	2.8	0.71	-	21520	33	0.71	0	
Rel Std Dev.	17	8.8	4.5	-	24	11.6	1.6	0	
SN22-A	23940	16.5	7.6	8.7	64540	10120	56	5.2	G6121
	22960	17.7	5.2	8.8	154540	12780	53	5.1	
Std Dev.	700	0.85	1.7	0.07	63640	1880	2.1	0.07	
Rel Std Dev.	3.0	5.0	27	0.81	58	16.4	3.9	1.4	

Table VI-7: Inorganic Element Results for Soil and Sediment Analytical Replicates (cont'd)

Sample	Cu	Ni	Co	Cd	Pb	Zn	Cr	As	Delineation Soil
									Corresponding Assessment Sample
SN24-10	500	36	16	1.1	1420	203	67	4.0	G6123
	1840	37	15.8	1.3	4880	196	73	4.8	
Std Dev.	940	0.71	0.14	0.14	2440	4.9	4.2	0.57	
Rel Std Dev.	81	1.9	0.89	11.8	78	2.5	6.1	12.9	
SN33-14	49	56	21	3.1	620	980	141	3.9	SN047
	55	56	19.9	2.6	560	820	159	3.8	
Std Dev.	4.2	0	0.78	0.35	42	113	12.7	0.07	
Rel Std Dev.	8.2	0	3.8	12.4	7.2	12.6	8.5	1.8	
SN33-4	294	47	25	1.4	1160	3500	111	3.2	SN047
	285	48	25	1.2	1100	3340	104	5.2	
Std Dev.	6.4	0.71	0	0.14	42	113	4.9	1.4	
Rel Std Dev.	2.2	1.5	0	10.9	3.8	3.3	4.6	34	
Average Relative	14.1	5.2	6.2	10.4	22	11.2	10.2	15.6	
Std Dev (n=30)									
Std Dev.	± 19.7	± 6.0	± 7.6	± 5.7	± 26	± 13.1	± 19	± 14.3	

Table VI-8: Inorganic Element Results for Plant Analytical Replicates

Sample	Cu	Ni	Co	Cd	Pb	Zn	Cr	As	Location
	ppm								
G6118P	9	<5	<5	1.9	<15	264	<10	<0.2	Depression ~ 4 m S of S end of foundations
	7	<5	<5	1.9	<15	391	<10	<0.2	
Std Dev	1.4	-	-	0	-	90	-	-	
Rel Std Dev	4.4	-	-	0	-	6.9	-	-	
G6136P	8.6	<5	<5	4.7	<15	361	<10	<0.2	~0.5 m N of bay door concrete pad, N side of foundation
	8.6	<5	<5	4.6	<15	331	<10	<0.2	
Std Dev	0	-	-	0.07	-	21	-	-	
Rel Std Dev	0	-	-	0.38	-	1.5	-	-	
G6161P	8.2	<5	<5	4.4	<15	302	<10	<0.2	Composite of debris etc. in bottom of oil change pit
	7.9	<5	<5	4.4	<15	309	<10	<0.2	
Std Dev	0.21	-	-	0	-	4.9	-	-	
Rel Std Dev	0.66	-	-	0	-	0.41	-	-	
G6164P	4.8	<5	<5	<0.5	<15	23	<10	<0.2	Edge of cement support midway along W side of garage foundation
	4.9	<5	<5	<0.5	<15	22	<10	<0.2	
Std Dev	0.07	-	-	-	-	0.71	-	-	
Rel Std Dev	0.36	-	-	-	-	0.79	-	-	
G6184P	8.8	6.3	<5	1.9	<15	225	<10	<0.2	Burn stain 3 m N of split in Snag Rd. near barracks building
	9.2	6.1	<5	1.9	<15	209	<10	<0.2	
Std Dev	0.28	0.14	-	0	-	11.3	-	-	
Rel Std Dev	0.79	0.57	-	0	-	1.3	-	-	
Average (n=5)	1.2	-	-	0.1	-	2.2	-	-	
Std Dev	± 1.8	-	-	± 0.19	-	± 2.7	-	-	

Table VI-9: PCB Analysis Results for Blind Mixtures of NRC Canada Certified Reference Materials

Sample	Composition	Aroclor 1242	Aroclor 1254 ppb (ng/g)	Aroclor 1260
ESG SRM20	75% HS-1/ 25% HS-2 9.01g/ 3.01 g	13	33	24
	Certified Value		44.3	
ESG SRM21	33.3% HS-1/ 66.7% HS-2 4.00 g/ 8.01 g	19	54	36
	Certified Value		81.8	
ESG SRM22	16.6% HS-1/ 83.3% HS-2 2.0 g/ 10.0 g	27	62	43
	Certified Value		96.7	

Table VI-10: Determination of PCBs (Aroclors) in Internal Spiked Reference Material for Soils and Water

Replicate	Aroclor 1242			Aroclor 1254 ppb or ng/g			Aroclor 1260			
	Determined	Expected	Recovery (%)	Determined	Expected	Recovery (%)	Determined	Expected	Recovery (%)	
SOIL										
SSPM 432	44	45	98	43	46	93	42	46	91	
SSPM 435	41	45	91	36	46	78	37	46	80	
SSPM 434	47	45	104	50	46	109	45	46	98	
SSPM 437	55	45	122	34	46	74	40	46	87	
SSPM 448	38	45	84	36	46	78	46	46	100	
SSPM 452	39	45	87	35	46	76	37	46	80	
SSPM 453	42	45	93	37	46	80	40	46	87	
SSPM 454	12	11	109	12	12	100	12	12	100	
SSPM 457	35	45	78	36	46	78	35	46	76	
SSPM 462	39	45	87	37	46	80	37	46	80	
SSPM 468	41	45	91	41	46	89	38	46	83	
SSPM 475	42	45	93	34	46	74	38	46	83	
SSPM 483	44	45	98	39	46	85	40	46	87	
SSPM 492	43	45	96	40	46	87	44	46	96	
SSPM 511	46	45	102	35	46	76	37	46	80	
SSPM 500	48	45	107	50	46	109	43	46	93	
SSPM 507	57	45	127	42	46	91	44	46	96	
SSPM 513	43	45	96	48	46	104	44	46	96	
SSPM 521	46	45	102	51	46	111	47	46	102	
SSPM 522	59	45	131	42	46	91	46	46	100	
SSPM 454	12	11	109	12	12	100	12	12	100	
SSPM 525	41	45	91	44	46	96	44	46	96	
1994 Soil Data Spiked Matrix										
SSPM 421	40	45	89	39	46	85	42	46	91	
Average (n=23)			99				89			
Std Dev			± 13				± 12			
Water										
Hi Res										
WSPM 461	160	110	150	140	120	120	130	120	110	

**Table VI-11: Determination of PCBs (Aroclors) in Plant Tissue Internal Standard
(N.I.S.T. Certified Reference Material 1588 - Cod Liver Oil)**

Mixture	Certified Value ppb (ng/g)	Mean (n=3)
Aroclor 1242	150 ± 60	160 ± 12
Aroclor 1254	1500 ± 500	1700 ± 230
Aroclor 1260	840 ± 210	930 ± 150

Table VI-12: Analytical Blanks for PCBs (Aroclors)

Sample I.D.	Aroclor			Total Aroclor
	1242	1254	1260	
ppb (ng/g)				
Soils				
SBlk 592	<0.86	<1.0	<0.46	
SBlk 595	<0.45	<0.4	<0.22	
SBlk 594	<0.13	<0.29	<0.21	
SBlk 597	<0.48	<0.5	<0.21	
SBlk 606	<0.47	<0.73	<0.35	
SBlk 607	<1.4	<1.4	<0.72	
SBlk 614	<8.3	<6.5	<5.1	
SBlk 616	<0.81	<0.89	<0.56	
SBlk 618 *	<0.07	<0.08	<0.11	
SBlk 621	<2.4	<1.6	<0.91	
SBlk 630	<1.2	<0.92	<0.54	
SBlk 634	<1.2	<1.2	<0.66	
SBlk 643	<0.63	<0.52	<0.27	
SBlk 650	<0.6	<0.56	<0.3	
SBlk 662	<0.51	<0.47	<0.40	
SBlk 674	<0.35	<0.34	<0.16	
SBlk 688	<0.53	<0.44	<0.40	
SBlk 682	<1.0	<0.92	<0.6	
SBlk 690	<0.58	3.7	0.51	4.21
SBlk 710	<13	<10	<4.5	
SBlk 711	<1.2	<0.37	<0.14	
SBlk 618	<0.07	<0.08	<0.11	
SBlk 716	<0.61	<0.67	<0.33	
1994 Data QA/QC				
SBlk 241	<0.28	<0.56	<0.98	
SBlk 579	<0.89	<1.9	<1.8	
Water				
		ng/l		
WBlk 623 *	<0.08	NDR(0.09)	<0.03	0.1
WBlk 739 *	<0.05	NDR(0.07)	NDR(0.03)	0.1
Plant Tissue				
TBlk 687	<1.2	<2.9	<3.0	
TBlk 683	<0.23	<0.44	<0.36	
TBlk 695 *	<0.009	NDR(0.01)	<0.004	0.01
TBlk 713	<0.32	<0.79	<0.7	
TBlk 714	<0.59	<1.2	<1.1	

NDR = Peak detected but did not meet quantification criteria

* HRGC/HRMS

Table VI-13: Aroclor PCB Results for Soil Samples Collected in the Field

Sample	Aroclor 1242	Aroclor 1254 ppb (ng/g)	Aroclor 1260	Aroclor Total	Replicate Std. Dev.	Replicate Relative Std. Dev.	Description
<i>1. Soils</i>							
AA129A	<0.62	<0.19	<0.03	-	-	-	13 km from Aishihik Airstrip
AA129B	<0.52	<0.54	<0.31	-	-	-	
G6193A	0.3	<0.25	<0.14	0.3	0	3.2	~ 10 km N of the airstrip
G6193B	<0.13	0.36	<0.16	0.36			
G6101A	<0.94	9.3	7.2	16.5	6.6	14	2.5 m SW of SW corner of tower building
G6101B	<0.91	1.7	5.5	7.2			
G6104A	<230	7400	1700	9100	2100	6.7	1.5 m N of N side of tower building, at doorway
G6104B	<310	5000	1200	6200			
G6117A	<1.2	35	5.8	40.8	16	14	~ 3 m S of G6116
G6117B	<1.2	18	3.2	18			
G6119A	2100	320000	48000	370100	148700	7.8	S end of barracks building basement
G6119B	3400	500000	77000	580400			
G6125A	<18	170	100	170	28	4.7	In pile of transformer plates SE of foundation
G6125B	<15	130	87	130			
G6128A	<92	430	110	540	110	4.6	1 m SW of chimney base on W side of powerhouse foundation
G6128B	<84	570	130	700			
G6140A	280	50100	8300	58800	21400	12	0.5 m E of E side of powerhouse foundation
G6140B	190	23500	4900	28600			
G6149A	<0.88	10	1.0	11	3.1	8.8	1.5 m SW of S corner of fire hall
G6149B	<0.48	6.55	<2.1	6.6			
G6166A	<2.5	660	170	830	250	6.3	~ 5 m SE of NW corner of garage foundation
G6166B	<0.57	900	290	1190			
L6103A	<0.66	19	5.6	24.6	3.6	3.3	6 m SE of L6102, 1 m from edge of worked area
L6103B	<0.55	22	7.7	29.7			

Table VI-13: Aroclor PCB Results for Soil Samples Collected in the Field
(cont'd)

Sample	Aroclor 1242	Aroclor 1254 ppb (ng/g)	Aroclor 1260	Aroclor Total	Replicate Std. Dev.	Replicate Relative Std. Dev.	Description
O6101A	<0.41	<0.64	<0.43	-	-	-	12 m N of O6100
O6101B	<0.46	<0.49	<0.49	-	-	-	
G6183A	<0.61	<0.56	<0.32	-	-	-	~ 20 m S of road over airstrip
G6183B	<0.95	<0.6	<0.31	-	-	-	~ 100 m E of tower building
G6186A	<2.6	<3.4	<2.7	-	-	-	Burn stain located where building previously stood
G6186B	<0.81	2.0	1.3	3.3			
(n=14)				Average	7.8		
				Std Dev	± 4.0		

Table VI-14: PCB Results for Soil and Sediment Analytical Replicates

Sample	Aroclor	Aroclor	Aroclor	Aroclor	Replicate	Replicate	Location
	1242	1254	1260	Total	Std. Dev.	Relative Std. Dev.	
ppb (ng/g)							
G6149B	<0.46	6.3	<2.0	6.3	0.4	1.3	1.5 m SW of S corner of fire hall
	<0.48	6.8	<2.1	6.8			
L6105	<1.4	34	11	45	2.8	1.6	Depression ~ 3 m S of SE side of dump toe
	<0.95	30	11	41			
G6137	<140	41000	10000	51000	9700	5.5	Midway along S side of powerhouse foundation
	<200	31000	6300	37300			
G6123	<730	6600	1700	8300	2600	10	~ 0.3 m S of stairs on E side of foundation
	<250	3700	950	4700			
G6181	<3.0	<3.8	<3.6				Red stain ~ 6 m W of board pile, N side of airstrip apron
	<3.1	<3.8	<3.3				
G6174	44	6300	2700	9000	52	0.1	SW corner of E- most water tank of pump house
	70	6300	2600	9000			
G6164	<85	7300	1200	8500	420	1.2	Midway along W side of garage foundation
	<110	7800	1300	9100			
G6109	<21	91	19	110	47	8.3	Burn pile ~13 m S of S side of tower building
	<14	140	37	180			
G6115	<0.7	11	3.3	14	0.2	0.4	Pile of soil & debris ~ 5 m NW of chimney
	<0.88	14	4.2	14			
G6183A	<0.61	<0.56	<0.32				~ 20 m S of road over airstrip ~ 100m E of tower building
	<0.42	<0.33	<0.18				
G6121	NDR(6.8)	640	220	870	260	6.2	Stain midway along S side of warehouse foundation
	NDR(6.3)	960	270	1200			
G6175	NDR(0.62)	<0.30	<0.11	0.6	0.1	2.8	75 m SE of Snag Rd. mile 19
	NDR(0.53)	<0.28	<0.59	0.5			
G6129	<100	18000	4900	22900	850	0.9	1 m E of triangular pipe cover
	<91	19000	5100	24100			

Table VI-14: PCB Results for Soil and Sediment Analytical Replicates (cont'd)

Sample	Aroclor	Aroclor	Aroclor	Aroclor	Replicate	Replicate	Location
	1242	1254	1260	Total	Std. Dev.	Relative	
ppb (ng/g)							
<hr/>							
G6152	<19	49	13	62	4.2	1.8	Stain ~12 m E of fire hall front
	<21	43	13	56			
G6155	<0.58	NDR(1.2)	2.5	3.7	2.5	11	Unvegetated area W of garage foundation
	<1.1	NDR(4.4)	2.8	7.2			
G6140A	31	5400	1000	6400	26700	26	0.5 m E of E side of powerhouse foundation
	260	35000	9000	44300			
	560	110000	15000	125600			
<hr/>							
n=16					Average	5.5	
						± 6.9	
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Table VI-15: Aroclor PCB Results for Plant Analytical Replicates

Sample	Aroclor	Aroclor	Aroclor	Aroclor	Replicate Std. Dev.	Replicate Relative Std. Dev.	Location
	1242	1254	1260	Total			
ppb (ng/g)							
G6139P	0.3	150	7.9	160	15	2.5	1 m NE of NE corner of powerhouse foundation
	0.3	130	7.1	140			
G6176P	0.1	0.2	0.1	0.4	0.1	5.8	35 m SE of Snag Rd. mile 19
	0.1	0.2	0	0.3			
G6162P	<0.2	3.3	<0.59	3.3	0.4	2.9	~ 2 m NW of SW corner of garage foundation
	<0.35	3.9	<0.85	3.9			
					Average	3.7	
(n=3)					Std Dev	1.8	

Table VI-16: Results of PAH Analysis for Blind Mixtures of NRC Canada Certified Reference Materials

Sample	ESG SRM-23		ESG SRM-23	
	50% HS-3/ 50% SES-1		33.3% HS-3/ 66.7% SES-1	
Dry Weight	5.99 g/ 6.00 g		4.01 g/ 8.03 g	
Compounds	Determined	Certified	Determined	Certified
	ppb (ng/g)	Value	ppb (ng/g)	Value
Naphthalene	4700	5350	3400	4120
Acenaphthylene	250	-	180	-
Acenaphthene	2100	2540	1400	1900
Fluorene	4800	7080	3200	4900
Phenanthrene	55000	43020	34000	29000
Anthracene	3200	6720	2100	4480
Fluoranthene	44000	30680	27000	20880
Pyrene	24000	20700	16000	14580
Benz(a)anthracene	6500	7560	4100	5200
Chrysene	8700	7600	5900	5420
Benzofluoranthenes	9300	-	7000	-
Benzo(e)pyrene	2800	-	1900	-
Benzo(a)pyrene	2700	-	1800	-
Perylene	770	-	530	-
Dibenz(ah)anthracene	960	960	880	840
Indeno(1,2,3-cd)pyrene	2500	3100	1800	2340
Benzo(ghi)perylene	2200	2840	1700	2120

**Table VI-17: Summary of PAH Results for Sediment Internal Standard
(N.I.S.T. Marine Reference Sediment HS-6)**

Compounds ppb (ng/g)	Mean (n=4)	Std. Dev.	Certified Value
Naphthalene	4500	290	4100 ± 100
Acenaphthylene	240	5	190 ± 50
Acenaphthene	170	27	230 ± 70
Fluorene	360	22	470 ± 120
Phenanthrene	3500	290	3000 ± 600
Anthracene	940	69	1100 ± 400
Fluoranthene	3600	240	3540 ± 650
Pyrene	2900	220	3000 ± 600
Benz(a)anthracene	1700	50	1800 ± 300
Chrysene	2300	170	2000 ± 300
Benzo(a)fluoranthene	4400	190	4230 ± 750
Benzo(e)pyrene	1600	96	
Benzo(a)pyrene	1900	96	2200 ± 400
Perylene	480	22	
Dibenz(ah)anthracene	420	21	490 ± 160
Indeno(1,2,3-cd)pyrene	2200	50	1950 ± 580
Benzo(ghi)perylene	1700	96	1780 ± 720

Table VI-18: Analytical Blanks for PAHs in Soils

SOIL/SEDIMENT					
Sample	Sblk 772	Sblk 786	Sblk 797	Sblk 804	Sblk 852
Sample Wt.	5.0g	4.0g	3.0g	8.0g	8.0g
ng/g (ppb) dry wt.					
Compounds					
Naphthalene	4.2	2.4	2.3	0.82	NDR(0.6)
Acenaphthylene	<0.17	<0.14	<0.25	NDR(0.1)	<0.09
Acenaphthene	NDR(1.1)	<0.13	<0.22	<0.03	<0.09
Fluorene	0.76	<0.25	<0.30	NDR(0.39)	0.2
Phenanthrene	1.8	<0.76	<0.88	0.21	0.34
Anthracene	NDR(0.24)	<0.11	<0.05	<0.07	<0.07
Fluoranthene	0.89	<0.20	<0.22	NDR(0.1)	NDR(0.14)
Pyrene	0.82	<0.31	<0.20	NDR(0.09)	NDR(0.12)
Benz(a)anthracene	<0.09	<0.09	<0.17	<0.07	<0.1
Chrysene	0.92	<0.09	<0.17	<0.07	<0.1
Benzo(a)fluoranthene	NDR(1.1)	<0.34	<0.06	<0.20	<0.1
Benzo(e)pyrene	NDR(0.53)	<0.33	<0.06	<0.20	<0.1
Benzo(a)pyrene	NDR(0.7)	<0.42	<0.10	<0.27	<0.12
Perylene	<0.08	<0.48	<0.08	<0.27	<0.13
Dibenz(ah)anthracene	<0.72	<0.36	<0.14	NDR(0.3)	<0.29
Indeno(1,2,3-cd)pyrene	<0.69	<0.81	<0.49	<0.18	<0.27
Benzo(ghi)perylene	<0.48	<0.72	<0.39	<0.13	<0.23
C1 naphthalenes	4.8	<0.91	2.2	0.4	0.33
C2 naphthalenes	16	<1.0	<0.15	0.65	<0.07
C3 naphthalenes	9.0	<1.5	<0.13	<0.04	<0.1
C4 naphthalenes	<0.08	<0.11	<0.15	<0.04	<0.08
C5 naphthalenes	<0.12	<0.16	<0.12	<0.05	<0.1
C1 phen,anth	0.87	<0.29	<0.11	<0.04	<0.06
C2 phen,anth	<0.14	<0.19	<0.13	<0.05	<0.09
C3 phen,anth	<0.14	<0.28	<0.17	<0.07	<0.15
C4 phen,anth	<0.13	<0.16	<0.14	<0.08	<0.12
Retene	<0.13	<0.16	<0.14	<0.08	<0.12
C5 phen,anth	<0.14	<0.33	<0.26	<0.13	<0.15
C1 fluor,pyrenes	<0.06	<0.12	<0.08	<0.03	<0.06
C2 fluor,pyrenes	<0.09	<0.30	<0.11	<0.09	<0.12
C3 fluor,pyrenes	<0.36	<0.39	<0.21	<0.23	<0.23
C4 fluor,pyrenes	<0.18	<0.44	<0.15	<0.22	<0.23
C5 fluor,pyrenes	<0.44	<0.56	<0.14	<0.23	<0.32
Dibenzothiophene	<0.06	<0.11	<0.08	<0.02	NDR(0.12)
C1 Dibenzothiophene	<0.07	<0.12	<0.08	<0.03	<0.07
C2 Dibenzothiophene	<0.02	<0.09	<0.06	<0.02	<0.07

NDR = Peak detected but did not meet quantification criteria

Table VI-19: Polycyclic Aromatic Hydrocarbon (PAH) Results for Sediment Analytical Replicates

Sample	G6109		Relative		G6186A		Relative		Average	Std Dev
Concentration in ppb (ng/g)			Std Dev				Std Dev	(n=2)		
Compounds										
Naphthalene	24	22	1.5	240	120	110	5.1	3.3	± 2.5	
Acenaphthylene	4.7	1.3	20	6.2	2.8	4.1	4.4	12	± 11	
Acenaphthene	3.0	NDR(5.8)	-	2.8	1.6	2.4	3.0	-	-	
Fluorene	3.7	4.5	3.4	2.8	NDR(2.1)	3.8	5.4	4.4	± 1.3	
Phenanthrene	87	84	0.6	130	100	150	2.2	1.4	± 1.1	
Anthracene	9.0	NDR(5.3)	-	4.8	3.8	18	9.9	-	-	
Fluoranthene	130	140	1.3	60	80	230	8.4	4.8	± 5.0	
Pyrene	92	100	1.5	27	37	95	7.7	4.6	± 4.4	
Benz(a)anthracene	28	28	0	5.9	13	33	9	4.5	± 6.4	
Chrysene	83	91	1.6	21	35	73	7	4.3	± 3.8	
Benzofluoranthenes	81	110	5.4	12	28	25	4.4	4.9	± 0.7	
Benzo(e)pyrene	58	78	5.2	8.5	23	12	5.8	5.5	± 0.4	
Benzo(a)pyrene	36	NDR(35)	-	<0.44	7.4	4.1	10	-	-	
Perylene	NDR(6.1)	NDR(3.3)	-	<0.34	NDR(5.1)	NDR(1.4)	-	-	-	
Dibenz(ah)anthracene	NDR(12)	NDR(10)	-	NDR(4.4)	8.1	2.5	19	-	-	
Indeno(1,2,3-cd)pyrene	NDR(22)	NDR(21)	-	<1.5	8.9	NDR(4)	-	-	-	
Benzo(ghi)perylene	30	NDR(33)	-	NDR(0.84)	15	5.7	16	-	-	
C1 naphthalenes	57	56	0.3	92	54	57	3.5	1.9	± 2.2	
C2 naphthalenes	110	110	0	42	22	25	4	2.0	± 2.9	
C3 naphthalenes	250	170	6.7	14	8.6	9.2	3.1	4.9	± 2.6	
C4 naphthalenes	360	200	10	<0.21	<0.06	<0.07	-	-	-	
C5 naphthalenes	<0.29	<0.55	-	<0.18	3.6	4.2	2.7	-	-	
C1 phen,anth	880	640	5.6	24	28	63	6.2	5.9	± 0.5	
C2 phen,anth	2400	1600	7.1	19	26	100	10	8.7	± 2.3	
C3 phen,anth	2000	1200	8.8	<6.0	19	32	9	8.9	± 0.1	
C4 phen,anth	17000	11000	7.6	21	10	15	4	5.8	± 2.5	
Retene	15000	10000	7.1	21	10	15	4	5.5	± 2.2	
C5 phen,anth	2700	1700	8	<0.53	<0.22	<0.25	-	-	-	
C1 fluor,pyrenes	410	250	8.6	7.7	21	56	9.8	9.2	± 0.9	
C2 fluor,pyrenes	140	100	5.9	<2.3	38	33	2.5	4.2	± 2.4	
C3 fluor,pyrenes	150	95	7.9	<0.79	65	<0.64	-	-	-	
C4 fluor,pyrenes	190	<18	-	<0.57	74	<0.62	-	-	-	
C5 fluor,pyrenes	69	<4.6	-	<0.55	84	<0.65	-	-	-	
Dibenzothiophene	NDR(5.2)	NDR(3.8)	-	8.7	6.8	10	2.1	-	-	
C1 Dibenzothiophene	28	22	4.2	<1.5	1.7	3.0	9.8	7.0	± 3.9	
C2 Dibenzothiophene	370	240	7.5	<1.1	1.8	4.2	14	11	± 4.7	

NDR = Peak detected but did not meet quantification criteria

Table VI-20: Determination of Pesticides in Internal Spiked Reference Material for Soils

Compounds ppb (ng/g)	Mean (n=3)	Expected	% Recovery
HCB	5.3 ± 0.9	5.6	94
alpha BHC	3.4 ± 0.2	5.6	61
beta BHC	6.7 ± 1.2	8.2	82
gamma BHC	4.3 ± 0.8	5.4	79
Heptachlor	5.9 ± 2.4	5.8	100
Aldrin	3.3 ± 1.2	3.6	93
Oxychlordane	5.1 ± 1.3	6.4	80
trans-Chlordane	2.9 ± 0.8	3.2	91
cis-Chlordane	4.3 ± 1.2	4.8	90
o,p'-DDE	4.7 ± 1.2	5.7	82
p,p'-DDE	4.7 ± 1.1	5.4	87
trans-Nonachlor	3.3 ± 0.7	4.1	80
cis-Nonachlor	3.1 ± 0.4	3.0	100
o,p'-DDD	3.6 ± 0.9	5.6	64
p,p'-DDD	4.2 ± 0.6	6.2	67
p,p'-DDT	5.5 ± 0.7	6.2	89
Mirex	5.5 ± 0.9	5.4	100
Heptachlor Epoxide	3.7 ± 1.1	4.0	93
alpha-Endosulphan	3.6 ± 0.2	4.0	89
Dieldrin	4.8 ± 1.4	5.2	92
Endrin	9.9 ± 3.1	11	90
Methoxychlor	22 ± 7.1	25	87

Table VI-21: Analytical Blanks for Pesticides in Soils

Sample	1994 Data			
	CL-S-BLK 614	CL-S-BLK 689	CL-S-BLK 700	CL-S-BLK 244
Compounds	ppb (ng/g)			
HCB	<1.0	<0.02	<0.11	<0.02
alpha BHC	<3.1	<0.1	<0.23	<0.02
beta BHC	<6.2	<0.2	<0.45	<0.001
gamma BHC	<4.9	<0.17	NDR(0.52)	<0.001
Heptachlor	<1.5	<0.11	<1.3	<0.03
Aldrin	<0.54	<0.04	NDR(0.41)	<0.03
Oxychlordane	<4.6	<0.14	<0.99	NDR(0.14)
trans-Chlordane	<0.49	<0.02	<0.21	<0.01
cis-Chlordane	<0.58	<0.02	<0.23	<0.04
o,p'-DDE	<0.16	<0.006	<0.06	<0.06
p,p'-DDE	<0.2	<0.01	<0.09	<0.03
trans-Nonachlor	<0.4	<0.01	<0.2	<0.04
cis-Nonachlor	<0.47	<0.02	<0.22	<0.007
o,p'-DDD	<0.2	<0.009	<0.08	<0.01
p,p'-DDD	<0.24	<0.01	<0.08	<0.05
p,p'-DDT	<0.44	<0.02	<0.16	<0.14
Mirex	<0.38	<0.02	<0.09	<0.04
Heptachlor Epoxide	<0.02	<0.02	<0.03	<0.03
alpha-Endosulphan	<0.02	<0.02	<0.03	<0.03
Dieldrin	<0.02	<0.02	<0.04	<0.03
Endrin	<0.04	<0.04	<0.06	<0.05
Methoxychlor	<0.06	<0.10	<0.14	<0.12

NDR = Peak detected but did not meet quantification criteria

Table VI-22: Pesticide Results for for Soil: Analytical Replicates

Sample	G6181		Rel Std. Dev.	G6119A		Rel Std. Dev.
Compound	ppb (ng/g)			ppb (ng/g)		
Hexachlorobenzene	<0.41	<0.51	-	<78	<100	-
alpha BHC	<0.76	<0.96	-	<180	<210	-
beta BHC	<1.5	<1.9	-	<350	<400	-
gamma BHC	<1.2	<1.5	-	<350	<400	-
Heptachlor	<0.88	<0.99	-	<830	<1400	-
Aldrin	<0.34	<0.33	-	<220	<300	-
Oxychlorane	<2.6	<2.6	-	<1100	<1000	-
trans-Chlordane	<0.28	<0.25	-	<160	<230	-
cis-Chlordane	<0.34	<0.3	-	<170	<250	-
o,p'-DDE	<0.1	<0.11	-	<32	<67	-
p,p'-DDE	2.3	1.2	11	<42	<88	-
trans-Nonachlor	<0.22	<0.23	-	<140	<180	-
cis-Nonachlor	<0.26	<0.27	-	<150	<190	-
o,p'-DDD	<0.12	<0.13	-	<45	<64	-
p,p'-DDD	<0.14	<0.20	-	<47	<68	-
p,p'-DDT	15.00	9.00	8.8	88.00	130.00	6.8
Mirex	<0.27	<0.26	-	<52	<120	-
Heptachlor Epoxide	<0.01	<0.02	-	<30	<28	-
alpha-Endosulphan	<0.01	<0.02	-	<29	<29	-
Dieldrin	<0.01	<0.02	-	<37	<35	-
Endrin	<0.05	<0.06	-	<59	<56	-
Methoxychlor	<0.06	<0.07	-	<130	<120	-

Table VI-23: Determination of Polychlorinated Dibenzo-P-Dioxin / Furan in Internal Spiked Reference Material

Sample	SSPM 582		SSPM 601		SSPM 624	
Soils						
Dioxins	Determined	% Recovery	Determined	% Recovery	Determined	% Recovery
	ppt (pg/g)		ppt (pg/g)		ppt (pg/g)	
T4CDD - Total						
2,3,7,8	1.6	89	1.8	100	2	110
P5CDD - Total						
1,2,3,7,8	5.4	110	5.9	120	5.5	110
H6CDD - Total						
1,2,3,4,7,8	5.0	93	4.2	78	6	110
1,2,3,6,7,8	4.6	92-	4.3	86	5.3	110
1,2,3,7,8,9	4.9	94	5.1	98	5	100
H7CDD - Total						
1,2,3,4,6,7,8	5.6	100	6.4	100	5.6	100
O8CDD - Total	14	100	14	-93	13	93
<hr/>						
Furans	Determined	% Recovery	Determined	% Recovery	Determined	% Recovery
T4CDF - Total						
2,3,7,8	2.3	82	2.1	110	2	110
P5CDF - Total						
1,2,3,7,8	4.7	100	4.8	100	5.6	120
2,3,4,7,8	4.1	89	4.4	96	4.6	100
H6CDF - Total						
1,2,3,4,7,8	7.2	99	6.4	88	8.5	120
1,2,3,6,7,8	7.4	97	5.9	78	8.4	110
2,3,4,6,7,8	5.8	130	5.0	110	6.2	110
1,2,3,7,8,9	4.4	96	3.9	85	5	98
H7CDF - Total						
1,2,3,4,6,7,8	6.4	110	7.3	110	8.9	120
1,2,3,4,7,8,9	4.1	87	3.6	77	5	100
O8CDF - Total	7.6	100	9.1	120	7.9	100

Table VI-23: Determination of Polychlorinated Dibenzo-P-Dioxin / Furan in **Internal Spiked Reference Material** (cont'd)

Sample Dioxins	SSPM 636			Average (n=4)	Std Dev
	Determined	% Recovery	Certified Value		
	ppt (pg/g)		ppt (pg/g)		
T4CDD - Total 2,3,7,8	1.9	110	1.8	100	± 7.9
P5CDD - Total 1,2,3,7,8	5.9	120	5.0	110	± 5.3
H6CDD - Total 1,2,3,4,7,8	5.6	100	5.4	96	± 15
1,2,3,6,7,8	5.2	100	5.0	97	± 9.6
1,2,3,7,8,9	4.3	83	5.2	94	± 7.8
H7CDD - Total 1,2,3,4,6,7,8	6.2	110	5.5	110	± 5.1
O8CDD - Total	14	100	14	97	± 4.0
Furans	Determined	% Recovery	Expected		
T4CDF - Total 2,3,7,8	2.2	110	2.0	100	± 13
P5CDF - Total 1,2,3,7,8	4.6	100	4.6	110	± 9.9
2,3,4,7,8	4.7	100	4.6	97	± 5.8
H6CDF - Total 1,2,3,4,7,8	4.8	100	4.6	100	± 12
1,2,3,6,7,8	4.7	100	4.6	97	± 14
2,3,4,6,7,8	4.1	89	4.6	110	± 15
1,2,3,7,8,9	3.8	83	4.6	90	± 7.6
H7CDF - Total 1,2,3,4,6,7,8	5.4	82	6.6	100	± 16
1,2,3,4,7,8,9	4.2	91	4.6	90	± 11
O8CDF - Total	8.4	110	7.8	110	± 6.3

Table VI-24: Polychlorinated Dibenzo-P-Dioxin / Furan Analytical (Procedural) Blanks

Sample	S-BLK 1304	S-BLK 1330	S-BLK 1363	S-BLK 1379
pg/g				
Dioxins				
T4CDD - Total	<0.1	<0.1	<0.1	<0.1
2,3,7,8	<0.1	<0.1	<0.1	<0.1
P5CDD - Total	<0.2	<0.2	<0.2	<0.1
1,2,3,7,8	<0.2	<0.2	<0.2	<0.1
H6CDD - Total	<0.3	<0.4	<0.4	<0.3
1,2,3,4,7,8	<0.3	<0.4	<0.4	<0.3
1,2,3,6,7,8	<0.3	<0.4	<0.4	<0.3
1,2,3,7,8,9	<0.3	<0.4	<0.4	<0.3
H7CDD - Total	<0.4	<0.6	<0.6	<0.5
1,2,3,4,6,7,8	<0.4	<0.6	<0.6	<0.5
O8CDD - Total	<0.6	<0.8	<1.0	<0.8
Furans				
T4CDF - Total	<0.1	<0.1	<0.1	<0.1
2,3,7,8	<0.1	<0.1	<0.1	<0.1
P5CDF - Total	<0.2	<0.2	<0.2	<0.1
1,2,3,7,8	<0.2	<0.2	<0.2	<0.1
2,3,4,7,8	<0.2	<0.2	<0.2	<0.1
H6CDF - Total	<0.3	<0.4	<0.4	<0.3
1,2,3,4,7,8	<0.3	<0.4	<0.4	<0.3
1,2,3,6,7,8	<0.3	<0.4	<0.4	<0.3
2,3,4,6,7,8	<0.3	<0.4	<0.4	<0.3
1,2,3,7,8,9	<0.3	<0.4	<0.4	<0.3
H7CDF - Total	<0.4	<0.6	<0.6	<0.5
1,2,3,4,6,7,8	<0.4	<0.6	<0.6	<0.5
1,2,3,4,7,8,9	<0.4	<0.6	<0.6	<0.5
O8CDF - Total	<0.6	<0.8	<1.1	<0.8

NDR = Peak detected but did not meet quantification criteria

Table VI-25: Polychlorinated Dibenzo-P-Dioxin / Furan Results for Analytical Replicates

Sample Dioxins	G6186A		Rel Std Dev		G6123		Rel Std Dev
	High Resolution	GC/MS	ppt (ng/g)		ppt (ng/g)		
T4CDD - Total	0.9	1.0	0.9	0.7	2.4	2.1	2.4
2,3,7,8	<0.2	<0.2	<0.2	-	0.3	0.3	0
P5CDD - Total	0.5	5.9	0.5	15	17	21	3.7
1,2,3,7,8	<0.4	<0.4	<0.4	-	1.3	1.5	2.5
H6CDD - Total	2.5	11	2.2	11	73	83	2.3
1,2,3,4,7,8	<0.6	<0.6	<0.6	-	2.6	2.7	0.7
1,2,3,6,7,8	<0.6	<0.6	<0.6	-	7.8	8.7	1.9
1,2,3,7,8,9	<0.6	1.2	<0.6	-	5.5	5.2	1
H7CDD - Total	7.8	22	9.8	6.5	310	340	1.6
1,2,3,4,6,7,8	2.4	7.5	3.2	7	160	180	2.1
O8CDD - Total	9.1	20	12	4.6	740	780	0.9
Furans							
T4CDF - Total	1.8	1.7	1.9	0.6	230	270	2.8
2,3,7,8	0.5	0.3	0.3	3.5	42	41	0.4
P5CDF - Total	0.5	1.2	0.8	4.7	160	190	3
1,2,3,7,8	<0.4	<0.4	<0.4	-	4.0	4.1	0.4
2,3,4,7,8	<0.4	<0.4	<0.4	-	14	14	0
H6CDF - Total	<0.6	<0.6	<0.6	-	360	370	0.5
1,2,3,4,7,8	<0.6	<0.6	<0.6	-	69	64	1.3
1,2,3,6,7,8	<0.6	<0.6	<0.6	-	26	36	5.7
2,3,4,6,7,8	<0.6	<0.6	<0.6	-	9.2	8.1	2.2
1,2,3,7,8,9	<0.6	<0.6	<0.6	-	0.7	0.5	5.9
H7CDF - Total	<0.8	<0.8	<0.8	-	350	360	0.5
1,2,3,4,6,7,8	<0.8	<0.8	<0.8	-	170	170	0
1,2,3,4,7,8,9	<0.8	<0.8	<0.8	-	15	13	2.5
O8CDF - Total	<1.0	<1.0	<1.0	-	240	270	2.1

Table VI-26: Surrogate Standard Recovery Values (%) for Polychlorinated Dibenzo-P-Dioxin / Furan Analysis in Soils

Analytical Blanks				
	S-BLK 1304	S-BLK 1330	S-BLK 1363	S-BLK 1379
13C-T4CDF:	72	72	59	67
13C-T4CDD:	65	65	63	71
13C-P5CDF:	86	86	69	75
13C-P5CDD:	74	74	55	63
13C-H6CDF:	87	87	68	82
13C-H6CDD:	81	81	64	77
13C-H7CDF:	75	75	45	75
13C-H7CDD:	60	60	39	63
13C-O8CDD:	52	52	26	52

Spiked Reference Materials				
Sample	S-SPM 582	S-SPM 601	S-SPM 624	S-SPM 636
13C-T4CDF	86	72	73	63
13C-T4CDD	93	70	78	75
13C-P5CDF	110	85	89	69
13C-P5CDD	87	70	85	57
13C-H6CDF	96	81	81	73
13C-H6CDD	92	77	82	70
13C-H7CDF	92	70	66	57
13C-H7CDD	89	50	65	49
13C-O8CDD	99	55	54	39

Sample Analytical Duplicates					
	G6186A	G6186A	G6186A	G6123	G6123
13C-T4CDF:	100	89	80	54	50
13C-T4CDD:	93	100	80	60	55
13C-P5CDF:	110	120	110	68	60
13C-P5CDD:	97	130	92	56	47
13C-H6CDF:	110	94	81	63	55
13C-H6CDD:	110	100	94	62	47
13C-H7CDF:	87	70	70	57	47
13C-H7CDD:	84	79	76	52	38
13C-O8CDD:	76	82	89	52	37

Table VI-27: Concentrations of Metals in Duplicate Analyses of Soil Samples by FPXRF

Sample	Cu	Pb	Zn
Concentration ppm or ug/g			
SN 24-4	104	560	272
SN 24-4	125	560	295
Std Dev	14.8	0	16.3
Rel Std Dev	3.2	0	1.4
SN 33-3	105	640	2760
SN 33-3	134	720	2920
Std Dev	21	57	113
Rel Std Dev	4.3	2.1	1
SN 33-5	57	208	540
SN 33-5	74	215	500
Std Dev	12	4.9	28
Rel Std Dev	4.6	0.59	1.4
SN 39-2	132	940	311
SN 39-2	79	1260	308
Std Dev	37	226	2.1
Rel Std Dev	8.9	5.1	0.17
SN 39-7	61	29	56
SN 39-7	69	42	67
Std Dev	5.7	9.2	7.8
Rel Std Dev	2.2	6.5	3.2
SN1-5	47	334	430
SN1-5	38	204	444
Std Dev	6.4	92	9.9
Rel Std Dev	3.7	8.5	0.57
SN1-20	183	660	500
SN1-20	184	760	468
Std Dev	0.71	71	23
Rel Std Dev	0.1	2.5	1.2
SN1-22	121	341	369
SN1-22	116	379	341
Std Dev	3.5	27	19.8
Rel Std Dev	0.75	1.9	1.4
Average Rel Std Dev (n=8)	5.4	9.4	13.7
Std Dev	± 2.7	± 3	± 0.89

Table VI-28: Concentrations of Copper, Lead and Zinc in Soils by Field Portable X-Ray Fluorescence (FPXRF) and Atomic Absorption Spectrometry (AAS)

Delineation Sample	Corresponding Assessment Sample	Concentration (ug/g or ppm)									
		PXRF Cu	AAS Cu	Rel Std Dev	PXRF Pb	AAS Pb	Rel Std Dev	PXRF Zn	AAS Zn	Rel Std Dev	
	G6121	11520	3200	20	6320	31580	24	16220	3200	24	
	G6123	199	276	5.7	160	4300	33	520	346	7.4	
	G6100	129	121	1.1	920	6340	26	1020	3200	18.2	
	L6103A	52	58	1.9	239	81	17.5	88	247	16.8	
	L6105	61	71	2.7	304	76	21	109	416	21	
	G6159	20	38	11	86	24	19.9	-	3.5	-	
	G6161	113	63	10	156	256	8.6	228	243	1.1	
	G6179	19	47	15	35	10.6	18.9	-	94	-	
	G6181	48	38	4.1	88	<10	-	-	71	-	
	L6110-D	32	76	14.4	115	21	24	1360	64	32	
SN1-1	G6100	55	60	1.5	2560	5020	11.5	3680	2240	8.6	
SN1-9	G6100	53	69	4.6	1580	1800	2.3	940	760	3.7	
SN22-1	G6121	4320	2320	10.7	6800	26940	21	14280	5360	16.1	
SN22-3	G6121	640	471	5.6	4920	14800	17.7	13140	3560	20	
SN22-7	G6121	124	138	1.9	193	89860	35	58700	281	35	
SN24-2	G6123	580	1220	12.4	315	7200	32	2040	422	23	
SN39-8	SN046	164	282	9.4	112	560	24	182	114	8.1	
SN39-9	SN046	86	40	12.9	85	25	19.3	-	96	-	
SN39-10	SN046	84	94	2	123	283	13.9	205	108	11	
SN39-11	SN046	284	382	5.2	246	920	20	337	293	2.5	
Average Rel Std Dev (n=20)				7.6				21	15.5		
Std Dev				± 5.5				± 8.1	± 10.1		

Table VI-29: Concentrations of Aroclors in Duplicate Analyses of Soil Samples by FPXRF

Sample	Abs	Conc (ppm or ug/g)
SN 33-2	1.1	0.8
	1.6	0.7
Std Dev		0
Rel Std Dev		1.4
SN 33-7	1.1	0.8
	1.14	0.8
Std Dev		0
Rel Std Dev		0.7
SN 39-5	1.03	0.9
	1.09	0.8
Std Dev		0
Rel Std Dev		0.9
G6129	0.25	26
	0.3	20
Std Dev		4.2
Rel Std Dev		4.7
G6141	1.13	0.2
	1.11	0.2
Std Dev		0
Rel Std Dev		4.3
G6100	0.93	0.7
	0.95	0.7
Std Dev		0
Rel Std Dev		1.3
G6121	0.91	0.8
	0.88	0.9
Std Dev		0
Rel Std Dev		1.2
SNCP-7	0.2	30
	0.2	30
Std Dev		0
Rel Std Dev		0
G6158	1.32	0.8
	1.36	0.8
Std Dev		0
Rel Std Dev		0.7

Table VI-29: Concentrations of Aroclors in Duplicate Analyses of Soil Samples by FPXRF (cont'd)

Sample	Abs	Conc (ppm or ug/g)
G6169	1.29	1
	1.19	0.7
Std Dev		0.2
Rel Std Dev		5.4
SN33-22	1.08	0.3
	1.03	0.4
Std Dev		0.1
Rel Std Dev		5.9
Average Relative Std Dev (n=11)		2.4
Std Dev		± 2.2

Table VI-30: Comparison of PCBs Analyzed by FPXRF and GC/ECD

Delineation Sample	Corresponding Assessment Sample	PCB Concentration		Relative Std Dev
		PXRF (ppm or ug/g)	Aroclor 1254 GC/ECD (ppm or ug/g)	
SNCP-1	SN049	> 50	302	-
SNCP-2	SN049	> 50	393	-
SNCP-4	SN049	1.24	13.9	30
SNCP-5	SN049	> 50	633	-
SNCP-6	SN049	20	1840	35
SNCP-7	SN049	30	59	12
SNCP-8	SN049	>50	1545	-
SN33-1	SN047	(> 50) or (38)	430	-
SN33-2	SN047	0.5	1.9	21
SN33-3	SN047	1.5	1.0	7.1
SN33-4	SN047	> 50	525	-
SN33-5	SN047	1.25	14.4	30
SN33-6	SN047	1.13	1.2	1.1
SN33-7	SN047	0.76	<0.5	-
SN33-8	SN047	1.72	96	34
SN33-12	SN047	1.1	4.5	21
SN33-13	SN047	0.2	0.6	18
SN33-16	SN047	1.95	6.4	19
SN33-18	SN047	1.2	2.5	12
SN33-22	SN047	0.38	9	32
SN33-23	SN047	0.22	1.2	24
Average Rel Std Dev (n=21)				21
Std Dev				± 10

APPENDIX C. SITE DESCRIPTIONS

Originally there were twelve buildings at Snag Airstrip. The remains of nine of these can still be found: the airstrip tower building, one barracks building, one of three log cabins which were used as married quarters, a warehouse, powerhouse, pump house, fire hall, garage and a storage shack. Only the airstrip tower building, the fire hall, and log cabin are still standing.

A. Background

Five soil, including one field duplicate, and three plant samples were collected in areas not directly impacted by the operation of the airstrip.

- G6175 - Background sample collected approximately 75 m southeast of Mile 19 on the Snag Road. No tag was placed.
 - A 10 cm layer of organics over fine light brown sand with roots.
 - *Lupinus arcticus* was sampled.
 - Other vegetation present: *Picea glauca*, *Vaccinium vitis-idaea*.

- G6176 - Background sample taken approximately 35 m southeast of Mile 19 on the Snag Road. No tag was placed.
 - Organic humus and roots.
 - *Salix bebbiana* was sampled.
 - Other vegetation present: *Picea glauca*, *Populus tremuloides*

- G6193A - Background sample taken approximately 10 km north of the airstrip. No tag was placed.
 - 3 cm organic layer of fine silt and light brown sand.
 - *Ledum decumbens* was sampled.
 - Other vegetation present: *Salix* sp., *Populus balsamifera*, *Epilobium angustifolium*, *Rosea* sp., *Aster* sp.

- G6193B - Field duplicate of G6193A.

- G6194 - Background sample taken from the riverbed along the White River, approximately 5 km northeast of airstrip. No tag was placed.
- Grey silt.
- Vegetation present: *Epilobium latifolium*, *Populus balsamifera*, *Salix alaxensis*.

B. Tower Building

The tower building is situated at the south end of the area occupied by the airstrip facilities. It was used as the control tower for the operation of the airstrip. The building was only partially standing at the time of the current study and debris from the collapsing structure was strewn around it. Thirteen assessment soil samples including two field duplicates were collected in the vicinity of the tower building, and 22 delineation soil samples were collected from the area off the southern side of the building. Three plant samples were collected in the vicinity of the tower building. A sample each of insulation and paint chips were collected from the building as well.

- G6100 - Below and outside the door on the south side of the tower building, 1 m from its foundation. Debris in the area included insulated wire, wood nails, painted wood and insulation. Tag #1.
- Leaves over rich brown damp soil over sand, rocks, and roots (below 6 cm, pieces of paint.
- *Populus balsamifera* was sampled.
- Other vegetation present: *Populus balsamifera*, *Oxytropis* sp., *Solidago* sp., *Epilobium angustifolium*, *Potentilla* sp., *Poa* sp.

SN1-1 through SN1-22

- 24 delineation soil samples were collected at G6100. 23 of these were collected at surface to 10 cm depth. SN1-4D was taken at 45 cm depth.

- G6101A - Approximately 2.5 m southwest of the southwest corner of the tower building. Debris included wood, painted wood, insulated wire and insulation. Tag #2.
- Dark brown, rich, sandy soil with some organics, roots with lichen on top.
- Vegetation present: *Shepherdia* sp., *Populus balsamifera*, *Oxytropis* sp., *Solidago* sp., *Epilobium angustifolium*.

- G6101B - Field duplicate of G6101A.
- G6102 - Possible former location of an outhouse: hole lined with wood supports, approximately 5 m west of west end of tower building. Tag #3.
- Dark brown soil with paint chips mixed in with leaves and humus, roots, organics, sand and rocks. Some charred wood and tin/aluminum can.
 - Vegetation present: *Populus balsamifera*, *Oxytropis* sp., *Solidago* sp.
- G6103 - Approximately 2 m northwest of the northwest corner of the tower building. Debris included a wood furnace. Tag #4.
- Light brown fine sand, roots, stones; compacted lichens on the surface.
 - *Oxytropis campestris* was sampled.
 - Vegetation present: *Colpodium* sp., *Salix* sp., *Potentilla* sp., *Arctostaphylos alpina*, *Oxytropis* sp., *Epilobium angustifolium*, *Solidago* sp.
- G6104A - 1.5 m north of the north side of the tower building outside the front door, beside a concrete step support. Debris present consisted of sheet metal, pressboard wood, conduit pipes and wires, and glass. Tag #5.
- Moss over black organics, over brown organics, with roots, some clay and a few rocks at approximately 6 cm, paint chips.
 - Vegetation present: *Salix alaxensis*, *Solidago* sp., *Epilobium angustifolium*, *Botrychium* sp., *Poa* sp., *Oxytropis* sp.
- G6104B - Field duplicate of G6104A.
- G6105 - Approximately 3 m northeast of the northeast corner of the tower building. Debris consisted of painted wood, window screen glass and tar paper. Tag #6.
- Lichen over a thin black silt layer over soil over brown sand, roots and rocks.
 - *Oxytropis campestris* was sampled.
 - Other vegetation present: *Populus balsamifera*, *Solidago* sp., *Astragalus alpinus*, *Potentilla* sp., *Botrychium* sp., *Epilobium angustifolium*, *Shepherdia* sp.
- G6106 - 3 m east of the east side of the tower building, perpendicular to the middle of the wall and electrical conduit extending out of the wall. Debris consisted of screened window, wood, pressboard and insulation. Tag #7.
- Top layer of white lichen over a layer of black soil, over fine sand with small amount of organics, roots and rocks.
 - Vegetation present: *Potentilla* sp., *Androsace septentrionalis*, *Anemone* sp., *Solidago* sp., *Botrychium* sp., *Oxytropis* sp., *Festuca* sp., *Achillea* sp.

- G6107 - Approximately 6 m north of G6103 and approximately 8 m from the northwest end of the tower building and approximately 3 m south of the road. Wood debris was present in the area. Tag #8.
- White lichen over a thin black layer of soil over loose, fine dry sand with roots and pebbles.
- Vegetation present: *Populus balsamifera*, *Solidago* sp., *Achillea* sp., *Potentilla* sp., *Astragalus* sp., *Agrostis* sp., *Oxytropis* sp.

- G6108 - Approximately 2.5 m southeast of the southeast corner of the tower building. Debris consisted of painted wood and press board. Tag # 9.
- Lichen over a 0.5 cm layer of black soil, over loose light brown sand, roots and rocks.
- Vegetation present: *Potentilla* sp., *Oxytropis* sp., *Polemonium* sp., *Solidago* sp.

- G6109 - Burn pile approximately 13 m south of the south side of the tower building. Debris consisted of wire, iron filings, burnt wood, aluminum cans, and possibly a battery. Tag #10.
- Damp soil, coarse sand and rocks. A fine black powdery substance in electrical equipment was sampled; iron filings and ash.
- No vegetation was present in the immediate sampling area.

- G6110 - Large hole approximately 30 m west of the west side of the tower building, perpendicular to the south side. No debris was present. Tag #11.
- Rotting leaves, roots and organics between very large rocks.
- Sparse vegetation present: *Epilobium angustifolium*, *Oxytropis* sp., *Populus balsamifera*, *Populus tremuloides*.

- SNASB-1 - Wall insulation from the tower building. Packaging labeled "Gyprack wool a GLA product".
- SNPC-1 - Paint chips collected from wood in the tower building.

C. DOT Barracks Building

The remains of the Department of Transport barracks building consisted of its foundation, a number of cement supports and a brick fireplace and chimney. Twelve assessment soil, including two field duplicates, and three plant samples were collected in the vicinity of the building. A sample of insulation lying on the surface of the building foundation was collected. Two water samples were collected from wells located near the DOT barracks.

- G6111 - North end of the DOT barracks building between the last set of cement supports. Sheet metal and painted wood debris were present. Tag #12.
- Light brown sand, stones, rocks and roots. Some organics.
 - Vegetation present: *Epilobium angustifolium*, *Oxytropis* sp., *Populus balsamifera*.
- G6112 - Approximately 4 m south of G6111 in a depression between the second and third sets of concrete supports of the DOT barracks. Debris consisted of sheet metal, wood, ash, nails and piping. Tag #13.
- Top layer of moss over approximately 6 cm of black ash over brown sand and clay, rocks and roots. The soil had smoky odour.
 - Vegetation present: *Populus balsamifera*, *Potentilla* sp., *Solidago* sp., *Arnica* sp., *Oxytropis* sp.
- G6113 - Approximately 7 m south of G6112 between the fourth and fifth concrete supports in a depression below the site of the DOT barracks. Debris included sheet metal, tar paper, tin cans, wood, nails and bolts. Tag # 14.
- Soft loose light brown soil, mixed with fine grey roots and possibly insulation; covered with a layer of wood, then a layer of drywall, another layer of wood, and a layer of insulation.
 - *Salix bebbiana* was sampled.
 - Other vegetation present: *Populus balsamifera*, *Shepherdia* sp., *Salix* sp., *Arctostaphylos alpina*.

- G6114 - In a depression between the third and fourth (from the north) concrete supports of the DOT barracks. Some sheet metal and wood debris were present. Tag #15.
- Lichen on top of a black layer of burnt, decayed wood, on top of 5 - 6 cm of grey drywall, wood, roots and rocks, medium brown sandy soil, dry organics and roots.
 - Vegetation present: *Shepherdia* sp., *Populus balsamifera*, *Oxytropis* sp., *Arctostaphylos alpina*, *Epilobium angustifolium*.
- G6115 - A pile of rocks, dirt and debris on the west side of the DOT barracks, approximately 5 m southwest of the 1994 Tag #47 and 5 m northwest of the chimney. Debris consisted of nails, sheet metal wire, electrical equipment, burnt wood and pipes. Tag #16.
- Rocks, fine sand and roots.
 - Vegetation present (very sparse): *Shepherdia* sp., *Potentilla* sp., *Epilobium angustifolium*, *Solidago* sp.
- G6116 - On the west side of the DOT barracks approximately 3 m from and directly west of the chimney, next to a pipe hole in the foundation. Debris consisted of sheet metal, possibly from the furnace. Tag #17.
- Leaves over burnt and rotting leaves and wood; rocks and nails.
 - *Salix exigua* was sampled.
 - Other vegetation present: *Astragalus* sp., *Epilobium angustifolium*, *Salix* sp.
- G6117A - On the west side of the DOT barracks approximately 3 m south of G6116, immediately adjacent to a dip in the foundation where a door may have been. Sheet metal, pipes and burnt wood debris were present. Tag #18.
- Brown, moist organic soil under drywall. Fine sand, some rocks and roots.
 - Vegetation present: *Salix* sp., *Populus balsamifera*, *Astragalus* sp., *Potentilla* sp., *Shepherdia* sp.
- G6117B - Field duplicate of G6117A.

- G6118 - 4 m south of the DOT barracks foundation in a depression. Debris consisted of wood, sheet metal and charred wood. Tag #19.
- Dried leaves and sawdust with many rocks and orange silt.
 - *Salix bebbiana* was sampled.
 - Other vegetation present: *Epilobium angustifolium*, *Arctostaphylos alpina*, *Populus balsamifera*, *Oxytropis* sp.
- G6119A - South end of the basement in the DOT barracks. Debris included some wire and wood. Tag #20.
- A thick layer of moss over a very thin layer of sandy dark brown silt.
 - Vegetation present: *Epilobium angustifolium*, *Cerastium* sp., *Salix* sp., species of grass and moss.
- G6119B - Field duplicate of G6119A.

- G6120 - East side of the DOT barracks foundation, approximately 1 m east of and midway along the edge of the basement. Debris consisted of what appeared to be a large metal tank, metal vent and burnt wood. Tag #21.
- A layer of grey ash over coarse grey and brown stones and bits of burnt wood; a few roots.
- Vegetation present: *Oxytropis* sp., *Hedysarum* sp., *Potentilla* sp., *Solidago* sp., *Arctostaphylos alpina*, *Shepherdia* sp., *Populus balsamifera*.

- SNASB-4 - Insulation from the DOT barracks.
- GW6100 - Groundwater sample from the northern-most well, north of DOT barracks.
- GW6101 - Groundwater sample from the well east of the DOT barracks chimney, and north of the tower building; the southern-most of two wells.

D. Warehouse

The foundation was all that remained of the warehouse. Some wooden supports in the vicinity suggested the presence of temporary storage buildings to the east of the warehouse. Seven soil samples, including one field duplicate, were collected in the vicinity of the warehouse foundation. Forty-one delineation soil samples were collected in three areas in the vicinity of the warehouse. Two plant samples were collected in this area as well.

- G6121 - A stain midway along the south side of, and immediately adjacent to the warehouse foundation. A motor oil can nearby suggests that its contents may have been burnt here. Debris consisted of bent nails. Tag #22.
- Sand and coarse stones; dark grey staining; appeared to be burnt.
- *Shepherdia canadensis* was sampled.
- Vegetation present (very sparse): *Epilobium angustifolium*, *Potentilla* sp.

SN22-1 through SN22-20

- Delineation soil samples collected at G6121 (Tag #22). SN22-1 through SN22-20 were collected at surface to a depth of 10 cm. SN22-A was a composite sample of grey powdery debris lying on the surface of the warehouse foundation.

- G6122 - On the west side of the warehouse foundation, approximately 1.5 m from the base of the bay door. Some wood debris was present in the area. Tag # 23.
- Compact and rocky, moist medium brown soil with organics and sand mixed in.
 - *Salix brachycarpa* was sampled.
 - Other vegetation present: *Shepherdia* sp., *Arctostaphylos alpina*, *Epilobium angustifolium*, *Oxytropis* sp.

- G6123 - On the east side of the warehouse foundation on the south side of, and approximately 0.3 m away from the stairs. Tag # 24.
- Rocky medium brown coarse sand with roots and some organics.
 - Vegetation present: *Populus balsamifera*, *Oxytropis* sp., *Solidago* sp., *Epilobium angustifolium*, *Potentilla* sp., *Oxytropis* sp., *Picea glauca*.

SN24-1 through SN24-11

- Delineation surface soil samples collected at sample location G6123 (Tag #24).

- G6124 - 1 m north of the north side of the warehouse foundation, midway along the foundation. Some insulated pipe was in the area. Tag # 25.
- Very rocky sand mixed with roots.
 - Vegetation present: *Populus balsamifera*, *Oxytropis* sp., *Potentilla* sp., *Achillea* sp.

- G6125A - Approximately 4 m south of 1994 Tag #39 (sample SN046), in a big pile of transformer plates. Other debris included aluminum cans and porcelain insulators. Tag # 26.
- Hard-packed brown rocky sand with many roots.
 - Vegetation present: *Populus balsamifera*, *Rosea* sp., *Salix* sp., *Arctostaphylos alpina*, *Oxytropis* sp., *Shepherdia* sp., *Epilobium angustifolium*.

- G6125B - Field duplicate of G6125A.

SN39-1 through SN39-11

- Delineation soil samples collected at 1994 sample location SN046. All samples collected at surface to 10 cm depth except for SN39-9 which was a subsurface sample collected at 30 cm depth.

- G6126 - On the north side of a small orange platform, at the east end of the warehouse. Nails and wood debris. Tag #27.
- Mossy lichen layer on the surface; sand and organics with many rocks and roots.
- Vegetation present: *Epilobium angustifolium*, *Arctostaphylos alpina*, *Populus tremuloides*, *Populus balsamifera*, *Oxytropis* sp., *Solidago* sp., *Astragalus* sp., *Salix* spp.

E. Powerhouse and Pump House

The powerhouse and pump house were both evidenced only by their foundations. Staining around the generator pads at the powerhouse was extensive. A large cistern containing water was located at the west end of the pump house and utilidors and underground pipes connected this to the rest of the site. Twenty-four assessment soil samples, including two field duplicates, were collected in the vicinity of the powerhouse. An additional five assessment soil samples were collected in the area surrounding the pump house. Thirty-three delineation soil samples were collected from the pump house basement (8 samples) and the east side of the powerhouse foundation (25 samples). Four plant samples were collected near the remains of these two buildings. Two water samples were collected from the pump house facilities.

- G6127 - 1 m off the northwest corner of the powerhouse foundation. Tag #28.
- Approximately 2 cm of moss over fine sand and organics mixed with roots.
- Vegetation present: *Populus balsamifera*, *Oxytropis* sp., *Epilobium angustifolium*, *Arctostaphylos uva-ursi*, *Rosea* sp.

- G6128A - Approximately 1 m west of the powerhouse foundation and approximately 7 m south of G6127, 1 m southwest of the base of the chimney. Debris consisted of porcelain insulators, concrete, wood and nails. Tag #29.
- Leaves over wood; medium brown sandy soil with some organics and roots.
- Vegetation present: *Achillea* sp., *Epilobium angustifolium*, *Arnica* sp., *Populus balsamifera*.

- G6128B - Field duplicate of G6128A.

- G6129 - 1 m west of the powerhouse foundation, approximately 5 m south of G6128 and 1 m east of the triangular pipe cover. Debris in the area included wood, nails and painted pressboard. Tag #30.
- Rocks and wood on top; rocks throughout coarse medium brown sand.
 - Vegetation present (sparse): *Potentilla* sp., *Epilobium angustifolium*, *Colpodium* sp., *Salix* sp., species of grass.
- G6130 - On the west side of an oil-drainage pit surrounding the generator pad, approximately midway along it. Debris in the area included bolts, nails and a pipe bracket. Tag #31.
- Oil-coated pieces of concrete which have crumbled from the edge of the foundation; leaves.
 - Vegetation present (very sparse): *Epilobium angustifolium*, *Poa* sp.
- G6131 - 1 m off the southwest corner of the powerhouse foundation. Debris in the area consisted of glass, wood and nails. Tag # 32.
- Very hard-packed rocky sand with some roots.
 - *Shepherdia canadensis* was sampled.
 - Vegetation present: *Shepherdia* sp., *Populus balsamifera*, *Populus tremuloides*, *Arctostaphylos uva-ursi*, *Oxytropis* sp., *Salix* sp.
- G6132 - 1 m south of the powerhouse foundation, approximately 4 m east of G6131. Debris in the area consisted of concrete and wood. Tag #33.
- A very thin layer of lichen; rocky, sandy medium brown soil with very few roots.
 - Vegetation present: *Oxytropis* sp., *Potentilla* spp., *Epilobium angustifolium*, *Populus balsamifera*, *Shepherdia* sp.
- G6133 - A cement-sided pit in the centre of the generator pad; free product (approximately 1 cm of free-standing oil) was present in the pit. Tag #34.
- Sand, organics and leaves; very strong hydrocarbon odour, thick black oily free product.
 - Vegetation present (very sparse): *Salix* spp.

- G6134 - A composite sample from the north side of the oil collection pit surrounding the generator pad. The concrete was cracking, and the subsurface was very oily in some spots. The pit sample is much like the sample collected at G6133. Debris consisted of concrete, steel bolts, paper and cardboard, pipe bracts and metal rods. Tag #35.
- Black stained oily sand and rocks, heavily saturated with oil in many places, with a very strong hydrocarbon odour.
- Vegetation present: *Epilobium angustifolium*, *Salix* spp., *Solidago* sp.
- G6135 - 0.75 m north of the powerhouse foundation, approximately 0.5 m west of the bay door concrete pad. Debris consisted of press board, metal rods, wood and nails. Tag #36.
- Thick moss over medium brown sand and roots; lighter coloured sand below.
- *Epilobium angustifolium* was sampled.
- Other vegetation present: *Populus balsamifera*, *Solidago* sp., *Petasites* sp., species of grass (sparse), moss and lichen.
- G6136 - 0.5 m north of the concrete pad for the bay door located on the north side of the building foundation, and midway along the edge. Bits of concrete pad were present in the sampling area. Tag #37.
- Moss over dark brown organics, over medium brown sandy soil.
- *Salix brachycarpa* was sampled.
- Other vegetation present: *Epilobium angustifolium*, *Astragalus*, *Populus balsamifera*, *Oxytropis* sp., *Arctostaphylos uva-ursi*.
- G6137 - On the south side of the powerhouse foundation, 1 m from the edge and midway along the south side of the foundation; approximately 3.5 m east of G6132. Wood debris was present in the area. Tag #38.
- Rocks with medium brown coarse sand.
- Vegetation present (sparse): *Oxytropis* sp., *Populus balsamifera*, *Epilobium angustifolium*, *Arctostaphylos uva-ursi*.
- G6138 - On the north side of the powerhouse foundation, approximately 1 m northeast of the northeast corner of the bay door concrete pad, approximately 3 m east of G6136. Pressboard was the only debris noted in the area. Tag #39.
- A 2 cm layer of organics over medium brown sand with pebbles and many roots.
- *Arctostaphylos uva-ursi* was sampled.
- Vegetation present: *Epilobium angustifolium*, *Oxytropis* sp., *Salix* sp., *Populus balsamifera*, *Aster* sp.

- G6139 - 1 m northeast of the northeast corner of the powerhouse foundation. Tar shingles, painted wood and a tin can were present in the area. Tag #40.
- Black organics and humus over medium brown sand with rocks and roots.
 - Vegetation present: *Arctostaphylos uva-ursi*, *Populus balsamifera*, *Epilobium angustifolium*, *Picea glauca*, *Oxytropis* sp., *Salix* sp.
- G6140A - 0.5 m east of the east side of the powerhouse foundation, approximately 7 m south of G6139. Debris consisted of rusty nails, tar shingles, wood, pressboard, burnt insulation, steel and pipes (possibly lead). Tag #41.
- A 1 cm layer of organics and humus over dark brown sandy soil with a few rocks and lots of roots.
 - Vegetation present: *Populus balsamifera*, *Oxytropis* sp., *Epilobium angustifolium*, *Solidago* sp., species of grass, lichen and moss.
- G6140B - Field duplicate of G6140A.
- G6141 - 1 m east of the east side of the powerhouse foundation, approximately 5 m from the southeast corner of the foundation and 5 m from G6140. Wood debris was present in the area. Tag #42.
- Dried moss layer over light brown sand, over medium brown sand with many stones.
 - Vegetation present: *Epilobium angustifolium*, *Astragalus* sp., *Potentilla* sp., *Populus balsamifera*, *Solidago* sp., *Populus tremuloides*.
- SN33-1 through SN33-25D
- Samples collected to delineate 1994 sample SN047 (Tag #33). 1995 sample G6141 (Tag #42) is part of this grid. All samples except those ending with a 'D' were collected at the surface down to approximately 10 cm. Samples collected at depth (SN33-24D & -25D) were from between 10 and 50 cm depth.
- G6142 - 1 m east of a raised concrete support pad jutting out from the powerhouse foundation on its southeast side; presumed site of the door into the powerhouse. Debris consisted of painted wood, burnt wood and nails. Tag #43.
- Fairly compact black layer of soot over medium brown organics and sand with roots and rocks.
 - Vegetation present: *Epilobium angustifolium*, *Populus balsamifera*, *Achillea* sp., *Salix* sp., *Picea glauca*, *Aster* sp., *Potentilla* sp.

- G6143 - 1 m south of the southeast corner of the powerhouse foundation near five concrete supports sticking out of the foundation. Wood, nails, metal strapping and tar shingles were present in the area. Rabbit frass was also identified in the area. Tag #44.
- Black organics mixed in with moss, many rocks and nails over coarse sand; some insulation.
- Vegetation present: *Populus balsamifera*, *Epilobium angustifolium*, *Arctostaphylos uva-ursi*, *Oxytropis* sp.
- G6144 - A composite sample of debris from the north half of the powerhouse foundation. Debris consisted of lots of pressboard, some with moss on it, painted pressboard, ash, rusty iron filings and soot. No tag was placed.
- G6145 - A composite sample from the south half of the powerhouse foundation. The sample consisted of sand, pebbles and insulation. No tag was placed.
- G6146 - A stain (2 m x 8 m) approximately 13 m north of the northwest corner of the powerhouse foundation. A metal rod and porcelain insulator were present in the area. Tag #45.
- A 1 cm thick black chunky layer over coarse medium brown sand with rocks and some roots.
- Vegetation present (sparse): *Populus balsamifera*, *Oxytropis* sp., *Epilobium angustifolium*.
- G6147 - Burn pile/stain containing nails and bolts, approximately 30 m southwest of the southwest corner of the powerhouse foundation. Burnt wood, many nails, bolts and electrical components were present. Tag #46.
- Lichen over a black layer of ash 1.5 cm thick; over coarse medium brown sand with rocks, lots of rusty nails, and a few roots.
- Vegetation present (sparse): *Populus balsamifera*, *Shepherdia* sp., *Oxytropis* sp., *Potentilla* sp.
- G6170 - In a 15-20 cm deep depression, approximately 5 m west of the end of the powerhouse foundation, and 3 m southeast of the pump house foundation. Wire, insulation and wood debris were present in the area. Tag #80.
- Medium-dark brown organics and roots under leaves, wood, insulation and rocks.
- Vegetation present: *Arnica*, *Epilobium angustifolium*, *Populus balsamifera*, *Heracleum* sp., *Oxytropis* sp., *Arctostaphylos alpina*.

- G6171 - 1 m south of the door to the pump house foundation, 1 m east of the wooden pipe cover. Nails and wood debris were present in the area. Tag #81.
- Very rocky, wood and nails, sandy light brown soil and roots.
 - Vegetation present: *Oxytropis* sp., *Epilobium angustifolium*, *Populus balsamifera*, *Arctostaphylos alpina*, species of grass.
- G6172 - At the top of the stairs leading east away from the door out the north end of the pump house. Tag #82.
- Moss and thick plant cover over dark brown organics, roots and rocks; medium brown sandy gravel underneath.
 - Vegetation present: *Oxytropis* sp., *Achillea* sp., *Populus balsamifera*, *Epilobium angustifolium*, *Ledum* sp.
- G6173 - 3 m southeast of G6172, 1m east of the pump house foundation, approximately midway along it. Debris consisted of tar paper, shingles, nails and a bottle cap. Tag #83.
- Lichen and moss coating over black silt and organics with lots of roots.
 - Vegetation present (sparse): *Populus balsamifera*, *Epilobium angustifolium*, *Hedysarum* sp., *Salix* sp., *Heracleum* sp., *Achillea* sp., *Potentilla* sp., *Solidago* sp., *Oxytropis* sp.
- G6174 - 1.5 m south of the southwest corner of the most easterly tank of the pump house. Some cement. Tag #84.
- A very thick (10 cm) layer of dried leaves over organics and roots; coarse medium brown sand and rocks below.
 - Vegetation present: *Epilobium angustifolium*, *Populus balsamifera*, *Arctostaphylos alpina*, *Aster* sp., *Lupinus* sp., *Hedysarum* sp., *Potentilla* sp., *Heracleum* sp.
- G6185 - Stain 8 m east of the powerhouse foundation, in line with 1994 Tag #33 (sample SN047). A 1 inch pipe and wood debris were present in the area. Tag #121.
- Dark brown sand and gravel stained black on the surface. No odour was detected.
 - Vegetation present: *Populus balsamifera*, *Oxytropis* sp., *Salix* sp., *Arctostaphylos alpina*, *Potentilla* sp., *Epilobium angustifolium*, *Aster* sp.

OIL-1 - Oil-soaked filter collected east of the powerhouse foundation and next to sample location G6185.

GW6102 - Water sample from the cistern at the west end of the pump house foundation area.

GW6103 - Water sample from the utilidor extending north from the pump house.

SNCP-1 through SNCP-8

- Delineation of 1994 sample SN049 collected in the pump house basement. Soil consisted mostly of moss and a small amount of silt, but was no greater than 10 cm thick in any one place.

F. Fire Hall

The fire hall was still standing, but had been gutted. Six assessment soil samples, including one field duplicate, were collected in the immediate vicinity of the fire hall. In addition, a sample each of insulation and pressboard were collected from the building.

G6148 - At the back of the fire hall, 2 m north of the north corner. Debris consisted of slate siding and painted white tar paper. Tag #47.

- Compact top layer 0.5 cm thick over loose gravely light brown sand containing many black shiny rocks and no roots.

- Vegetation present (sparse): *Populus balsamifera*, *Arctostaphylos alpina*, *Shepherdia* sp., *Oxytropis* sp.

G6149A - 1.5 m west of the west corner of the fire hall. Debris consisted of tar paper, shingles and wood. Tag #48.

- Coarse light-medium brown sand and stones.

- Vegetation present: *Epilobium angustifolium*, *Populus balsamifera*, *Shepherdia* sp., *Oxytropis* sp.

G6149B - Field duplicate of G6149A.

- G6150 - Midway along the south wall of the fire hall in a black stain. Much of the soil at the back of the fire hall appears stained. Debris consisted of shingles and tar paper. Tag #49.
- Black shiny layer on top of coarse sand containing fine roots and rocks.
 - Vegetation present: *Populus balsamifera*, *Potentilla* sp., *Heracleum* sp.
- G6151 - 1.5 m east of the east wall and large door of the fire hall. Debris consisted of painted wood. Tag #50.
- Crusty layer over coarse light brown sand with lots of rocks but few roots.
 - Vegetation present: *Arctostaphylos alpina*, *Oxytropis* sp., *Solidago* sp., *Agropyron* sp., *Sericeum* sp., *Potentilla* sp.
- G6152 - Burn stain (approximately 1 m x 1 m) approximately 12 m east of the front of the fire hall. Electrical components, nails and wood were present in the area. Tag #51.
- Grey ash over brown sand, stones and rock; many nails.
 - Vegetation present: *Populus balsamifera*, *Oxytropis* sp., *Potentilla* sp., *Epilobium angustifolium*, species of moss.
- SNASB-2 - Insulation from the fire hall.
- SNASB-3 - Pressboard from the fire hall.

G. Garage

The location of the garage was apparent from its foundation and the large oil-change pit located at its north end. A second smaller oil change pit was located along the west side of the foundation. Fourteen assessment soil samples and four plant samples were collected in the vicinity of the garage foundation.

- G6153 - Composite sample of debris, moss, paint chips and drywall from the bottom of the oil-change pit located in the garage foundation. Wood, bolts, drywall and insulation were present in the pit. No tag was placed.
- Moss, paint chips, drywall and insulation.
 - *Salix brachycarpa* was sampled.
 - Other vegetation present (sparse): *Epilobium angustifolium*, species of grass.
- G6154 - A possible stain on the east side of the garage, approximately 20 m southeast of the east corner. Nails were present in the sampling area. Tag #52.
- Compact black lichen-covered layer over orange sand with many rocks and some roots.
 - Vegetation present (sparse): *Oxytropis* sp., *Populus balsamifera*, *Potentilla* sp., *Epilobium angustifolium*.
- G6155 - A large area (approximately 15 m x 20 m) south of the garage foundation, which has not revegetated as the rest of the site has. Tag #53.
- Crusty grey silty soil with white specks on top, with stones.
 - Vegetation present (sparse, *Populus* spp. appear stunted): *Populus* spp., *Oxytropis* sp., *Lupinus* sp.
- G6157 - A burn pile 10 m north of the garage foundation beside the garage door. Debris in the area consisted of a grey wooden door and burnt wood. Tag #56.
- Grey ash approximately 10 cm thick over brown sand.
 - Vegetation present (sparse): *Oxytropis* sp., *Populus balsamifera*, *Salix* sp.

- G6160 - Midway along the east side of the garage foundation, approximately 25 m southwest of the northeast corner of the foundation. Debris in the area consisted of painted wood and nails. Tag #71.
- Thin crusty layer over medium brown sand with rocks, nails, roots and some organics.
 - Vegetation present: *Oxytropis* sp., *Populus balsamifera*, *Epilobium angustifolium*, *Salix* sp., *Arctostaphylos alpina*, *Solidago* sp., *Shepherdia* sp.
- G6161 - Approximately 1m east of garage foundation, 2 m east of the south corner of the foundation. Wood was the only debris in the area. Tag #72.
- A thin crusty layer over medium brown sand with rocks, roots and some organics.
 - *Populus balsamifera* was sampled.
 - Other vegetation present: *Potentilla* sp., *Epilobium angustifolium*, *Oxytropis* sp., *Arnica* sp., *Shepherdia* sp., species of grass.
- G6162 - Approximately 2 m northwest of the west corner of the garage foundation. Wood was the only debris in the area. Tag #73.
- A thin crusty layer over rocks, fine sand and roots.
 - *Shepherdia canadensis* was sampled.
 - Other vegetation present: *Populus balsamifera*, *Oxytropis* sp., *Anemone* sp., *Agropyron* sp., *Potentilla* sp.
- G6163 - 5 m west of G6162 between two wooden slats placed in the ground (looks like a driveway), on the west side of the garage foundation near its west corner. Nails and wood debris were present in the area. Tag #74.
- Dried leaves over light brown sand , some roots and rocks.
 - Vegetation present: *Populus balsamifera*, *Epilobium angustifolium*, *Oxytropis* sp., *Potentilla* sp., *Arnica* sp.
- G6164 - On the edge of a rectangular cement extension from the west side of the garage foundation, approximately 15 m southwest of the north corner of the foundation. Tag #75.
- Drywall, stones, metal disks, roots and organics.
 - *Shepherdia canadensis* was sampled.
 - Other vegetation present: *Epilobium angustifolium*, *Populus tremuloides*, *Populus balsamifera*, *Arnica* sp., species of grass.

- G6165 - Debris from a small oil-change pit in the rectangular cement extension on the west side of the garage foundation, 3 m southeast of G6164. Debris in the area consisted of glass, porcelain, nails and insulation. No tag was placed.
- 3 cm of leaves and moss over rich black organics mixed with fine sand.
 - Vegetation present: *Epilobium angustifolium*, species of bryophyte and moss.
- G6166A - 2 m west of the west side of the garage foundation approximately 5 m southwest of the north corner of the foundation. A tin can was present in the sampling area. Tag #76.
- A crust of lichen and moss over fine sand, roots, rocks and organics.
 - Vegetation present: *Solidago* sp., *Shepherdia* sp., *Populus balsamifera*, *Anemone* sp., *Polemonium* sp., *Epilobium angustifolium*, *Arctostaphylos alpina*, *Heracleum* sp.
- G6166B - Field duplicate of G6166A.
- G6167 - 1 m north of the north end of the garage foundation, midway along the foundation edge. Debris in the area consisted of rusted metal parts and nails. Tag #77.
- A thick moss layer over dark brown organics, sand and roots.
 - Vegetation present: *Populus balsamifera*, *Shepherdia* sp., *Epilobium angustifolium*, *Arctostaphylos alpina*, *Oxytropis* sp., *Heracleum* sp., *Rosea* sp., *Linnaea* sp., species of grass.
- G6168 - A stain off the east corner of the garage foundation, approximately 2 m northeast of the foundation. Tar paper debris. Tag #78.
- Faint hydrocarbon odour. Very rocky, organics over medium brown sand and roots.
 - Vegetation present: *Populus balsamifera*, *Epilobium angustifolium*, *Oxytropis* sp., *Potentilla* sp., *Polemonium* sp., *Aster* sp.

H. Dump

The dump is located approximately 1 km southwest of the main area of the site just off the access road which extends northeast from the Alaska Highway. It is situated along a medium grade slope. The dump had been worked extensively with large amounts of clean fill added in the spring of 1995 and hence very little debris was visible. Erosion of the face of the dump was not evident, so sampling was concentrated at the base of the slope. Twelve assessment soil samples, including one field duplicate, and six plant samples were collected at the dump. One of the soil samples was collected at approximately 50 cm depth.

- L6101
 - Off the southwest toe of the worked area of the dump, approximately 0.5 m from the edge of the filled area. Buried debris in the area consisted of a beer bottle, plastic and tin cans. Tag #58.
 - Thick moss and grass over black organics, over brown sand with organics and rocks.
 - *Populus balsamifera* was sampled.
 - Vegetation present: *Rosea* sp., *Epilobium angustifolium*, *Populus balsamifera*, *Populus tremuloides*, *Mertensia* sp., *Heracleum* sp., species of grass.

- L6102
 - 8 m east of L6101, at the southwest toe of the dump, 1 m from the edge of the filled area. Tag #59.
 - A 1 cm moss layer over black organics, over dark brown sand with organics and many roots.
 - Vegetation present: *Epilobium angustifolium*, *Rosea* sp., *Fragaria* sp., *Mertensia* sp., *Aster* sp., *Cerastium* sp., *Lupinus* sp.

- L6103A
 - 6 m southeast of L6102, approximately 1.5 m south of the edge of the filled area on a flat spot. Debris in the area included tin cans and wood. Tag #60.
 - A moss layer approximately 1.5 cm thick over dark brown organics with rocks and roots.
 - *Epilobium angustifolium* was sampled.
 - Other vegetation present: *Populus tremuloides*, *Populus balsamifera*, *Arctostaphylos alpina*, *Rosea* sp., *Lupinus* sp., *Achillea* sp., *Rubus* sp., species of grass.

- L6103B
 - Field duplicate of L6103A.

- L6104 - 2 m east of east side of the worked area, approximately 1 m from the toe of the dump, and midway along the toe in a low spot near a pile of tires. Other debris included wood, crushed tin cans and glass. Tag #61.
- A thin organic layer of soil over silt, organics and roots.
 - Vegetation present: *Cerastium* sp., *Rosea* sp., *Epilobium angustifolium*, *Salix* sp., *Rubus* sp., species of grass.
- L6105 - Approximately 3 m south of the southeast side of the dump in a depression surrounded by partly buried debris. Debris present in the area included tin cans, plastic, glass, cigarette foil and beer bottles. Tag #62.
- 1 cm of organics over loose dark brown organics with roots and some rocks.
 - *Epilobium angustifolium* was sampled.
 - Other vegetation present: *Achillea* sp., *Heracleum* sp., *Mertensia* sp., *Populus balsamifera*, *Populus tremuloides*, *Rubus* sp., *Rosea* sp.
- L6106 - Approximately 7 m southeast of the southeast toe of the filled area in an area surrounded by debris, at a low spot. Debris in the area consisted of crushed tin cans and metal. Tag #63.
- Dark brown organics with many rocks.
 - Vegetation present: *Rosea* sp., *Arctostaphylos alpina*, *Mertensia* sp., *Populus tremuloides*, *Salix* sp., *Epilobium angustifolium*, *Cerastium* spp., species of grass.
- L6107 - 2 m east of the east side of the filled area in an area with buried debris. Other debris in the area included a metal chassis, a PHILCO-type battery and a plastic bowl. Tag #64.
- A layer of rotting leaves, many roots, buried metal waste over 6 cm of organics, over light brown sandy soil with a few rocks and organics.
 - *Salix bebbiana* was sampled.
 - Other vegetation present: *Rosea* sp., *Arctostaphylos alpina*, *Populus tremuloides*, *Populus balsamifera*, *Picea glauca*, *Mertensia* sp., *Cerastium* sp., *Polemonium* sp., *Anemone* sp., *Linnaea* sp.
- L6108 - 5 m south of L6102, at the toe of the dump. Buried metal was present under the sampling location. Tag #100.
- A thick mossy layer (3 cm) over dark brown silt and organics.
 - Vegetation present: *Epilobium angustifolium*, *Salix* sp., *Mertensia* sp., *Populus tremuloides*, *Fragaria* sp., *Rosea* sp., *Arctostaphylos alpina*.

- L6109 - 5 m south of L6103 in a low spot. Tag #101.
 - Thick organic layer with dead leaves, many roots, sand and organics.
 - *Salix myrtillifolia* was sampled.
 - Vegetation present: *Populus balsamifera*, *Populus tremuloides*, *Polemonium* sp., *Mertensia*, *Arctostaphylos alpina*, *Epilobium angustifolium*, grass and moss.

- L6110 - A surface sample approximately 5 m south of the toe of the dump at a low spot, midway along the toe. Glass was present in the area. Tag #102.
 - 1 cm layer of black organics over silt and organics.
 - *Salix myricoides* was sampled.
 - Other vegetation present: *Rosea* sp., *Achillea* sp., *Mertensia* sp., *Potentilla fruticosa*.

- L6110-D - Subsurface sample below 50 cm depth, taken at the same location as L6110. Tag #102.

I. Septic Field

The location of the septic field appears to have been an unvegetated area northeast of the married quarters. An underground system of pipes located nearby and accessible by manholes may have formed part of the septic system. Six assessment soil samples, including one field duplicate, were collected in the vicinity of the septic field.

- 06100 - Approximately 50 m northeast of the married quarters, at the south end of the proposed septic field. Tag #65.
 - Thin crusty layer of lichen over fine dry sand and silt with many roots and some rocks.
 - Vegetation present (sparse): *Populus balsamifera*, *Potentilla* sp., *Epilobium angustifolium*, *Solidago* sp.

- 06101A - 12 m northeast of O6100 in the septic field. Tag #66.
 - Light brown sand covered with a thin layer of lichen.
 - Vegetation present (sparse): *Populus balsamifera*, *Solidago* sp., *Potentilla* sp., *Lupinus* sp.

- 06101B - Field duplicate of 06101A.

- 06102 - 12 m northeast of O6101 in the septic field. Tag #67.
 - Medium-light brown very rocky sand covered by thin lichen layer.
 - Vegetation present (sparse): *Populus balsamifera*, *Lupinus* sp., *Epilobium angustifolium*, *Potentilla* sp., *Solidago* sp.

- 06103 - 12 m northwest of O6100 and O6101, on the west side of the septic field. Tag #68.
 - Medium brown sand with a few stones, covered by a thin crusty lichen layer.
 - Vegetation present: *Cerastium* sp., *Anemone* sp., *Populus balsamifera*, *Populus tremuloides*, *Epilobium angustifolium*, *Astragalus* sp., *Arctostaphylos alpina*.

- 06104 - In the northern-most manhole, northeast of the married quarters. Pieces of wire were present in the hole. Tag #69.
 - Rotten leaves, rust particles.
 - No vegetation was present in the immediate sampling area.

J. General Site Proximity

Sixteen assessment soil samples, including one field duplicate, and four plant samples were collected in the general vicinity of the airstrip facilities. One water sample from the Beaver Creek DIAND Office was collected for reference, as the plants were washed using this water.

- G6156 - Isolated black stain (2 m x 3 m) approximately 50 m northwest of the garage, and approximately 40 m west of the fire hall. There is a second stain 3 m northwest of this marker. Tag #54.
 - Compact black crusty layer over dark brown silt and organics, roots and many rocks.
 - Vegetation present: *Populus balsamifera*, *Oxytropis* sp., *Epilobium angustifolium*, species of grass.

- L6100 - A pile of debris approximately 50 m west of the fire hall, containing electrical equipment and burnt wood. Other debris present included sheet metal. Tag #55.
- Coarse sand and stones.
 - Vegetation present: *Oxytropis* sp., *Epilobium angustifolium*, *Populus balsamifera*.
- G6158 - 3m south of the south side of the married quarters in a depression below and west of a large pile of dirt which may contain buried debris. A wooden door was present amongst the debris. Rabbits were seen in the area. Tag #57.
- Silty soil, some organics, roots and a few rocks.
 - Vegetation present: *Shepherdia* sp., *Epilobium angustifolium*, *Arctostaphylos alpina*, *Potentilla* sp., *Oxytropis* sp., *Lupinus* sp., *Astragalus* sp.
- G6159 - North of a small shack/shed near a barrel pile area at the northwest end of the site. Wood debris and mechanical parts were present in the area. Tag #70.
- Organic dark brown soil with some sand.
 - Vegetation present (sparse): *Populus balsamifera*, *Lupinus* sp., species of grass.
- G6169 - A series of stains at the crossroads to the barrel dump area northwest of the main site. Burnt wood and tin cans. Tag #79.
- Strong hydrocarbon odour. Black stained sand and gravel.
 - Vegetation present: very sparse: *Epilobium angustifolium*, *Lupinus* sp., *Linnaea* sp., *Populus balsamifera*, *Solidago* sp.
- G6177 - Possible site of fuel tanks northwest of the powerhouse foundation and approximately 70 m west of Snag Road. This is a rectangular area with low vegetation density. Tag #86.
- Coarse medium brown sand and gravel.
 - Vegetation present (sparse): *Populus balsamifera*, *Oxytropis* sp.

- G6178 - Approximately 70 m from Snag Road, west of the powerhouse foundation, the second open area from the north. Grouse droppings were present in the sampling area. Tag #91.
- Coarse sand and gravel.
 - Vegetation present: very sparse growth: *Aster* sp., *Epilobium angustifolium*, *Potentilla* sp., *Arnica* sp.
- G6179 - In an open area approximately 25 m northwest of the fire hall, the third open area from the north. Tag #92.
- Rocks, roots, organics and gravel with a layer of leaves covering.
 - *Salix brachycarpa* was sampled.
 - Other vegetation present (more abundant than at the previous sample location): *Epilobium angustifolium*, *Shepherdia* sp., *Oxytropis* sp., *Solidago* sp., *Potentilla* sp.
- G6180 - Approximately 25 m northwest of the west end of the garage in a large open area of low vegetation, 1 m northwest of the samples taken off the west end of the garage. Tag #94.
- Sticky orange-brown silt under a moss layer.
 - Vegetation present (sparse): *Populus balsamifera*, *Lupinus* sp., *Potentilla* sp., *Salix* sp., *Epilobium angustifolium*.
- G6181 - On the north side of the airstrip apron in a red stain approximately 6 m west of a pile of boards and 150 m east of the tower building. The affected area is 10 m x 10 m x 5 cm. Some wood debris was present in the sampling area. Tag #96.
- Red-coloured sand and gravel.
 - *Populus balsamifera* was sampled.
 - Vegetation present (sparse): *Populus balsamifera*, *Achillea* sp., species of moss.
- G6182 - On the south side of the airstrip apron approximately 35 m southwest of G6181 and approximately halfway between the airstrip and the tower building. Possible location of the bowser tanks. Tag #97.
- A layer of lichen over silty gravel.
 - Vegetation present (sparse): *Oxytropis* sp., *Populus balsamifera*, *Epilobium angustifolium*, *Shepherdia* sp., *Potentilla* sp.

- G6183A - Approximately 20 m south of the road over the airstrip apron and approximately 100 m southeast of the tower building, a second possible location of the bowser tanks. Tag #98.
- Silt and gravel with rocks.
 - Vegetation present (sparse): *Populus balsamifera*, *Potentilla* sp., *Oxytropis* sp.
- G6183B - Field duplicate of G6183A.
- G6184 - A small burn spot 3 m east of the road to Snag Village, just past the Y in the road and off the area where the DOT barracks building was located. There was a guy wire for a pole approximately 2 m away. Tag #99.
- Slightly black surface over dark brown sand, gravel and rocks. A smell of ash.
 - *Salix bebbiana* was sampled.
 - Other Vegetation present (sparse): *Epilobium angustifolium*, *Arctostaphylos alpina*.
- G6195 - A pile of debris at the north end of the airstrip in thick bush. Debris included pallets and orange-coloured bags and powder. Tag #116.
- Organics containing paint.
 - Vegetation present: *Mertensia* sp., *Epilobium angustifolium*, *Achillea* sp., *Potentilla* sp., *Cerastium* sp., species of grass.
- G6196 - On the north side of the road to the airstrip across from the tower building and below a large chunk of painted wall removed from the tower building. 5 m east of 1994 Tag #45 (sample SN048). Evidence of bears, cranes and hares in the area. Tag #105.
- Dark brown silt with some roots, covered by a thin layer of lichen.
 - Vegetation present (very sparse): *Populus balsamifera*, *Oxytropis* sp., *Solidago* sp.
- WP6100 - Potable water from the Beaver Creek DIAND office (tap over the laundry tub in the workshop).

K. Beacon Site

The beacon site is located north of the airstrip approximately 7 km. The site consists of the remains of a single burnt-down building and downed radar towers. Eight assessment soil samples, including one field duplicate, and two plant samples were collected at the beacon site. Paint chips were collected from the pile of wood constituting the downed radar towers.

- G6186A - A burn pile and stain where the building would have stood, 2m from some large metal electrical cabinets. Debris included painted wood, burnt wood, rusty metal pipes and rusty nails. Fireweed (*Epilobium angustifolium*) in the area looks stressed. Tag #109.
 - A 2 cm layer of dark ash and particulates over sand and gravel, over 1 cm of light brown sand, over orange sand.
 - Vegetation present (sparse): *Shepherdia* sp., *Populus tremuloides*, *Arctostaphylos alpina*, *Oxytropis* sp., *Epilobium angustifolium*.

- G6186B - Field duplicate of G6185A.

- G6187 - 4 m southeast of G6186 immediately adjacent to the metal cabinets. Debris including an electrical panel, metal-coated wire, rusty metal can and nails was present in the area. Tag #110.
 - A lichen layer 1 cm thick over 1.5 cm of coarse orange sand, over dark brown sand.
 - *Shepherdia canadensis* was sampled.
 - Other vegetation present: *Salix* spp., *Picea glauca*, *Populus balsamifera*.

- G6188 - 10 m south of G6187. A bare area southeast of the area formerly occupied by the building, at the top of what appears to be a drainage path away from the building area to the south. Glass, burnt wood and other wood debris were present in the area. Tag #111.
 - Crusty lichen over crumbly, moist brown silt with some rocks.
 - Vegetation present: *Shepherdia* sp., *Epilobium angustifolium*, *Arctostaphylos alpina*, *Fragaria* sp., *Betula occidentalis*, *Linnaea* sp., *Achillea* sp., *Antennaria* sp.

- G6189 - 4 m south of G6188 in the same drainage which runs to the south. Shattered debris was present in the area and included a ceramic tile and a 30 cm x 15 cm electrical box. Tag #112.
- Dark brown silt covered by a thin layer of lichen.
 - Vegetation present: *Betula occidentalis*, *Shepherdia* sp., *Epilobium angustifolium*, *Picea glauca*, *Taraxacum* sp., *Antennaria* sp., *Arctostaphylos alpina*, *Salix* sp., *Populus balsamifera*.
- G6190 - 10 m south of G6189 at the base of the same drainage, 3 m northeast of a barrel (there are 3 in the area). Tag #113.
- Dark brown silt.
 - Vegetation present (sparse): *Linnaea* sp., *Epilobium angustifolium*, *Shepherdia* sp., *Fragaria* sp., *Populus balsamifera*, *Antennaria* sp., *Betula occidentalis*
- G6191 - 8 m east of a pole that may have borne a transformer, and 15 m west of G6190, in an open unvegetated area. Debris in the area included a beer bottle. There was evidence of grizzly bear, moose, and grouse frequenting the area. Tag #114.
- Dark brown silt covered with a layer of white lichen.
 - Vegetation present (some plants look stressed): *Arctostaphylos alpina*, *Epilobium angustifolium*, *Populus balsamifera*, *Shepherdia* sp., *Antennaria* sp., *Trisetum* sp., *Fragaria* sp., *Linnaea* sp.
- G6192 - Light brown potential stain approximately 15 m x 4 m and approximately 30 m north of the building remains. Tag #115.
- Dark brown silt.
 - *Populus balsamifera* was sampled.
 - Other vegetation present: *Alnus* sp., *Salix* sp., *Picea glauca*.
- SNPC-2 - Paint chips collected from wood piled at the beacon site.

L. Vascular Plant Check List

<u>Species</u>	<u>Common Name</u>
<u>Ophioglossaceae (Adder's-Tongue Family)</u>	
<i>Botrychium lunaria</i> (L.) Sw.	Moonwort
<u>Pinaceae (Pine Family)</u>	
<i>Picea glauca</i> (Moench) Voss	White Spruce
<u>Poaceae (Grass Family)</u>	
<i>Bromus inermis</i> Leyss. ssp. <i>inermis</i>	Hungarian Brome
<i>Calamagrostis purpurascens</i> R.Br.	Reed-Bentgrass
<i>Colpodium vahlianum</i> (Liebm.) Nevski	
<i>Elymus trachycaulus</i> (Link) Gould	
var. <i>latiglume</i> (Schribn. & Sm.) Beetle	Slender Wheatgrass
<i>Festuca elatior</i> L. var. <i>elatior</i>	Meadow Fescue
<i>Festuca ovina</i> L. var. <i>saximontana</i> (Rydb.) Gl.	Sheep Fescue
<i>Festuca rubra</i> L. var. <i>arenaria</i> (Osbeck) Fries	Red Fescue
<i>Hordeum jubatum</i> L.	Squirrel-tail Grass
<i>Poa abbreviata</i> R.Br.	Bluegrass
<i>Poa glauca</i> Vahl. ssp. <i>glauca</i>	Glaucous Bluegrass
<i>Poa palustris</i> L.	Fowl Meadow-Grass
<i>Poa pseudoabbreviata</i> Roshev.	Bluegrass
<i>Trisetum spicatum</i> (L.) Richt.	
<u>Cyperaceae (Sedge Family)</u>	
<i>Carex aquatilis</i> Wahlenb.	
<i>Carex membranacea</i> Hook.	
<i>Carex physocarpa</i> Presl	
<u>Liliaceae (Lily Family)</u>	
<i>Zygadenus elegans</i> Pursh	Mountain Death Camas

<u>Species</u>	<u>Common Name</u>
<u>Iridaceae (Iris Family)</u>	
<i>Sisyrinchium montanum</i> Greene	Blue-Eyed Grass
<u>Salicaceae (Willow Family)</u>	
<i>Populus balsamifera</i> L.	Balsam Poplar
<i>Populus tremuloides</i> Michx.	Trembling Aspen
<i>Salix alaxensis</i> (Anderss.) Cov.	Felt-leaved Willow
<i>Salix arbusculoides</i> Anderss.	Willow
<i>Salix barclayi</i> Anderss.	Barclay's Willow
<i>Salix barrattiana</i> Hook. var. <i>marcescens</i> Raup	Barratt's Willow
<i>Salix bebbiana</i> Sarg.	Bebb's Willow
<i>Salix brachycarpa</i> Nutt.	Willow
<i>Salix exigua</i> Nutt.	Sandbar Willow
<i>Salix glauca</i> L.	Bluegreen Willow
<i>Salix myricoides</i> Muhl.	Blue-leaved Willow
<i>Salix myrtilifolia</i> Anderss.	Willow
<i>Salix richardsonii</i> Hook.	Richardson's Willow
<u>Betulaceae (Birch Family)</u>	
<i>Betula glandulosa</i> Michx.	Ground/Dwarf Birch
<i>Betula occidentalis</i> Hook.	Black/Red/Mountain Birch
<u>Caryophyllaceae (Pink Family)</u>	
<i>Cerastium</i> sp.	Chickweed
<i>Stellaria humifusa</i> Rottb.	Chickweed
<u>Ranunculaceae (Crowfoot Family)</u>	
<i>Anemone patens</i> L.	Pasque-flower
<u>Saxifragaceae (Saxifrage Family)</u>	
<i>Saxifraga tricuspidata</i> L.	Prickly Saxifrage

<u>Species</u>	<u>Common Name</u>
<u>Rosaceae (Rose Family)</u>	
<i>Chamaerhodos erecta</i> (L.) Bunge	Chamaerhodos
<i>Dryas drummondii</i> Richards.	Drummond's Mountain Avens
<i>Dryas integrifolia</i> M. Vahl	Mountain Avens
<i>Fragaria virginiana</i> Duchesne	Strawberry
<i>Potentilla egedii</i> Wormsk.	Cinquefoil
<i>Potentilla fruticosa</i> L.	Shrubby Cinquefoil
<i>Potentilla pensylvanica</i> L.	Cinquefoil
<i>Rosa acicularis</i> Lindl.	Prickly Rose
<i>Rubus arcticus</i> L.	Raspberry
<u>Fabaceae (Legume Family)</u>	
<i>Astragalus alpinus</i> L.	Alpine Milk Vetch
<i>Hedysarum alpinum</i> L.	Licorice Root
<i>Oxytropis campestris</i> (L.) DC.	Stemless Locoweed
<u>Empetraceae (Crowberry Family)</u>	
<i>Empetrum nigrum</i> L.	Crowberry
<u>Elaeagnaceae (Oleaster Family)</u>	
<i>Elaeagnus commutata</i> Bernh.	Silverberry
<u>Onagraceae (Primrose Family)</u>	
<i>Epilobium angustifolium</i> L.	Fireweed
<i>Epilobium latifolium</i> L.	Broad-leaved Willow-herb
<u>Pyrolaceae (Wintergreen Family)</u>	
<i>Pyrola grandiflora</i> Radius	Large-Flowered Wintergreen

<u>Species</u>	<u>Common Name</u>
<u>Ericaceae (Heath Family)</u>	
<i>Arctostaphylos alpina</i> (L.) Spreng.	Alpine Bear Berry
<i>Arctostaphylos uva-ursi</i> (L.) Spreng.	Common Bearberry
<i>Ledum decumbens</i> (Ait.) Lodd.	Labrador Tea
<i>Vaccinium uliginosum</i> L. s. lat.	Bilberry
<i>Vaccinium vitis-idaea</i> L.	Mountain Cranberry
<u>Primulaceae (Primrose Family)</u>	
<i>Androsace septentrionalis</i> L.	Fairy Candelabra
<u>Polemoniaceae (Polemonium Family)</u>	
<i>Phlox richardsonii</i> Hook.	Richardson's Phlox
<i>Polemonium caeruleum</i> L.	Tall Jacob's Ladder
<u>Boraginaceae (Borage Family)</u>	
<i>Mertensia paniculata</i> (Ait.) G. Don	Tall Lungwort
<u>Caprifoliaceae (Honeysuckle Family)</u>	
<i>Linnaea borealis</i> L.	Twinflower
<u>Campanulaceae (Bluebell Family)</u>	
<i>Campanula aurita</i> Greene	Bellflower
<u>Asteraceae (Aster Family)</u>	
<i>Achillea millefolium</i> L.	Common Yarrow
<i>Antennaria rosea</i> (Eat.) Greene	Pink Pussy-Toes
<i>Arnica cordifolia</i> Hook.	Heart-leaved Arnica
<i>Artemisia frigida</i> Willd.	Wormwood
<i>Aster sibericus</i> L. var. <i>sibericus</i>	Siberian Aster
<i>Petasites frigidus</i> (L.) Fries	Sweet Coltsfoot
<i>Solidago decumbens</i> Greene	Dune Goldenrod
<i>Taraxacum lacinum</i> Greene	Dandelion

M. Record Of Bird and Wildlife Observations

1. Birds

Species	Common Name	Number Observed
<i>Corvus corax</i>	Raven	>10
<i>Cyanocitta stelleri</i>	Steller's Jay	>10
<i>Perisoreus canadensis</i>	Gray Jay	5

2. Mammals

Species	Common Name	Number Observed
<i>Alces alces</i>	Moose	3
<i>Ursus americanus</i>	Black Bear	1, tracks, droppings
<i>Ursus horribilis</i>	Grizzly Bear	tracks, droppings
<i>Lepus americanus</i>	Snowshoe Hare	1, many droppings
<i>Erethizon dorsatum</i>	Porcupine	quills

Table VI-31: Inorganic Element Results for Soil for Each Area of the Site

Sample	Tag #	Cu	Ni	Co	Cd	Pb	Zn	Cr	As	Location
ppm (ug/g)										
<i>1. Background</i>										
SN127	No Tag	17	<5.0	6.6	<1.0	<10	59	<20	2.4	2 km from Aishihik Airstrip
SN128	No Tag									5 km from Aishihik Airstrip
SN129	No Tag	17	15	12	<1.0	<10	64	59	12	13 km from Aishihik Airstrip
SN130	No Tag	13	11	7.7	<1.0	<10	84	40	11	13 km from Aishihik Airstrip
SN158	No Tag	12	9.3	5.9	<1.0	<10	40	<20	1.9	Creek sediment 15 km S of Aishihik Airstrip
G6175	No Tag	14	7.5	<5.0	<1.0	<10	59	<20	1.8	75 m SE of Snag Rd. mile 19
G6176	No Tag	16	7.5	<5.0	<1.0	<10	13	<20	0.94	35 m SE of Snag Rd. mile 19
G6193A	No Tag	39	25	9.4	<1.0	<10	85	39	3.2	~ 10 km N of Snag Airstrip
G6193B	No Tag	42	25	10	<1.0	<10	81	44	3.6	Field duplicate of G6193A
G6194	No Tag	39	30	13	<1.0	<10	87	61	5.1	In river bed ~5 km NE of Snag Airstrip
Mean (n=10)		23	15	7.8	0.5	5	64	31	4.7	
Std Dev		13	9.6	3.8	0	0	25	22	4.1	
Minimum		12	<5.0	<5.0	<1.0	<10	12.8	<20	0.94	
Maximum		42	30	13	<1.0	<10	87	61	12	
<i>2. Tower Building</i>										
G6100	1	120	27	12	2.3	6300	3200	84	3.8	S side of tower building below doorway
G6101A	2	87	33	15	<1.0	640	280	45	5.1	2.5 m SW of SW corner of tower building
G6101B	2	93	39	12	<1.0	640	270	56	6.3	Field duplicate of G6101A
G6102	3	37	28	12	<1.0	67	190	42	4.7	In hole 5 m W of W end of tower building
G6103	4	40	33	14	<1.0	660	380	65	5.7	~2 m NW of NW corner of tower building
G6104A	5	31	27	15	1.3	2060	1800	46	5.3	1.5 m N of N side of tower building, at doorway
G6104B	5	34	26	14	<1.0	329	580	56	6.5	Field duplicate of G6104A
G6105	6	76	32	15	<1.0	660	390	45	5.4	~ 3 m NE of NE corner of tower building
G6106	7	52	47	15	<1.0	340	250	48	6.1	3m E of E side of tower building
G6107	8	38	28	14	<1.0	61	110	47	5.4	~ 6 m N of G6103, ~8 m from NW end of tower building
G6108	9	41	31	13	<1.0	370	250	67	8.9	~2.5 m SE of SE corner of tower building
G6109	10	186	55	22	46	640	16000	38	25	Burn pile ~13 m S of S side of tower building
G6110	11	45	23	13	<1.0	<10	160	35	4.2	Large hole ~ 30 m W of W side of tower building
Mean (n=13)		68	33	14	4.2	980	1900	52	7.1	
Std Dev		45	9.1	2.6	12.6	1700	4500	14	5.5	
Minimum		31	23	12	<1.0	<10	110	35	3.8	
Maximum		190	55	22	46	6300	16000	84	25	
<i>3. DOT Barracks Building</i>										
G6111	12	33	29	11	<1.0	34	100	42	4.0	N end of foundations
G6112	13									Depression ~ 4 m S of G6111
G6113	14									Depression ~ 7 m S of G6112
G6114	15	43	39	15	<1.0	320	470	53	12	Depression between 3rd & 4th S-most concrete supports
G6115	16	39	24	13	<1.0	20	140	45	3.3	Pile of soil & debris ~ 5 m NW of chimney
G6116	17	40	227	23	1.5	130	480	160	4.0	~ 3 m W of chimney

1. <=Less than the detection limit indicated

Table VI-31: Inorganic Element Results for Soil for Each Area of the Site (cont'd)

Sample	Tag #	Cu	Ni	Co	Cd	Pb	Zn	Cr	As	Location
ppm (ug/g)										
<i>3. DOT Barracks (cont)</i>										
G6117A	18	93	30	12	<1.0	400	820	64	5.8	~ 3 m S of G6116
G6117B	18	80	32	15	<1.0	3900	700	59	30	Field duplicate of G6117A
G6118	19	39	27	16	<1.0	1100	660	85	4.2	Depression ~ 4 m S of S end of foundation
G6119A	20	42	81	22	<1.0	1100	2500	170	4.1	S end of barracks basement
G6119B	20	130	57	18	2	1100	2600	140	4.7	Field duplicate of G6119A
G6120	21	34	30	13	<1.0	210	620	89	4.7	~ 1 m E of E side of foundation
Mean (n=12)		58	58	16	0.75	840	900	91	7.7	
Std Dev		33	62	4.0	0.54	1200	880	49	8.2	
Minimum		33	24	11	<1.0	20	100	42	3.3	
Maximum		130	230	23	2.0	3900	2600	170	30	
<i>4. Warehouse</i>										
G6121	22	3200	24	12	1.8	32000	3200	46	13	Stain midway along S side of foundation
G6122	23	210	33	15	1.2	1300	290	47	7.8	1.5 m W of base of bay door
G6123	24	280	31	15	<1.0	4300	350	64	6.8	~ 0.3 m S of stairs on E side of foundation
G6124	25	860	30	14	<1.0	28000	1300	64	4.3	Midway along N side of foundation
G6125A	26	57	33	13	<1.0	63	61	47	5.7	In pile of transformer plates SE of foundation
G6125B	26	67	32	15	<1.0	71	83	59	5.1	Field duplicate of G6125A
G6126	27	410	28	15	1.7	5000	1100	266	6.8	N side of orange platform at E end of foundation
Mean (n=7)		720	30	14	0.96	10000	900	85	7.1	
Std Dev		1100	3.2	1.3	0.6	14000	1100	80	2.9	
Minimum		57	24	12	<1.0	63	61	46	4.3	
Maximum		3200	33	15	1.8	32000	3200	270	13	
<i>5. Powerhouse and Pump House</i>										
G6127	28	51	29	14	<1.0	150	300	50	2	1 m off NW corner of powerhouse foundation
G6128A	29	90	32	14	<1.0	150	410	65	4.6	1 m SW of chimney base W side of powerhouse
G6128B	29	81	33	16	<1.0	160	420	66	5.3	Field duplicate of G6128A
G6129	30	73	31	17	<1.0	55	140	66	5.7	1 m E of triangular pipe cover
G6130	31	340	28	19	12.8	1800	2000	140	4.2	W side of oil drainage pit in generator pad
G6131	32	47	34	17	<1.0	61	200	72	6.9	1 m off SW corner of powerhouse foundation
G6132	33	56	38	19	<1.0	67	180	61	5.5	S of powerhouse foundation, ~ 4 m E of G6131
G6133	34	680	41	23	8.3	1700	3000	460	21	Sludge from pit in centre of generator pad
G6134	35	450	27	22	7.8	1400	2600	320	4.2	Composite: N side of pit around generator pad
G6135	36	110	33	16	1.1	240	430	78	3.2	W of bay door concrete pad, N side of foundation
G6136	37	56	24	13	1.1	270	500	54	3.6	N of bay door concrete pad, N side of foundation
G6137	38	65	45	17	<1.0	190	130	99	5.1	Midway along S side of powerhouse foundation
G6138	39	72	27	12	1.1	260	350	60	3.6	~ 1 m NE of NE corner of the bay door entrance pad
G6139	40	110	28	14	<1.0	262	330	88	4.2	1 m NE of NE corner of powerhouse foundation
G6140A	41	74	124	24	2.9	820	1900	180	3.7	0.5 m E of E side of powerhouse foundation
G6140B	41	64	118	23	2.2	900	1600	190	2.7	Field duplicate of G6140A
G6141	42	57	87	22	<1.0	240	840	100	4.4	~ 5 m from the SE corner of powerhouse foundation
G6142	43	38	40	19	<1.0	250	200	92	3.9	SE side of powerhouse foundation, 1 m E of doorway

1. <=Less than the detection limit indicated

Table VI-31: Inorganic Element Results for Soil for Each Area of the Site (cont'd)

Sample	Tag #	Cu	Ni	Co	Cd	Pb	Zn	Cr	As	Location
ppm (ug/g)										
<i>5. Powerhouse and Pump House (cont'd)</i>										
G6143	44	48	31	17	<1.0	160	280	60	4.8	1 m S of SE corner of powerhouse foundation
G6144	No Tag									Composite:debris from N half of powerhouse foundation
G6145	No Tag	290	31	18	3.7	840	640	67	3.4	Composite: debris from S half of powerhouse foundation
G6146	45	34	46	23	<1.0	55	270	220	4.2	Stain ~ 13 m N of NW corner of powerhouse foundation
G6147	46	30	24	18	<1.0	<10	52	50	2.9	Burn pile 30 m S of SW corner of powerhouse
G6170	80	47	29	14	<1.0	180	190	71	3.1	Depression ~ 5 m SE of the pump house foundation
G6171	81	54	28	15	<1.0	34	160	62	5.2	1 m S of previous location of pump house door
G6172	82	130	33	17	<1.0	180	310	77	7.8	At top of stairs leading E away from pump house door
G6173	83									1 m E of and midway along pump house foundation
G6174	84	38	23	11	<1.0	48	200	63	4.1	1.5 m S of cistern of pump house
G6185	121	240	40	16	<1.0	140	440	67	5.8	Stain 8 m E of E side of powerhouse foundation
Mean (n=27)		130	41	17	1.9	390	660	110	5.0	
Std Dev		150	26	3.6	3.0	520	800	94	3.4	
Minimum		30	23	11	<1.0	<10	52	50	2.0	
Maximum		680	124	24	13.0	1800	3000	460	21	
<i>6. Fire Hall</i>										
G6148	47									2 m W of W corner of the fire hall
G6149A	48	28	27	17	<1.0	<10	50	55	2.7	1.5 m SW of S corner of fire hall
G6149B	48	30	32	17	<1.0	<10	45	52	2.9	Field duplicate of G6149A
G6150	49	40	32	13	<1.0	33	100	43	2.7	Stain midway along fire hall S wall
G6151	50	30	31	15	<1.0	<10	47	51	3.6	1.5 m NE of E wall and large door of fire hall
G6152	51	55	42	12	<1.0	460	960	100	4.4	Stain ~12 m E of fire hall front
Mean (n=6)		37	33	15	0.5	100	240	60	3.3	
Std Dev		11	5.5	2.1	0.0	200	400	23	0.74	
Minimum		28	27	12	<1.0	<10	45	43	2.7	
Maximum		55	42	17	<1.0	460	960	100	4.4	
<i>7. Garage</i>										
G6153	No Tag	140	17	31	5.2	2500	3100	120	16	Composite of debris in bottom of oil change pit
G6154	52	86	27	9.0	2.4	380	340	88	4.6	Stain ~ 20 m SE of N corner of garage foundation
G6155	53	46	40	21	<1.0	<10	100	82	8.5	Unvegetated area S of garage foundation
G6157	56	110	120	7.5	<1.0	1700	1600	110	4.4	Burn pile 10 m N of garage foundation
G6160	71	99	27	16	1.5	360	1300	81	5.5	2 m E of and midway along E side of garage foundation
G6161	72	63	28	16	<1.0	260	240	67	4.0	~ 1 m E of garage foundation, 2 m N of SE corner
G6162	73	51	29	15	<1.0	100	120	66	7.7	~ 2 m NW of SW corner of garage foundation
G6163	74	54	31	16	<1.0	54	100	59	19	50 m W of G6162 on W side of garage foundation
G6164	75	62	49	22	2.2	640	3300	75	29	Midway along W side of garage foundation
G6165	No Tag	410	95	26	19	3300	8000	900	10	Debris from pit on W side of garage foundation
G6166A	76	27	23	15	<1.0	15	93	52	6.7	~ 5 m SE of NW corner of garage foundation
G6166B	76	28	22	13	<1.0	18	93	44	7.1	Field duplicate of G6166A

1. <=Less than the detection limit indicated

Table VI-31: Inorganic Element Results for Soil for Each Area of the Site (cont'd)

Sample	Tag #	Cu	Ni	Co	Cd	Pb	Zn	Cr	As	Location
ppm (ug/g)										
<i>7. Garage (cont'd)</i>										
G6167	77	140	63	20	<1.0	980	1500	160	8.9	1 m N of N end of garage foundation
G6168	78	52	27	16	<1.0	210	280	62	8.5	Stain ~ 2 m NW of N corner of garage foundation
Mean (n=14)		98	43	17	2.5	760	1400	140	10.0	
Std Dev		97	31	6.2	4.9	1000	2200	220	6.9	
Minimum		27	17	7.5	<1.0	<10	93	44	4.0	
Maximum		410	120	31	19.0	3300	8000	900	29	
<i>8. Dump</i>										
L6101	58	54	37	17	<1.0	130	210	82	8.7	~ 0.5 m off the SW toe of the worked area
L6102	59	57	37	17	<1.0	140	210	62	6	8 m E of L6101, 1 m from edge of worked area
L6103A	60	58	39	18	<1.0	81	250	60	9.4	6 m SE of L6102, 1 m from edge of worked area
L6103B	60	51	35	17	<1.0	50	180	56	8	Field duplicate of L6103A
L6104	61									2 m E of E side of worked area
L6105	62	71	35	17	<1.0	76	420	54	8.4	Depression ~ 3 m S of SE side of dump toe
L6106	63									Depression ~ 7 m SE of SE toe of worked area
L6107	64									2 m E of E side of worked area
L6108	100									At toe of dump toe, 5 m S of L6102
L6109	101	40	37	15	<1.0	20	150	58	12	Depression 5 m S of L6103, 3 m W of L6110
L6110	102	49	37	15	<1.0	16	160	64	10	Depression 3 m E of L6109
L6110-D	102	76	28	13	<1.0	21	64	47	9.7	Subsurface sample collected at L6110
Mean (n=12)		57	36	16	0.5	66	200	60	9.1	
Std Dev		12	3.3	1.6	0.0	48	100	10	1.8	
Minimum		40	28	13	0.5	16	64	47	6.0	
Maximum		76	39	18	0.5	140	420	82	12	
<i>9. Septic Field</i>										
O6100	65	38	30	15	<1.0	<10	110	55	7.4	~ 50 m N of married quarters, S end of septic field
O6101A	66	40	44	19	<1.0	<10	110	63	3.9	12 m N of O6100
O6101B	66	36	35	16	<1.0	<10	96	65	7.3	Field duplicate of O6101A
O6102	67	42	33	17	<1.0	<10	82	63	4.2	12 m N of O6101
O6103	68	34	39	21	<1.0	<10	79	79	11	12 m NW of O6100, on W side of septic field
O6104	69	350	53	17	1.5	50	800	56	33	In N-most concrete manhole N of married quarters
Mean (n=6)		90	39	18	0.67	13	210	64	11.0	
Std Dev		130	8.4	2.0	0.4	18	290	8.6	11	
Minimum		34	30	15	<1.0	<10	79	55	3.9	
Maximum		350	53	21	1.5	50	800	79	33	
<i>10. General Site Proximity</i>										
G6156	54	34	29	12	<1.0	<10	400	48	6	Stain ~ 50 m SW of garage, ~ 40 m S of fire hall
L6100	55	37	25	12	<1.0	<10	81	49	3.7	Pile of partially covered debris ~ 50 m S of fire hall
G6158	57	35	30	17	<1.0	85	220	56	7.8	Depression beside pile of debris S side of married quarters

1. <= Less than the detection limit indicated

Table VI-31: Inorganic Element Results for Soil for Each Area of the Site (cont'd)

Sample	Tag #	Cu	Ni	Co	Cd	Pb	Zn	Cr	As	Location
ppm (ug/g)										
<i>10. General Site Porximity (cont'd)</i>										
G6159	70	38	16	14	1.1	24	3.5	41	4.8	Collapsed storage shack W ~ 150 m of powerhouse
G6169	79	45	31	16	<1.0	<10	290	95	6.3	Composite of black stains on road to storage shack
G6177	86									Open area NW of powerhouse, ~ 70 m W of Snag Rd.
G6178	91	39	38	17	<1.0	<10	63	65	7.7	2nd open area from the N, NW of powerhouse
G6179	92	47	32	17	<1.0	11	94	65	6.5	3rd open area from the N, ~ 65 m W of fire hall
G6180	94									4th open area from the N, 25 m W of SW end of garage
G6181	96	38	33	14	<1.0	<10	71	55	5.2	Red stain ~ 6 m W of board pile, N side of airstrip apron
G6182	97	35	39	19	<1.0	<10	68	71	8.8	S side of apron between airstrip and tower building
G6183A	98	38	45	17	<1.0	<10	60	62	8.4	~20 m S of road over airstrip ~ 100 m E of tower building
G6183B	98	35	43	14	<1.0	<10	74	65	9.1	Field duplicate of G6183A
G6184	99	35	30	13	<1.0	<10	130	50	7.1	Burn stain 3 m N of split in Snag Rd. near DOT barracks
G6195	120	64	30	8.7	1.6	<10	300	76	13	Pile of debris in thick bushes at N end of airstrip
G6196	100	47	45	19	<1.0	31	71	98	10	Below debris N of tower building
Mean (n=16)		41	33	15	0.62	14	140	64	7.5	
Std Dev		8.1	8	2.9	0.3	22	120	17	2.4	
Minimum		34	16	8.7	<1.0	<10	3.5	41	3.7	
Maximum		64	45	19	1.6	85	400	98	13	
<i>11. Beacon Site</i>										
G6186A	109	410	140	26	<1.0	332	2200	150	83	Burn stain located where building previously stood
G6186B	109	260	150	27	<1.0	360	1500	160	79	Field duplicate of G6185A
G6187	110	320	56	19	<1.0	280	1100	110	14	4 m SE of G6185, immed. adjacent electrical cabinet
G6188	111	32	41	16	<1.0	<10	77	60	5.1	Drainage path 10 m SE of G6187,
G6189	112									4 m S of G6188 in same drainage
G6190	113									10 m S of G6189, at base of same drainage
G6191	114	24	21	12	<1.0	9.9	60	55	5.1	15 m W of G6190
G6192	115	47	34	17	<1.0	32	91	77	3.6	Stain ~ 30 m N of building remains
Mean (n=8)		180	73	20	0.5	170	840	100	32	
Std Dev		170	55	5.8	0	170	920	46	38	
Minimum		24	21	12	<1.0	<10	60	55	3.6	
Maximum		410	150	27	0.5	360	2200	160	83	

1. <=Less than the detection limit indicated

(Table continues)

Table VI-31: Inorganic Element Results for Soil for Each Area of the Site (cont'd)

Sample	Tag #	Cu	Ni	Co	Cd	Pb	Zn	Cr	As	Location
ppm (ug/g)										
<i>12. 1994 Data</i>										
SN 043	46	87	32	14	1.2	20	250	78	4.5	~ 2 m from S side of garage foundations
SN 044	47	13	12	14	2.5	430	410	39	0.2	In middle of DOT barracks
SN 045	47	20	14	11	1.5	340	310	32	0.8	Field duplicate of SN044
SN 046	39	5800	24	13	<1.0	24000	360	41	2.9	~ 10 m from E end of warehouse foundation
SN 047	33	71	46	23	<1.0	290	320	59	3.4	E side of powerhouse, ~ 8 m from road
SN 048	45	53	43	28	<1.0	340	99	90	5.2	Base of pole (chopped down), ~8 m N tower building
SN 049		220	420	61	<1.0	640	2100	710	3.4	In pump house basement
SN 050	42	36	33	15	<1.0	120	560	68	4.5	Large black stain in barrel cache, W side of site
SN 051	43	14	42	19	<1.0	44	150	81	5.9	In barrel cache, W side of site
Mean (n=8)		700	74	22	0.91	3000	500	130	3.4	
Std Dev		1900	130	16	0.7	8000	620	220	1.9	
Minimum		13	12	11	<1.0	44	99	32	0.2	
Maximum		5800	420	61	2.5	24000	2100	720	5.9	

1. <=Less than the detection limit indicated

Table VI-32: Aroclor PCB Results for Soil for Each Area of the Site

Sample	Tag	Aroclor 1242	Aroclor 1254 ppb (ng/g)	Aroclor 1260	Aroclor Total	Location
<i>1. Backgrounds</i>						
SN127	No Tag	0.49	<0.10	<0.04	0.50	2 km from Aishihik Airstrip
SN128	No Tag	0.56	0.17	0.16	0.90	5 km from Aishihik Airstrip
SN129A	No Tag	<0.62	<0.19	<0.03		13 km from Aishihik Airstrip
SN129B	No Tag	<0.52	<0.54	<0.31		13 km from Aishihik Airstrip
SN158	No Tag	0.34	0.54	0.36	1.2	Creek sediment 15 km S of Aishihik Airstrip
G6175	No Tag	NDR(0.57)	<0.30	<0.59	0.60	75 m SE of Snag Rd. mile 19
G6176	No Tag	<0.52	NDR(1.2)	<0.29	1.2	35 m SE of Snag Rd. mile 19
G6193A	No Tag	NDR(0.30)	<0.25	<0.14	0.30	~ 10 km N of the airstrip
G6193B	No Tag	<0.13	NDR(0.36)	<0.16	0.40	Field duplicate of G6193A
G6194	No Tag	<0.06	<0.12	<0.10		In river bed ~5 km NE of the airstrip
Mean (n=10)					0.60	
Std Dev					0.40	
Minimum					<0.28	
Maximum					1.2	
<i>2. Tower Building</i>						
G6100	1	<14	140	180	320	S side of tower building below doorway
G6101A	2	<0.94	9.3	7.2	17	2.5 m SW of SW corner of tower building
G6101B	2	<0.91	1.7	5.5	7.2	Field duplicate of G6101A
G6102	3	<31	<28	26	26	In hole 5 m W of W end of tower building
G6103	4	<2.1	260	100	360	~2 m NW of NW corner of tower building
G6104A	5	<230	7400	1700	9100	1.5 m N of N side of tower building, at doorway
G6104B	5	<310	5000	1200	6200	Field duplicate of G6104A
G6105	6	<110	<170	<34		~ 3 m NE of NE corner of tower building
G6106	7					3m E of E side of tower building
G6107	8	<15	82	47	130	~ 6 m N of G6103, ~8 m from NW end of tower building
G6108	9	<23	30	14	44	~ 2.5 m SE of SE corner of tower building
G6109	10	<21	115	28	140	Burn pile ~13 m S of S side of tower building
G6110	11	<1.1	<2.1	1.5	1.5	Large hole ~ 30 m W of W side of tower building
Mean (n=13)					1400	
Std Dev					3000	
Minimum					1.5	
Maximum					9100	
<i>3. DOT Barracks Building</i>						
G6111	12	<66	<71	<39		N end of foundations
G6112	13					Depression ~ 4 m S of G6111
G6113	14					Depression ~ 7 m S of G6112
G6114	15	<0.78	6.6	4.9	12	Depression between 3rd & 4th S-most concrete supports
G6115	16	<0.88	13	3.3	16	Pile of soil & debris ~ 5 m NW of chimney

<=Less than the detection limit indicated

Table VI-32: Aroclor PCB Results for Soil for Each Area of the Site (cont'd)

Sample	Tag	Aroclor 1242	Aroclor 1254 ppb (ng/g)	Aroclor 1260	Aroclor Total	Location
<i>3. DOT Barracks Building (cont'd)</i>						
G6116	17					~ 3 m W of chimney
G6117A	18	<1.2	35	5.8	41	~ 3 m S of G6116
G6117B	18	<1.2	18	3.2	18	Field duplicate of G6117A
G6118	19	NDR(3.8)	450	45	500	Depression ~ 4 m S of S end of foundations
G6119A	20	2100	320000	48000	370100	S end of DOT barracks basement
G6119B	20	3400	500000	77000	580400	Field duplicate of G6119A
G6120	21	<0.94	12	4.5	17	~ 1 m E of E side of foundation
Mean (n=12)					105700	
Std Dev					216000	
Minimum					12	
Maximum					580400	
<i>4. Warehouse</i>						
G6121	22	6.50	800	250	1100	Stain midway along S side of warehouse foundation
G6122	23	<12	490	220	710	1.5 m W of base of bay door, W side of foundation
G6123	24	<730	5200	1300	6500	~ 0.3 m S of stairs on E side of foundation
G6124	25	<5.6	1900	520	2400	~ 1 m N of & midway along N side of foundation
G6125A	26	<18	170	100	170	In pile of transformer plates SE of foundation
G6125B	26	<15	130	87	130	Field duplicate of G6125A
G6126	27	<540	<3100	<1200		N side of orange platform at E end of foundation
Mean (n=7)					1900	
Std Dev					2200	
Minimum					130	
Maximum					6500	
<i>5. Powerhouse and Pump House</i>						
G6127	28	360	76000	17000	93000	1 m off NW corner of powerhouse foundation
G6128A	29	<92	430	110	540	1 m SW of chimney base on W side of powerhouse foundation
G6128B	29	<84	570	130	700	Field duplicate of G6128A
G6129	30	<100	19000	5000	24000	1 m W of powerhouse foundation, 1 m E of triangular pipe cover
G6130	31	81	380000	67000	450000	W side of oil drainage pit surrounding generator pad
G6131	32	<35	6300	2100	8400	1 m off SW corner of powerhouse foundation
G6132	33	<20	5400	1800	7200	S of powerhouse foundation, ~ 4 m E of G6131
G6133	34	<260	160000	43000	200000	Sludge from pit in centre of generator pad
G6134	35	730	350000	68000	420000	Composite of contents of N side of pit around generator pad
G6135	36	<160	20000	4600	25000	~ 0.5 m W of bay door concrete pad, N side of foundation
G6136	37	<430	21000	3600	25000	~ 0.5 m N of bay door concrete pad, N side of foundation
G6137	38	<260	36000	7600	44000	Midway along S side of powerhouse foundation
G6138	39	<1100	57000	9900	67000	~ 1 m NE of NE corner of the bay door entrance pad
G6139	40	NDR(410)	56000	9700	66000	1 m NE of NE corner of powerhouse foundation

<=Less than the dection limit indicated

Table VI-32: Aroclor PCB Results for Soil for Each Area of the Site (cont'd)

Sample	Tag	Aroclor 1242	Aroclor 1254 ppb (ng/g)	Aroclor 1260	Aroclor Total	Location
<i>5. Powerhouse and Pump House (cont'd)</i>						
G6140A	41	280	50000	8300	59000	0.5 m E of E side of powerhouse foundation
G6140B	41	190	23000	4900	29000	Field duplicate of G6140A
G6141	42	<0.55	89	34	120	~ 5 m from the SE corner of powerhouse foundation
G6142	43	<5.0	410	130	540	SE side of powerhouse foundation, 1 m E of doorway concrete pad
G6143	44	<5.0	390	99	490	1 m S of SE corner of powerhouse foundation
G6144	No Tag	12000	3300000	700000	4012000	Composite of debris from N half of powerhouse foundation
G6145	No Tag	300	95000	22000	120000	Composite of debris from S half of powerhouse foundation
G6146	45	<100	<89	<52		Stain ~ 13 m N of NW corner of powerhouse foundation
G6147	46	<1.4	5.3	2.4	7.7	Burn pile ~ 30 m S of SW corner of powerhouse foundation
G6170	80	<100	8400	1500	9900	Depression ~ 5 m SE of the pump house foundation
G6171	81	3.7	900	280	1200	1 m S of previous location of pump house door
G6172	82	<76	7200	1600	8800	At top of stairs leading E away from pump house door
G6173	83	<68	6300	1400	7700	1 m E of and midway along pump house foundation
G6174	84	57	6300	2650	9000	1.5 m S of SW corner of cistern of pump house
G6185	121	<0.82	300	66	370	Stain 8 m E of E side of powerhouse foundation
Mean (n=29)					200000	
Std Dev					740000	
Minimum					7.7	
Maximum					4012000	
<i>6. Fire Hall</i>						
G6148	47					2 m W of W corner of the fire hall
G6149A	48	<0.88	10	1.0	11	1.5 m SW of S corner of fire hall
G6149B	48	<0.48	6.55	<2.1	6.6	Field duplicate of G6149A
G6151	50	<2.2	<5.7	10	10	1.5 m NE of E wall and large door of fire hall
G6152	51	<21	46	13	59	Stain ~12 m E of fire hall front
Mean (n=5)					22	
Std Dev					25	
Minimum					6.6	
Maximum					59	
<i>7. Garage</i>						
G6153	No Tag	9300	2400000	400000	2809300	Composite of debris etc. in bottom of oil change pit
G6154	52	<0.62	470	260	730	Stain ~ 20 m SE of N corner of garage foundation
G6155	53	<1.1	2.8	2.6	5.5	Unvegetated area S of garage foundation
G6157	56	<1.5	51	300	350	Burn pile 10 m N of garage foundation, beside garage door
G6160	71	<87	600	230	830	2 m E of and midway along E side of garage foundation
G6161	72	<4.4	810	160	970	~ 1 m E of garage foundation, 2 m N of SE corner
G6162	73	<4.6	170	190	360	~ 2 m NW of SW corner of garage foundation
G6163	74	<1.2	66	33	99	50 m W of G6162 on W side of garage foundation

<=Less than the detection limit indicated

Table VI-32: Aroclor PCB Results for Soil for Each Area of the Site (cont'd)

Sample	Tag	Aroclor 1242	Aroclor 1254 ppb (ng/g)	Aroclor 1260	Aroclor Total	Location
<i>7. Garage (cont'd)</i>						
G6164	75	<110	7500	1300	8800	Edge of cement support midway along W side of garage foundation
G6165	No Tag	5300	1100000	170000	1275300	Debris from pit on W side of garage foundation near G6164
G6166A	76	<2.5	660	170	830	~ 5 m SE of NW corner of garage foundation
G6166B	76	<0.57	900	290	1200	Field duplicate of G6166A
G6167	77	25	7000	1100	8100	1 m N of N end of garage foundation
G6168	78	12	16000	3200	19000	Stain ~ 2 m NW of N corner of garage foundation
Mean (n=14)					290000	
Std Dev					800000	
Minimum					5.5	
Maximum					2809300	
<i>8. Dump</i>						
L6101	58	<27	<18	10	10	~ 0.5 m off the SW toe of the worked area
L6102	59	<17	<14	<6.7		8 m E of L6101, 1 m from edge of worked area
L6103A	60	<0.66	19	5.6	25	6 m SE of L6102, 1 m from edge of worked area
L6103B	60	<0.55	22	7.7	30	Field duplicate of L6103A
L6104	61					2 m E of E side of worked area
L6105	62	<1.4	32	11	43	Depression ~ 3 m S of SE side of dump toe
L6106	63					Depression ~ 7 m SE of SE toe of worked area
L6107	64					2 m E of E side of worked area
L6108	100					At toe of dump, 5 m S of L6102
L6109	101					Depression 5 m S of L6103, 3 m W of L6110
L6110	102	<33	<22	<11		Depression ~ 5 m W of toe of worked area, 3 m E of L6109
L6110-D	102	<6.5	<8.4	<7.4		Subsurface sample collected at L6110
Mean (n=12)					24	
Std Dev					12	
Minimum					10	
Maximum					43	
<i>9. Septic Field</i>						
O6100	65	<27	<17	<8.5		~ 50 m N of married quarters, S end of septic field
O6101A	66	<0.41	<0.64	<0.43		12 m N of O6100
O6101B	66	<0.46	<0.49	<0.49		Field duplicate of O6101A
O6102	67					12 m N of O6101
O6103	68	<18	<14	<7.3		12 m NW of O6100, on W side of septic field
O6104	69	<88	480	190	670	In N-most manhole N of married quarters
Mean (n=6)					140	
Std Dev					290	
Minimum					<1.44	
Maximum					670	

<=Less than the dection limit indicated

Table VI-32: Aroclor PCB Results for Soil for Each Area of the Site (cont'd)

Sample	Tag	Aroclor 1242	Aroclor 1254 ppb (ng/g)	Aroclor 1260	Aroclor Total	Location
<i>10. General Site Proximity</i>						
G6156	54	<0.89	30	5.1	35	Stain ~ 50 m SW of garage foundation, ~ 40 m S of fire hall
L6100	55	<0.66	2.3	0.54	2.8	Pile of partially covered debris ~ 50 m S of fire hall
G6158	57	<1.3	<0.98	1.1	1.1	Depression beside pile of debris S side of married quarters
G6159	70	<1.4	1.7	<0.70	1.7	Collapsed storage shack W ~ 150 m of powerhouse
G6169	79	<0.66	13	1.9	15	Composite of black stains on road to storage shack
G6177	86					Open area NW of powerhouse, ~ 70 m W of Snag Rd.
G6178	91	<0.68	<0.75	<0.48		2nd open area from the N, NW of powerhouse
G6179	92	<43	<25	<12		3rd open area from the N, ~ 65 m W of fire hall
G6180	94					4th open area from the N, ~ 25 m W of SW end of the garage
G6181	96	<3.1	<3.8	<3.6		Red stain ~ 6 m W of board pile, N side of airstrip apron
G6182	97	<1.3	<0.89	<0.53		S side of apron half way between airstrip and tower building
G6183A	98	<0.61	<0.56	<0.32		~ 20 m S of road over airstrip ~ 100 m E of tower building
G6183B	98	<0.95	<0.6	<0.31		Field duplicate of G6183A
G6184	99	<1.9	NDR(4.8)	<2.3	4.8	Burn stain 3 m N of split in Snag Rd. near DOT barracks building
G6195	116	<14	<11	<6.8		Pile of debris in thick bushes at N end of airstrip
G6196	105	<0.89	<0.98	<0.62		Below debris from tower building on N side of road to airstrip
Mean (n=16)					9.1	
Std Dev					13	
Minimum					<1.49	
Maximum					35	
<i>11. Beacon Site</i>						
G6186A	109	<2.6	<3.4	<2.7		Burn stain located where building previously stood
G6186B	109	<0.81	2.0	1.3	3.3	Field duplicate of G6185A
G6187	110	<34	<25	<13		4 m SE of G6185, immed. adjacent electrical cabinet
G6188	111	<0.86	<0.87	0.66	1.5	Drainage path running SE of building remains, 10 m SE of G6187,
G6189	112					4 m S of G6188 in same drainage
G6190	113					10 m S of G6189, at base of same drainage
G6191	114	<0.63	<0.48	<0.29		8 m E of transformer-bearing pole, 15 m W of G6190
G6192	115	<0.80	<0.58	<0.30		Stain ~ 30 m N of building remains
Mean (n=8)					7.8	
Std Dev					14	
Minimum					<1.4	
Maximum					3.3	

<=Less than the detection limit indicated

Table Continues

Table VI-32: Aroclor PCB Results for Soil for Each Area of the Site (cont'd)

Sample	Tag	Aroclor 1242	Aroclor 1254 ppb (ng/g)	Aroclor 1260	Aroclor Total	Location
<i>12. 1994 Data</i>						
SN 043	46	<4.8	2200	620	2800	~ 2 m from S side of garage foundation
SN 044	47	<1.1	1.9	<0.99	1.9	In middle of DOT barracks building
SN 045	47	<1.5	<2.6	<2.5		Field duplicate of SN044
SN 046	39	<2.0	250	120	370	~ 10 m from E end of warehouse foundation
SN 047	33	26	4100	900	5000	E side of powerhouse, ~ 8 m from road
SN 048	45	<0.65	2.4	1.4	3.8	Base of pole (chopped down), ~8 m N of tower building
SN 049		2000	360000	86000	450000	In pump house basement
SN 050	42	<1.7	690	94	780	Large black stain in barrel cache, W side of site
SN 051	43	<1.3	240	25	270	In barrel cache, W side of site
Mean (n=9)					51000	
Std Dev					150000	
Minimum					1.9	
Maximum					450000	
<=Less than the dection limit indicated						

Table VI-33: Inorganic Element Results for Water Samples

Sample	Cu	Ni	Co	Cd ppb (Og/l)	Pb	Zn	Cr	As	Location
WP6100	0.030	<0.0040	<0.0040	0.002	<0.010	0.063	<0.010	<0.0010	Potable water from Beaver Creek DIAND office (plant washing)
GW6100	<0.0080	<0.0040	<0.0040	<0.0010	<0.010	0.034	<0.010	<0.0010	Ground water from N-most well N of married quarters
GW6101									Ground water from well E of DOT Barracks building
GW6102									Ground water from holding tank assoc. with pump house
GW6103	<0.0080	<0.0040	<0.004	<0.0010	<0.010	2.440	<0.010	<0.0010	Ground water from bottom of N wooden extention of holding tank

<=Less than the dection limit indicated

TableVI-34: Aroclor PCB Results for Water Samples

Sample	Aroclor 1242	Aroclor 1254	Aroclor 1260	Aroclor Total	Location
	ng/l (ppt)				
WP6100	0.16	NDR(0.34)	0.20	0.70	Potable water from Beaver Creek DIAND office (plant washing)
GW6100	0.30	3.0	0.48	3.8	Ground water from N-most well N of married quarters
GW6101	0.21	0.50	0.11	0.80	Ground water from well E of DOT Barracks building
GW6102	0.20	2.3	0.40	2.9	Ground water from holding tank assoc. with pump house
GW6103	1.10	280	56	340	Ground water from bottom of N wooden extention of holding tank

<=Less than the dection limit indicated

Table VI-35: Inorganic Element Results for Vegetation for Each Area of the Site

Sample	Tag #	Species	Cu	Ni	Co	Cd	Pb	Zn	Cr	As	Location
ppm											
<i>1. Backgrounds</i>											
SN127P	No Tag	<i>Salix brachycarpa</i>	12.0	8.3	<2.0	3.2	<2.0	130	20	<0.2	2 km from Aishihik Airstrip
SN128P	No Tag	<i>Salix brachycarpa</i>	7.0	4.3	<2.0	1.5	2.8	83	5.6	<0.2	5 km from Aishihik Airstrip
SN129P	No Tag	<i>Salix brachycarpa</i>	5.0	8.7	<2.0	1.6	<2.0	76	13.0	<0.2	13 km from Aishihik Airstrip
G6175P	No Tag	<i>Lupinus arcticus</i>	8.5	<5.0	<5.0	<0.5	<15	13	<10	<0.2	75 m SE of Snag Rd. mile 19
G6176P	No Tag	<i>Salix bebbiana</i>	8.2	<5.0	<5.0	<0.5	<15	20	<10	<0.2	35 m SE of Snag Rd. mile 19
G6193P	No Tag	<i>Ledum decumbens</i>									~ 10 km N of the airstrip
Mean (n=5)											
Std Dev			8.1	5.3	1.6	1.4	4	64	9.7	0.1	
Minimum			2.4	3.1	0.82	1.2	3.3	48	6.7	0	
Maximum			5.0	2.5	<2.0	<0.5	<2.0	13	5.6	<0.2	
			12	8.7	<5.0	3.2	<15	130	20	<0.2	
<i>2. Tower Building</i>											
G6100P	1	<i>Populus balsamifera</i>	5.3	<5	<5	1.8	<15	430	<10	<0.2	S side of tower building below doorway
G6103P	4	<i>Oxytropis campestris</i>	6.3	<5	<5	<0.5	18	50	<10	<0.2	~2 m NW of NW corner of tower building
G6105P	6	<i>Oxytropis campestris</i>	6.6	<5	<5	<0.5	40	58	<10	<0.2	~ 3 m NE of NE corner of tower building
Mean (n=3)			6.1	2.5	2.5	0.77	22	180	5	0.1	
Std Dev			0.68	0	0	0.89	17	220	0	0	
Minimum			5.3	<5	<5	<0.5	<15	50	<10	<0.2	
Maximum			6.6	<5	<5	1.8	40	430	<10	<0.2	
<i>3. DOT Barracks Building</i>											
G6113P	14	<i>Salix bebbiana</i>	7.9	<5	<5	1.3	<15	290	<10	<0.2	Depression ~ 7 m S of G6112
G6116P	17	<i>Salix exigua</i>	5.4	<5	<5	1.2	<15	310	<10	<0.2	~ 3 m W of chimney
G6118P	19	<i>Salix bebbiana</i>	9	<5	<5	1.9	<15	260	<10	<0.2	Depression ~ 4 m S of S end of foundations
Mean (n=3)			7.4	2.5	2.5	1.5	7.5	290	5	0.1	
Std Dev			1.8	0	0	0.38	0	24	0	0	
Minimum			5.4	<5	<5	1.2	<15	260	<10	<0.2	
Maximum			9.0	<5	<5	1.9	<15	310	<10	<0.2	
<i>4. Warehouse</i>											
G6121P	22	<i>Shepherdia canadensis</i>	5.5	<5	<5	<0.5	<15	10	10	<0.2	Stain midway along S side of foundation
G6122P	23	<i>Salix brachycarpa</i>	9.1	<5	<5	2.4	<15	190	<10	<0.2	1.5 m W of base of bay door

1. <=Less than the detection limit indicated

Table Continues

Table VI-35: Inorganic Element Results for Vegetation for Each Area of the Site (cont'd)

Sample	Tag #	Species	Cu	Ni	Co	Cd	Pb	Zn	Cr	As	Location
ppm											
<i>5. Powerhouse</i>											
G6131P	32	<i>Shepherdia canadensis</i>	6.8	<5	<5	<0.5	<15	260	<10	<0.2	1 m off SW corner off foundation
G6135P	36	<i>Epilobium angustifolium</i>	6.9	<5	<5	<0.5	<15	47	<10	<0.2	~0.5 m W of bay door concrete pad
G6136P	37	<i>Salix brachycarpa</i>	8.6	<5	<5	4.7	<15	350	<10	<0.2	~0.5 m N of bay door concrete pad
G6139P	40	<i>Arctostaphylos uva-ursi</i>	5.4	<5	<5	<0.5	<15	220	17	<0.2	1 m NE of NE corner of foundation
Mean (n=4)			6.9	2.5	2.5	1.4	7.5	220	8.1	0.1	
Std Dev			1.3	0	0	2.2	0	130	6.1	0	
Minimum			5.4	<5	<5	<5	<15	47	<10	<0.2	
Maximum			8.6	<5	<5	4.7	<15	350	17.2	<0.2	
<i>6. Garage</i>											
G6153P	No Tag	<i>Salix brachycarpa</i>	11	<5	<5	15.6	83	1100	12	0.22	Bottom of oil-change pit
G6161P	72	<i>Populus balsamifera</i>	8.1	<5	<5	4.4	<15	310	<10	<0.2	~1 m E of foundation, 2 m N of SE corner
G6162P	73	<i>Shepherdia canadensis</i>	5.9	<5	<5	<0.5	<15	36	<10	<0.2	~2 m NW of SW corner of foundation
G6164P	75	<i>Shepherdia canadensis</i>	4.9	<5	<5	<0.5	<15	23	<10	<0.2	Midway along W side of foundation
Mean (n=4)			7.6	2.5	2.5	5.1	26	360	6.8	0.13	
Std Dev			2.8	0	0	7.3	38	490	3.6	0.06	
Minimum			4.9	<5	<5	<0.5	<15	23	<10	<0.2	
Maximum			11	<5	<5	15.6	83	1100	12	0.22	
<i>7. Dump</i>											
L6101P	58	<i>Populus balsamifera</i>	10	<5	<5	1.3	<15	250	<10	<0.2	~0.5 m off the SW toe of the worked area
L6103P	60	<i>Epilobium angustifolium</i>	9.6	<5	<5	<0.5	<15	42	11	<0.2	6 m SE of L6102, 1 m from edge of worked area
L6105P	62	<i>Epilobium angustifolium</i>	7.1	<5	<5	<0.5	<15	41	<10	<0.2	Depression ~ 3 m S of SE side of dump toe
L6107P	64	<i>Salix bebbiana</i>									2 m E of E side of worked area
L6108P	100	<i>Salix myrtilifolia</i>									At toe of dump, 5 m S of L6102
L6110P	102	<i>Salix myricoides</i>	7	<5	<5	1.9	<15	390	<10	<0.2	Depression 3 m E of L6109
Mean (n=4)			8.4	2.5	2.5	0.93	7.5	180	6.5	0.1	
Std Dev			1.6	0	0	0.82	0	170	2.9	0	
Minimum			7	<5	<5	<0.5	<15	41	<10	<0.2	
Maximum			10	<5	<5	1.9	<15	390	11	<0.2	

1. <=Less than the detection limit indicated

Table Continues

Table VI-35: Inorganic Element Results for Vegetation for Each Area of the Site (cont'd)

Sample	Tag #	Species	Cu	Ni	Co	Cd ppm	Pb	Zn	Cr	As	Location
<i>8. General Site Proximity</i>											
G6179P	92	<i>Salix brachycarpa</i>	9.5	<5	<5	1.8	<15	160	<10	<0.2	3rd open area from the N, ~ 65 m W of fire hall
G6181PS	96	<i>Populus balsamifera</i> , shoots	9.3	12	6.2	<0.5	<15	150	<10	<0.2	Red stain ~ 6 m W of board pile, N side of airstrip apron
G6181PR	96	<i>Populus balsamifera</i> , roots	8.6	13	<5	<0.5	<15	99	<10	0.85	Red stain ~ 6 m W of board pile, N side of airstrip apron
G6184P	99	<i>Salix bebbiana</i>	9	6.2	<5	1.9	<15	220	<10	<0.2	Burn stain 3 m N of split in Snag Rd. near DOT barracks
Mean (n=4)			9.1	8.4	3.4	1.1	7.5	160	5	0.29	
Std Dev			0.39	4.9	1.9	0.92	0	49	0	0.38	
Minimum			8.6	<5	<5	<0.5	<15	99	<10	<0.2	
Maximum			9.5	13	6.2	1.9	<15	220	<10	0.85	
<i>9. Beacon Site</i>											
G6187P	110	<i>Shepherdia canadensis</i>	4.3	<5	<5	<0.5	<15	11	10	<0.2	4 m SE of G6185, immed. adjacent electrical cabinet
G6192P	115	<i>Populus balsamifera</i>	5.9	16	<5	0.5	<15	130	39	0.34	Stain ~ 30 m N of building remains
1. <=Less than the detection limit indicated											

Table VI-36: Aroclor PCB Results for Vegetation for Each Area of the Site

Sample	Tag	Species	Aroclor 1242	Aroclor 1254	Aroclor 1260	Aroclor Total	Location
ppb							
<i>1. Backgrounds</i>							
SN127P	No Tag	<i>Salix brachycarpa</i>	0.05	<0.22	<0.08	0.10	2 km from Aishihik Airstrip
SN128P	No Tag	<i>Salix brachycarpa</i>	NDR(0.06)	<0.13	<0.13	0.10	5 km from Aishihik Airstrip
SN129P	No Tag	<i>Salix brachycarpa</i>	NDR(0.05)	<0.20	<0.05	0.10	13 km from Aishihik Airstrip
G6175P	No Tag	<i>Lupinus arcticus</i>	0.03	0.12	0.08	0.20	75 m SE of Snag Rd. mile 19
G6176P	No Tag	<i>Salix bebbiana</i>	0.07	0.21	0.07	0.30	35 m SE of Snag Rd. mile 19
G6193P	No Tag	<i>Ledum decumbens</i>					~ 10 km N of the airstrip
Mean (n=6)						0.10	
Std Dev						0.10	
Minimum						0.10	
Maximum						0.30	
<i>2. Tower Building</i>							
G6100P	1	<i>Populus balsamifera</i>	<0.67	9.5	1.9	11	S side of tower building below doorway
G6103P	4	<i>Oxytropis campestris</i>	<0.26	4.6	0.93	5.5	~2 m NW of NW corner of tower building
G6105P	6	<i>Oxytropis campestris</i>	<0.22	3.5	0.87	4.4	~ 3 m NE of NE corner of tower building
Mean (n=3)						7.1	
Std Dev						3.8	
Minimum						4.4	
Maximum						11	
<i>3. DOT Barracks Building</i>							
G6113P	14	<i>Salix bebbiana</i>	<0.22	1.6	<0.58	1.6	Depression ~ 7 m S of G6112
G6116P	17	<i>Salix exigua</i>	<0.20	3.8	<0.55	3.8	~ 3 m W of chimney
G6118P	19	<i>Salix bebbiana</i>	<0.60	4.4	<1.1	4.4	Depression ~ 4 m S of S end of foundations
Mean (n=3)						3.3	
Std Dev						1.5	
Minimum						1.6	
Maximum						4.4	
<i>4. Warehouse</i>							
G6121P	22	<i>Shepherdia canadensis</i>	<0.50	3.6	<1.2	3.6	Stain midway along S side of foundation
G6122P	23	<i>Salix brachycarpa</i>	<0.30+H64	2.2	<0.57	2.2	1.5 m W of base of bay door

1. <=Less than the detection limit indicated

Table Continues

Table VI-36: Aroclor PCB Results for Vegetation for Each Area of the Site (cont'd)

Sample	Tag	Species	Aroclor 1242	Aroclor 1254	Aroclor 1260	Aroclor Total	Location
<i>5. Powerhouse</i>							
G6131P	32	<i>Shepherdia canadensis</i>	<0.27	42	1.5	44	1 m off SW corner off foundation
G6135P	36	<i>Epilobium angustifolium</i>	0.28	220	13	230	~ 0.5 m W of bay door concrete pad
G6136P	37	<i>Salix brachycarpa</i>	0.23	44	1.9	46	~ 0.5 m N of bay door concrete pad
G6139P	40	<i>Arctostaphylos uva-ursi</i>	0.28	140	7.5	150	1 m NE of NE corner of foundation
Mean (n=4)						120	
Std Dev						91	
Minimum						44	
Maximum						230	
<i>6. Garage</i>							
G6153P	No Tag	<i>Salix brachycarpa</i>	9.0	6700	270	7000	Bottom of oil-change pit
G6161P	72	<i>Populus balsamifera</i>	<0.50	3.6	<1.1	3.6	~ 1 m E of foundation, 2 m N of SE corner
G6162P	73	<i>Shepherdia canadensis</i>	<0.35	3.6	<0.85	3.6	~ 2 m NW of SW corner of foundation
G6164P	75	<i>Shepherdia canadensis</i>	<0.25	29	1.0	30	Midway along W side of foundation
Mean (n=4)						1800	
Std Dev						3500	
Minimum						3.6	
Maximum						7000	
<i>7. Dump</i>							
L6101P	58	<i>Populus balsamifera</i>	<0.33	<0.87	<0.76		~ 0.5 m off the SW toe of the worked area
L6103P	60	<i>Epilobium angustifolium</i>	<0.46	<0.95	<1.0		6 m SE of L6102, 1 m from edge of worked area
L6105P	62	<i>Epilobium angustifolium</i>	<0.46	<0.93	<1.3		Depression ~ 3 m S of SE side of dump toe
L6107P	64	<i>Salix bebbiana</i>	<0.43	<1.0	<0.98		2 m E of E side of worked area
L6108P	100	<i>Salix myrtilifolia</i>	<0.66	<1.4	<1.4		At toe of dump, 5 m S of L6102
L6110P	102	<i>Salix myricoides</i>					Depression 3 m E of L6109
<i>8. General Site Proximity</i>							
G6179P	92	<i>Salix brachycarpa</i>	<0.36	<1.0	<0.83		3rd open area from the N, ~ 65 m W of fire hall
G6181PS	96	<i>Populus balsamifera</i> , shoots					Red stain ~ 6 m W of board pile, N side of airstrip apron
G6181PR	96	<i>Populus balsamifera</i> , roots					Red stain ~ 6 m W of board pile, N side of airstrip apron
G6184P	99	<i>Salix bebbiana</i>	<0.62	<1.3	<1.2		Burn stain 3 m N of split in Snag Rd. near DOT barracks
<i>9. Beacon Site</i>							
G6187P	110	<i>Shepherdia canadensis</i>	<0.51	<1.0	<0.96		4 m SE of G6185, immed. adjacent electrical cabinet
G6192P	115	<i>Populus balsamifera</i>	<0.66	<1.5	<1.4		Stain ~ 30 m N of building remains
1. <=Less than the detection limit indicated							

Table VI-37: Pesticide Results for Soils

Sample	G6181	G6181	G6184	L6110-D	G6186A	O6104	G6104A
Sample Wt. (g dry)	4.88	4.68g dry	4.81	3.33	3.81	2.36	3.62
Area	Site Proximity	Site Proximity duplicate	Site Proximity	Dump	Beacon Site	Septic Field	Tower Bldg
Compound	ppb (ng/g)						
Hexachlorobenzene	<0.41	<0.51	<0.39	<1.1	<0.65	2.8	<18
alpha BHC	<0.76	<0.96	<0.7	<1.8	<1.0	NDR(0.38)	<39
beta BHC	<1.5	<1.9	<1.4	<3.5	<1.3	NDR(0.71)	<75
gamma BHC	<1.2	<1.5	<1.1	<2.8	<1.0	NDR(0.49)	<75
Heptachlor	<0.88	<0.99	<0.52	<2.2	<0.83	1.2	<260
Aldrin	<0.34	<0.33	<0.22	<0.76	<0.25	<0.25	<46
Oxychlorane	<2.6	<2.6	<1.2	<3.9	<1.6	<0.98	<180
trans-Chlordane	<0.28	<0.25	<0.16	<0.66	<0.25	42	<42
cis-Chlordane	<0.34	<0.3	<0.19	<0.78	<0.3	40	<46
o,p'-DDE	<0.1	<0.11	0.47	<0.23	<0.1	6.2	<12
p,p'-DDE	2.3	1.2	100	1.6	<0.14	63	270
trans-Nonachlor	<0.22	<0.23	<0.16	<0.46	<0.17	16	<30
cis-Nonachlor	<0.26	<0.27	<0.16	<0.54	<0.2	2.9	<33
o,p'-DDD	<0.12	<0.13	0.68	<0.29	<0.16	120	<14
p,p'-DDD	<0.14	<0.20	2.9	<0.34	<0.18	360	18
p,p'-DDT	15	9.0	310	6.3	<0.34	590	1300
Mirex	<0.27	<0.26	<0.13	<0.43	<0.37	NDR(0.78)	<18
Heptachlor Epoxide	<0.01	<0.02	<0.01	<0.02	<0.01	3.6	<4.0
alpha-Endosulphan	<0.01	<0.02	<0.01	<0.02	<0.02	<0.14	<4.6
Dieldrin	<0.01	<0.02	<0.02	<0.02	<0.02	49	<5.0
Endrin	<0.05	<0.06	<0.04	<0.1	<0.05	2.0	<8.1
Methoxychlor	<0.06	<0.07	<0.04	<0.12	<0.06	18	<18

<=Less than the detection limit indicated

NDR - peak detected but did not meet quantification criteria

Data have not been blank corrected

Table VI-37: Pesticide Results for Soils (cont'd)

Sample	G6109	G6119A	G6119A	SN 046	SN 049	G6133	G6153	G6158
Sample Wt. (g dry)	5.01	1.41	1.37	9.54	0.93	2.52	1.85	4.5
Area	Tower Bldg	DOT barracks	DOT barracks duplicate	Warehouse	Powerhouse	Powerhouse	Garage	Fire Hall
Compound								
Hexachlorobenzene	<10	<78	<100	<0.04	<31	<23	<87	<0.33
alpha BHC	<20	<180	<210	<0.06	12	<200	<170	<0.64
beta BHC	<38	<350	<400	<0.09	<19	<380	<330	<1.2
gamma BHC	<38	<350	<400	<0.05	<10	<380	<330	<1.2
Heptachlor	<200	<830	<1400	0.89	<33	<510	<1000	<4.4
Aldrin	<47	<220	<300	<0.08	76	<470	<240	<1.0
Oxychlordane	NDR(1900)	<1100	<1000	0.87	NDR(37)	<260	NDR(950)	<2.8
trans-Chlordane	96	<160	<230	2.9	<10	<89	<220	<0.72
cis-Chlordane	75	<170	<250	3.1	<11	<98	<250	<0.79
o,p'-DDE	<7.8	<32	<67	NDR(2.7)	ND*	<110	390	<0.16
p,p'-DDE	<10	<42	<88	45	<35	<150	1300	2.9
trans-Nonachlor	<32	<140	<180	4.4	380	<54	<140	<0.63
cis-Nonachlor	<34	<150	<190	2.9	<9.0	<58	<150	<0.68
o,p'-DDD	<11	<45	<64	NDR(2.2)	ND*	<180	NDR(57)	<0.2
p,p'-DDD	<11	<47	<68	15	ND*	<190	110	<0.29
p,p'-DDT	57	88	130	150	<160	<360	2900	16
Mirex	<15	<52	<120	<0.12	<35	<230	<97	<0.34
Heptachlor Epoxide	<5.3	<30	<28	0.53	<22	<15	<24	<0.12
alpha-Endosulphan	<5.2	<29	<29	<0.26	<24	<14	<24	<0.1
Dieldrin	<6.7	<37	<35	<0.25	<24	<18	<31	1.4
Endrin	<11	<59	<56	<0.37	<36	<31	<53	<0.25
Methoxychlor	<21	<130	<120	<0.92	<87	<62	<100	NDR(4.9)

1. * Interference peaks noted at retention times close to the expected retention times of these compounds
2. <=Less than the detection limit indicated
3. NDR - peak detected but did not meet quantification criteria
4. Data have not been blank corrected

Table VI-37: Pesticide Results for Soils (addendum)¹

Sample	G6123	G6126
Sample Wt. (dry)	4.95g dry	4.57g dry
Area	Warehouse	Warehouse
	ppb	
Compound		
Hexachlorobenzene	<64	<22
alpha BHC	<150	<76
beta BHC	<370	<190
gamma BHC	<350	<180
Heptachlor	<840	120000
Aldrin	<150	NDR(220)
Oxychlorane	<790	NDR(490)
trans-Chlordane	190	340000
cis-Chlordane	180	270000
o,p'-DDE	<32	30
p,p'-DDE	<44	170
trans-Nonachlor	<84	97000
cis-Nonachlor	<100	18000
o,p'-DDD	<42	NDR(53)
p,p'-DDD	<45	120
p,p'-DDT	<130	7700
Mirex	<62	<51
Heptachlor Epoxide	<15	5400
alpha-Endosulphan	<23	<60
Dieldrin	<17	<45
Endrin	<27	<69
Methoxychlor	<50	<64

<=Less than the detection limit indicated

NDR - peak detected but did not meet quantification criteria

Data have not been blank corrected

¹ The following section was added on 11 April 1996 subsequent to the receipt of additional analytical results which were pending at the time of publication of this report (31 March 1996). A total of four addenda have been inserted following pages III-40, IV-4, VI-120 and VI-134.



Table VI-38: Polycyclic Aromatic Hydrocarbon (PAH) Results for Soils

Sample	G6104A	G6109	G6109	G6119A	G6121	G6125A	G6133	G6150	G6153
Sample Wt. (g dry)	8.46	4.69	5	2.73	4.95	4.85	3.2	9.64	1.78
Area	Tower	Tower	Tower duplicate	Barracks	Warehouse	Warehouse	Powerhouse	Fire Hall	Garage
Compounds	ng/g (ppb)								
Naphthalene	14	24	22	170	210	23	250	NDR(1.6)	1200
Acenaphthylene	3.0	4.7	1.3	NDR(14)	3.8	2.6	NDR(24)	NDR(0.45)	1300
Acenaphthene	1.3	3.0	NDR(5.8)	NDR(4.6)	9.4	7.5	52	<0.07	130
Fluorene	5.3	3.7	4.5	NDR(47)	9.8	29	380	0.44	440
Phenanthrene	71	87	84	270	140	150	720	3.6	26000
Anthracene	63	9.0	NDR(5.3)	NDR(7.8)	17	21	60	0.81	3800
Fluoranthene	62	130	140	65	140	91	670	8.3	100000
Pyrene	58	92	100	58	110	110	1500	8.7	130000
Benz(a)anthracene	25	28	28	NDR(26)	45	66	NDR(180)	<0.06	30000
Chrysene	63	83	91	210	100	93	1200	130	43000
Benzo(a)fluoranthene	54	81	110	NDR(95)	160	99	850	32	53000
Benzo(e)pyrene	24	58	78	130	130	38	NDR(470)	42	21000
Benzo(a)pyrene	28	36	NDR(35)	NDR(23)	58	76	NDR(320)	NDR(2.3)	37000
Perylene	5.2	NDR(6.1)	NDR(3.3)	ND	NDR(9)	17	NDR(240)	<0.06	10000
Dibenz(ah)anthracene	NDR(3.6)	NDR(12)	NDR(10)	NDR(20)	NDR(10)	13	<20	NDR(3.7)	3800
Indeno(1,2,3-cd)pyrene	26	NDR(22)	NDR(21)	NDR(18)	32	52	NDR(350)	NDR(7.0)	41000
Benzo(ghi)perylene	22	30	NDR(33)	NDR(38)	53	41	NDR(590)	11	30000
C1 naphthalenes	19	57	56	830	290	54	1600	1.6	1200
C2 naphthalenes	22	110	110	2400	92	220	8600	1.0	3200
C3 naphthalenes	16	250	170	2300	41	520	20000	0.3	4600
C4 naphthalenes	ND	360	200	880	13	740	21000	<0.04	2700
C5 naphthalenes	NDR(3.1)	<0.29	<0.55	170	1.3	390	9900	<0.05	1300
C1 phen,anth	58	880	640	410	82	400	2900	6.0	14000
C2 phen,anth	61	2400	1600	800	81	590	14000	40	13000
C3 phen,anth	34	2000	1200	6600	110	580	20000	92	41000
C4 phen,anth	11	17000	11000	NDR(58)	91	370	5700	170	8300
Retene	11	15000	10000	NDR(58)	28	47	610	12	NDR(480)
C5 phen,anth	ND	2700	1700	<1.9	7.4	150	1400	85	<3.8
C1 fluor,pyrenes	37	410	250	240	81	200	1200	24	22000
C2 fluor,pyrenes	29	140	100	<3.1	100	290	2300	100	19000
C3 fluor,pyrenes	12	150	95	<6.9	120	190	5200	230	4600
C4 fluor,pyrenes	ND	190	<18	<5.8	94	130	4100	<0.20	4300
C5 fluor,pyrenes	ND	69	<4.6	<5.2	<0.89	120	1300	<0.20	2200
Dibenzothiophene	NDR(3.1)	NDR(5.2)	NDR(3.8)	68	NDR(10)	NDR(12)	NDR(230)	NDR(0.38)	NDR(920)
C1 Dibenzothiophene	3.6	28	22	84	9.3	51	650	0.56	650
C2 Dibenzothiophene	3.6	370	240	62	13	82	630	2.9	700

1. SDL = Sample Detection Limit
2. <= Less than the detection limit indicated
3. NDR = Peak detected but did not meet quantification criteria
4. Data have not been blank corrected.

Table VI-38: Polycyclic Aromatic Hydrocarbon (PAH) Results for Soils (cont'd)

Sample	G6159	G6169	G6181	G6186A	G6192	L6103A	L6103B	L6110-D
Sample Wt. (g dry)	3.99	4.83	4.87	6.1	4.71	1.58	1.2	3.29
Area	Site Proximity	Site Proximity	Site Proximity	Beacon Site	Beacon Site	Dump	Dump	Dump
ng/g (ppb)								
Compounds								
Naphthalene	25	16	7.8	160	42	56	78	11
Acenaphthylene	2.6	2.8	NDR(2.6)	4.4	NDR(1.6)	6.5	8.9	0.86
Acenaphthene	0.64	2.3	NDR(2.6)	2.3	NDR(12)	1.1	NDR(1.2)	<0.22
Fluorene	1.2	7.0	1.7	3.3	11	4.0	5.2	1.2
Phenanthrene	13	54	18	130	57	41	55	9.9
Anthracene	0.87	8.1	3.0	8.9	<2.4	3.0	4.2	NDR(1.1)
Fluoranthene	8.0	68	62	120	36	19	29	4.9
Pyrene	7.7	66	54	53	25	19	29	5.1
Benz(a)anthracene	2.3	NDR(20)	42	17	6.3	6.4	12	2.5
Chrysene	22	58	69	43	19	22	33	11
Benzofluoranthenes	8.1	NDR(70)	83	22	<8.7	16	25	6.3
Benzo(e)pyrene	8.2	47	28	15	<8.3	9.8	16	3.8
Benzo(a)pyrene	NDR(1.6)	34	40	3.9	<14	4.1	NDR(7.3)	<0.81
Perylene	<0.43	NDR(13)	8.0	NDR(2.2)	<9.2	<1.0	NDR(2.2)	<0.68
Dibenz(ah)anthracene	<0.71	NDR(3.4)	NDR(2.1)	5.3	<38	<1.6	<2.0	<1.2
Indeno(1,2,3-cd)pyrene	NDR(2.4)	NDR(75)	36	4.8	<20	NDR(6.2)	NDR(11)	<1.4
Benzo(ghi)perylene	3.2	NDR(110)	28	10	<18	8.0	13	NDR(2.2)
C1 naphthalenes	15	27	6.1	68	79	50	74	14
C2 naphthalenes	9.1	60	20	30	110	51	78	6.6
C3 naphthalenes	4.4	44	19	10.6	76	32	41	5.1
C4 naphthalenes	<0.10	13	<0.13	0.05	<3.3	<0.23	<0.34	<0.12
C5 naphthalenes	<0.08	6.2	<0.18	2.6	<1.0	<0.19	<0.29	<0.31
C1 phen,anth	8.6	68	15	38.3	12	38	54	7.5
C2 phen,anth	10	130	16	48.3	<4.6	57	77	8.7
C3 phen,anth	4.7	49	7.1	18	<3.1	32	58	<0.33
C4 phen,anth	10	36	1.1	15.3	14	23	64	10
Retene	10	NDR(4.6)	1.1	15	14	23	64	10
C5 phen,anth	<0.20	<0.19	<0.18	4	<2.4	<0.48	<0.65	<0.31
C1 fluor,pyrenes	7.3	40	32	28	<2.0	16	28	4.2
C2 fluor,pyrenes	19	57	37	24	<2.6	24	38	4.6
C3 fluor,pyrenes	17	71	6.2	22	<4.1	<0.42	<0.57	<0.74
C4 fluor,pyrenes	28	<0.27	<0.21	25	<6.6	<0.30	<0.41	<1.2
C5 fluor,pyrenes	25	<0.68	<0.52	28	<2.3	<0.29	<0.40	<0.72
Dibenzothiophene	<0.38	14	NDR(0.71)	8.5	NDR(2.9)	NDR(2.4)	NDR(3.3)	<0.12
C1 Dibenzothiophene	<0.60	16	0.43	1.8	<1.1	4.8	5.5	<0.19
C2 Dibenzothiophene	<0.40	7.0	<0.02	2.2	<13	4.2	6.9	<0.17

1. SDL = Sample Detection Limit
2. < = Less than the detection limit indicated
3. NDR = Peak detected but did not meet quantification criteria
4. Data have not been blank corrected.

Table VI-39: Polychlorinated Dibenzodioxins and Dibenzofurans Results for Soils

Sample Area	G6104A Tower Building	G6114 Barracks	G6119A Barracks	G6121 Warehouse	G6123 Warehouse	G6123 Warehouse	G6133 Powerhouse	G6141 Powerhouse
Compounds	ppt (pg/g)							
Dioxins								
T4CDD - Total	2.7	7.4	66	210	2.4	2.1	140	0.1
2,3,7,8	0.4	0.2	6.4	4.4	0.3	0.3	5.0	<0.1
P5CDD - Total	10	12	170	44	17	21	820	0.5
1,2,3,7,8	0.9	1.2	20	2.5	1.3	1.5	54	0.2
H6CDD - Total	47	30	830	540	73	83	280	5.9
1,2,3,4,7,8	1.6	1.1	30	29	2.6	2.7	76	0.4
1,2,3,6,7,8	5.0	3.5	89	40	7.8	8.7	180	1.0
1,2,3,7,8,9	3.2	3.9	86	100	5.5	5.2	190	0.8
H7CDD - Total	190	82	3500	650	310	340	7300	32
1,2,3,4,6,7,8	97	47	2000	320	160	180	3700	19
O8CDD - Total	440	160	7700	760	740	780	12000	98
Furans								
T4CDF - Total	89	7.2	13000	2900	230	270	8800	20
2,3,7,8	13	1.4	2200	640	42	41	880	3.7
P5CDF - Total	140	5.8	13000	2700	160	190	12000	41
1,2,3,7,8	1.8	0.3	460	83	4.0	4.1	79	0.4
2,3,4,7,8	9.6	0.4	1600	220	14	14	560	4.0
H6CDF - Total	290	18	29000	3900	360	370	14000	65
1,2,3,4,7,8	66	0.9	9400	950	69	64	3300	19
1,2,3,6,7,8	31	0.6	4500	330	26	36	1700	8.2
2,3,4,6,7,8	7.1	0.3	600	610	9.2	8.1	360	1.6
1,2,3,7,8,9	<0.4	<0.3	40	5.2	0.7	0.5	14	<0.3
H7CDF - Total	200	30	9400	2200	350	360	4700	37
1,2,3,4,6,7,8	100	12	3800	1900	170	170	2100	15
1,2,3,4,7,8,9	12	0.4	1800	89	15	13	780	<0.4
O8CDF - Total	150	16	7900	700	240	270	3800	37
2,3,7,8 - TCDD TEQs (Using NATO I-TEFs)								
2,3,7,8 - TCDD TEQs (ND=1/2 DL)	21.13pg/g	3.0 pg/g	2625.5pg/g	414.8 pg/g	28.9pg/g	29.6pg/g	1067.6pg/g	6.1 pg/g
2,3,7,8 - TCDD TEQs (ND=0)	21.11pg/g	3.0 pg/g	2625.5pg/g	414.8 pg/g	28.9pg/g	29.6pg/g	1067.6pg/g	6.1 pg/g
NDR = Peak detected but did not meet quantification criteria								

Table VI-39: Polychlorinated Dibenzodioxins and Dibenzofurans Results for Soils (cont'd)

Sample Area	G6153 Garage	G6184 Site Proximity	L6103A Dump	L6103B Dump	G6186A Beacon Site	G6186A Beacon Site	G6186A Beacon Site
Compounds	ppt (pg/g)						
Dioxins							
T4CDD - Total	<0.9	0.5	11	12	0.9	1.0	0.9
2,3,7,8	<0.9	<0.1	0.3	0.3	<0.2	<0.2	<0.2
P5CDD - Total	95	1.2	12	15	0.5	5.9	0.5
1,2,3,7,8	8.6	0.3	1.0	1.0	<0.4	<0.4	<0.4
H6CDD - Total	690	8.4	39	48	2.5	11	2.2
1,2,3,4,7,8	<2.0	0.5	1.0	1.2	<0.6	<0.6	<0.6
1,2,3,6,7,8	120	1.4	4.9	5.2	<0.6	<0.6	<0.6
1,2,3,7,8,9	37	1.0	3.7	5.3	<0.6	1.2	<0.6
H7CDD - Total	8900	49	310	450	7.8	22	9.8
1,2,3,4,6,7,8	5300	28	120	160	2.4	7.5	3.2
O8CDD - Total	17000	130	1000	1300	9.1	20	12
Furans							
T4CDF - Total	40000	4.1	29	33	1.8	1.7	1.9
2,3,7,8	9500	0.3	4.4	5.1	0.5	0.3	0.3
P5CDF - Total	57000	10	20	26	0.5	1.2	0.8
1,2,3,7,8	1300	<0.1	0.9	0.9	<0.4	<0.4	<0.4
2,3,4,7,8	4800	0.1	1.3	1.4	<0.4	<0.4	<0.4
H6CDF - Total	69000	19	35	40	<0.6	<0.6	<0.6
1,2,3,4,7,8	20000	0.4	2.0	2.4	<0.6	<0.6	<0.6
1,2,3,6,7,8	12000	0.5	1.8	2.0	<0.6	<0.6	<0.6
2,3,4,6,7,8	3000	0.6	1.7	1.8	<0.6	<0.6	<0.6
1,2,3,7,8,9	140	<0.3	<0.4	<0.3	<0.6	<0.6	<0.6
H7CDF - Total	21000	38	81	83	<0.8	<0.8	<0.8
1,2,3,4,6,7,8	11000	15	25	25	<0.8	<0.8	<0.8
1,2,3,4,7,8,9	3800	<0.5	1.1	1.3	<0.8	<0.8	<0.8
O8CDF - Total	14000	38	58	71	<1.0	<1.0	<1.0
2,3,7,8 - TCDD TEQs (Using NATO I-TEFs)							
2,3,7,8 - TCDD TEQs (ND=1/2 DL)	7181.6pg/g	1.3pg/g	6.0 pg/g	7.1 pg/g			
2,3,7,8 - TCDD TEQs (ND=0)	7181.0pg/g	1.3pg/g	6.0 pg/g	7.1 pg/g	0.08	0.12	0.07
NDR = Peak detected but did not meet quantification criteria							

Table VI-40: Inorganic Element Results for Paint Samples

Sample	Cu	Ni	Co	Cd ppm	Pb	Zn	Cr	As	Locations
SNPC-1A	<3	<5	160	<0.5	9300	15000	260	0.3	Paint chips from interior walls of tower building
SNPC-1B	<3	<5	140	<0.5	11000	22000	310	<0.2	Field duplicate of SNPC-1A
SNPC-2	12.0	<5	150	<0.5	220000	6900	31000	0.9	Orange paint chips from wood piled at beacon site

1.<=Less than the detection limit indicated

Table VI-41: Aroclor PCB Results for Paint Samples

Sample	Aroclor 1242	Aroclor 1254 ng/g (ppb)	Aroclor 1260	Aroclor Total	Location
SNPC-1A	240	12000	6300	19000	Paint chips from interior walls of tower building
SNPC-1B					Field duplicate of SNPC-1A
SNPC-2					Orange paint chips from wood piled at beacon site

Table VI-42: Insulation Material Asbestos Results

Sample	Asbestos Content	Location
SNASB-1	Asbestos not detected	Wall insulation from tower building
SNASB-2	Asbestos not detected	Insulation from fire hall
SNASB-3	Asbestos not detected	Pressboard from fire hall
SNASB-4	Asbestos not detected	Insulation from married quarters

* Asbestos not detected denotes below detection limit of 0.5%

Table VI-43: Aroclor PCB Results for Swab Samples

Sample	Aroclor 1242	Aroclor 1254 ng/filter	Aroclor 1260	Total	Location
SN-01	<8.9	14	21	35	Wall facing airstrip, tower building
SN-02					Wall facing airstrip, tower building
SN-03					Wall facing airstrip, tower building
SN-04	<5.5	<4.5	<4.5		N wall of fire hall
SN-05					N wall of fire hall
SN-06					N wall of fire hall
SN-07	12	<4.1	<4.9	12	W wall of married quarters
SN-08					W wall of married quarters
SN-09					W wall of married quarters

1. <= Less than the detection limit indicated

Table VI-44: Comparison of Leachate Test Results to Leachate Quality Standards

Sample Area	Leachate Quality Standards (Ontario MOE)	G6109	G6100	G6117B	G6119B	G6124
		Tower	Tower	DOT Barracks ppm (mg/l)	DOT Barracks	Warehouse
Arsenic	5.0	<0.05	<0.05	<0.05	<0.05	<0.05
Barium	100	<1.0	<1.0	<1.0	<1.0	<1.0
Cadmium	0.5	0.18	<0.005	<0.005	0.02	0.01
Chromium	5.0	<0.05	<0.05	<0.05	<0.05	<0.05
Lead	5.0	<0.05	0.18	<0.05	<0.05	48
Mercury	0.1	<0.001	<0.001	<0.001	<0.001	<0.001
Selenium	1.0	<0.010	<0.010	<0.010	<0.010	<0.010
Silver	5.0	<0.05	<0.05	<0.05	<0.05	<0.05
Boron	500	<1.0	<1.0	<1.0	<1.0	<1.0
Cyanide	20	<0.1	<0.1	<0.1	<0.1	<0.1
Fluoride	240	<0.1	0.13	<0.1	<0.1	<0.1
Copper	100	0.07	<0.05	<0.05	<0.05	0.43
Nickel		<0.10	<0.10	<0.10	<0.10	<0.10
Cobalt		<0.10	<0.10	<0.10	<0.10	<0.10
Zinc	500	230	2	3.7	2.5	7.1
PCBs	0.3	<0.001	<0.001	<0.003	<0.001	<0.001

1.<=Less than the detection limit indicated

Table VI-44: Comparison of Leachate Test Results to Leachate Quality Standards (cont'd)

Sample Area	Leachate Quality Standards (Ontario MOE)	G6121	G6121	G6121	G6121	G6121	G6140B	G6145	G6133
		Warehouse	SN22-8 Delineation	SN22-10 Delineation	SN22-18 Delineation	SN22-19 Delineation	Powerhouse	Powerhouse	Powerhouse
Compound									
Arsenic	5.0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Barium	100	<1.0	<0.5	<0.5	<0.5	<0.5	<1.0	<1.0	<1.0
Cadmium	0.5	<0.005	<0.010	<0.010	<0.010	<0.010	<0.005	0.02	<0.005
Chromium	5.0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Lead	5.0	24	1.1	695	1.5	86	<0.05	0.91	<0.05
Mercury	0.1	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Selenium	1.0	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Silver	5.0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Boron	500	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Cyanide	20	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Fluoride	240	<0.1	<0.10	<0.10	0.13	<0.10	<0.1	<0.1	0.13
Copper	100	2.8	0.09	9.6	1.4	<0.10	<0.05	0.2	<0.05
Nickel		<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Cobalt		<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Zinc	500	19.3	4.1	26	0.76	0.71	1.9	4.5	1.6
PCBs	0.3	<0.001	0.003	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

1.<=Less than the detection limit indicated

Table VI-44: Comparison of Leachate Test Results to Leachate Quality Standards (cont'd)

Sample Area	Leachate Quality Standards (Ontario MOE)	G6152	G6164	G6153	G6157	O6104	G6186A	SNPC-1 paint chip Tower Bldg
		Fire Hall	Garage	Garage	Garage ppm (mg/l)	Septic field	Beacon Site	
Compound								
Arsenic	5.0	<0.05	<0.05	<0.05	<0.05	<0.05	0.22	<0.05
Barium	100	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<0.10
Cadmium	0.5	0.02	0.01	0.24	<0.010	<0.005	0.01	<0.010
Chromium	5.0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Lead	5.0	0.22	<0.05	0.71	0.41	<0.05	<0.05	0.74
Mercury	0.1	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Selenium	1.0	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Silver	5.0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Boron	500	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	
Cyanide	20	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
Fluoride	240	0.17	<0.1	<0.1	0.62	<0.1	0.52	
Copper	100	<0.05	<0.05	<0.05	<0.10	<0.05	0.2	<0.05
Nickel		<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Cobalt		<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.96
Zinc	500	0.28	7.4	19.6	1	0.23	1.9	30
PCBs	0.3	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.007

1. <= Less than the detection limit indicated

Table VI-45: X-Ray Fluorescence and Correlating Atomic Absorption Inorganic Results

Delineation Sample	Corresponding Assessment Sample	Depth cm	XRF			AA							
			Cu ppm	Pb ppm	Zn ppm	Cu ppm	Ni ppm	Co ppm	Cd ppm	Pb ppm	Zn ppm	Cr ppm	As ppm
	G6121	0-10	11000	6300	16000	3200	24	12	1.8	31000	3200	46	13
	G6123	0-10	200	160	530	280	31	15	<1.0	4300	350	64	6.8
	G6100	0-10	130	920	1000	120	27	12	2.3	6300	3200	84	3.8
	L6103A	0-10	52	240	88	58	39	18	<1.0	81	250	60	9.4
	L6105	0-10	61	300	110	71	35	17	<1.0	76	420	54	8.4
	G6159	0-10	20	86	-	38	16	14	1.1	24	3.5	41	4.8
	G6161	0-10	110	160	230	63	28	16	<1.0	260	240	67	4
	G6179	0-10	19	35	-	47	32	17	<1.0	11	94	65	6.5
	G6181	0-10	48	88	-	38	33	14	<1.0	<10	71	55	5.2
	L6110-D	30-50	32	120	1300	76	28	13	<1.0	21	64	47	9.7
SN1-1	G6100	0-10	55	2600	3700	60	26	13	1.2	5000	2200	79	4.2
SN1-2*	G6100	0-10	77	1500	1600								
SN 1-3	G6100	0-10	34	2000	3600								
SN 1-4*	G6100	0-10	53	1700	2100								
SN1-4D	G6100	0-10				48	32	17	<1.0	110	150	66	5.1
SN1-5*	G6100	0-10	65	420	430								
SN1-6	G6100	0-10				44	28	13	<1.0	1200	700	78	3.7
SN1-7	G6100	0-10				55	31	15	<1.0	760	340	73	5.2
SN 1-8	G6100	0-10	46	720	480								
SN1-9	G6100	0-10	53	1600	940	69	36	16	<1.0	1800	760	70	5.7
SN1-10	G6100	0-10				45	32	15	<1.0	470	330	75	1.3
SN 1-11	G6100	0-10	63	430	360								
SN1-12	G6100	0-10				83	34	16	<1.0	300	520	72	4.6
SN1-13	G6100	0-10				92	36	17	1	720	450	74	5.8
SN1-14	G6100	0-10				349	33	16	1.3	840	490	68	4.3
SN 1-15	G6100	0-10	390	890	910								
SN 1-16	G6100	0-10	59	310	250								
SN 1-17	G6100	0-10	110	300	260								
Sn 1-18	G6100	0-10	65	580	440								
SN1-19	G6100	0-10	40	300	330								
SN1-20	G6100	0-10	180	720	490								
SN1-21	G6100	0-10	92	320	440								
SN1-22	G6100	0-10	120	360	360								
SN22-A	G6121	0				23000	17.1	6.4	8.7	110000	11000	54	5.2
SN22-1	G6121	0-10	4300	6800	14000	2300	26	15	4.2	27000	5400	61	19
SN22-2	G6121	0-10				2800	13	5.4	8.5	370000	35000	44	2.7
SN22-3	G6121	0-10	650	4900	13000	470	25	15	2.5	15000	3600	79	32
SN22-4	G6121	0-10				580	33	14	<1.0	6600	760	82	7.1
SN22-5	G6121	0-10				500	27	15	<1.0	16000	780	82	7.3
SN22-6	G6121	0-10				190	32	14	<1.0	1100	189	70	6.5
SN22-7	G6121	0-10	120	190	59000	140	32	16	<1.0	90000	280	44	64
SN22-8	G6121	0-10				1200	33	15	5.4	9200	2300	65	12
SN22-9	G6121	0-10				1000	31	14	2.5	15000	4900	62	26
SN22-10	G6121	0-10				6500	27	13	6.8	28000	7500	63	27
SN 22-11	G6121	0-10	110	620	190								
SN22-12	G6121	0-10				130	32	15	1.5	430	270	74	6.3

* value is the average of two or more analytical replicates

Table VI-45: X-Ray Fluorescence and Correlating Atomic Absorption Inorganic Results (cont'd)

Delineation Sample	Corresponding Assessment Sample	Depth cm	XRF			AA							
			Cu	Pb	Zn	Cu	Ni	Co	Cd	Pb	Zn	Cr	As
			ppm			ppm							
SN22-13	G6121	0-10				200	35	16	<1.0	1400	220	76	6.3
SN22-14	G6121	0-10				120	34	16	<1.0	2500	98	66	3.4
SN22-15	G6121	0-10				120	32	14	<1.0	7500	260	58	7.9
SN22-16	G6121	0-10				50	7.8	6.2	5.7	520	350	<20	2.2
SN22-17	G6121	0-10				220	18	8	1.1	73000	240	34	65
SN22-18	G6121	0-10				3800	41	17	<1.0	15000	580	68	1.7
SN22-19	G6121	0-10				74	17	6.3	0.99	200000	170	39	77
SN 22-20	G6121	0-10	71	170	140								
SN 24-1*	G6123	0-10	180	130	480								
SN24-2	G6123	0-10	590	320	2000	1220	28	17.2	<1.0	7200	422	66	4.8
SN 24-3	G6123	0-10	420	2000	1300								
SN 24-4*	G6123	0-10	130	440	450								
SN24-5	G6123	0-10				290	34	17	<1.0	2300	280	280	5
SN24-6	G6123	0-10				210	27	16	<1.0	1200	200	79	2.7
SN24-7	G6123	0-10				90	29	17	<1.0	560	120	54	2.6
SN24-8	G6123	0-10				110	35	18	1.1	920	220	85	7.8
SN24-9	G6123	0-10				220	35	20	1.2	1200	270	68	4.5
SN24-10	G6123	0-10				1200	37	16	1.2	3100	200	70	4.4
SN33-1	SN047	0-10											
SN33-2	SN047	0-10											
SN 33-3	SN047	0-10	120	680	2800								
SN33-4	SN047	0-10				290	48	25	1.3	1100	3400	110	4.2
SN 33-5	SN047	0-10	66	210	530								
SN 33-6	SN047	0-10	76	110	240								
SN 33-7	SN047	0-10	<20	<20	160								
SN33-8	SN047	0-10											
SN33-9	SN047	0-10											
SN33-10	SN047	0-10											
SN33-11	SN047	0-10											
SN33-12	SN047	0-10											
SN 33-13	SN047	0-10	160	84	400								
SN33-14	SN047	0-10				52	56	20	2.9	600	900	150	3.8
SN33-15	SN047	0-10											
SN33-16	SN047	0-10											
SN33-17	SN047	0-10											
SN33-18	SN047	0-10											
SN33-19	SN047	0-10											
SN33-20	SN047	0-10											
SN33-21	SN047	0-10											
SN33-22	SN047	0-10											
SN 33-23	SN047	0-10	49	40	170								
SN33-24D	SN047	30-50											
SN 33-25D	SN047	30-50	<20	82	160								
SN 33-25D	SN047	30-50	<20	61	160								

* value is the average of two or more analytical replicates

Table VI-45: X-Ray Fluorescence and Correlating Atomic Absorption Inorganic Results (cont'd)

Delineation Sample	Corresponding Assessment Sample	Depth cm	XRF			AA								
			Cu	Pb	Zn	Cu	Ni	Co	Cd	Pb	Zn	Cr	As	
			ppm			ppm								
SN 39-1*	SN046	0-10	51	80	82									
SN39-1A	SN046	20-40	66	120	45									
SN 39-2*	SN046	0-10	86	630	320									
SN 39-3*	SN046	0-10	36	99	68									
SN 39-4	SN046	0-10	64	71	85									
SN 39-5*	SN046	0-10	66	94	98									
SN 39-6*	SN046	0-10	38	83	69									
SN 39-7*	SN046	0-10	65	65	40									
SN39-8	SN046	0-10	160	110	180	280	33	15	<1.0	560	110	85	6.2	
SN39-9	SN046	0-10	86	85	-	40	35	19	<1.0	25	96	76	6.5	
SN39-10	SN046	0-10	84	120	210	94	31	16	<1.0	280	110	64	2.5	
SN39-11	SN046	0-10	280	250	340	380	32	16	6.2	920	290	86	4.8	
SNCP-1	SN049	0-10												
SNCP-2	SN049	0-10												
SNCP-3	SN049	0-10												
SNCP-4	SN049	0-10												
SNCP-5	SN049	0-10												
SNCP-6	SN049	0-10												
SNCP-7	SN049	0-10												
SNCP-8	SN049	0-10												

* value is the average of two or more analytical replicates

Table VI-46 Test Kit and Correlating GC/ECD PCB Results for Delineation Soil Samples

Delineation Sample	Corresponding Assessment Sample	Test Kit	GC/ECD	Relative Standard Deviation
		PCB	Aroclor 1254	
		ppm	ug/g	
SNCP-1	SN049	> 50	302	-
SNCP-2	SN049	> 50	393	-
SNCP-4	SN049	1.24	13.9	30
SNCP-5	SN049	> 50	633	-
SNCP-6	SN049	20	1840	35
SNCP-7	SN049	30	59	12
SNCP-8	SN049	>50	1545	-
SN33-1	SN047	(> 50) or (38)	430	-
SN33-2	SN047	0.5	1.9	21
SN33-3	SN047	1.5	1.0	7.1
SN33-4	SN047	> 50	525	-
SN33-5	SN047	1.25	14.4	30
SN33-6	SN047	1.13	1.2	1.1
SN33-7	SN047	0.76	<0.5	-
SN33-8	SN047	1.72	96	34
SN33-12	SN047	1.1	4.5	21
SN33-13	SN047	0.2	0.6	18
SN33-16	SN047	1.95	6.4	19
SN33-18	SN047	1.2	2.5	12
SN33-22	SN047	0.38	9	32
SN33-23	SN047	0.22	1.2	24
Average Rel Std Dev (n=21)				21
Std Dev				10

Table VI-47: Inorganic and PCB Results for Barrel and Oil Samples

Sample	Signature	Cl	PCB (ppm)	Pb	Cr	Cd	Location
SN-BS1	Water	<100	<2.0	-	-	-	Clear fluid some rust on bottm, barrel labelled One
SN-BS2	Oil and Grease	<1000	<2.0	*	*	*	Tar barrel next to truck cab (army green)
OIL-1	-	-	49 ^a	29	<10	0.60	Used engine oil filter

a. Detected as Aroclor 1254



**Table VI-48: Compounds Detected in Open Scan of G6126
Fraction 1 Extract¹**

Peak #	Inferred compound	MW	Abundance ²
1	pentachlorochlordene	302	2
2	chlordene	336	2
3	chlordene-II	336	5
4	dihydrochlordene	338	1
5	heptachlor	370	10
6	a-chlordene	336	3
7	C ₁₁ H ₇ Cl ₇	384	4
8	dihydroheptachlor	372	2
9	heptachlor isomer	370	2
10	gamma-chlordene	336	3
11	beta-chlordene	336	3
12	unknown	384	2
13	unknown	332	1
14	heptachlor isomer	370	2
15	heptachlor isomer	370	1
16	dihydroheptachlor + chlordane isomer	336/372	5
17	dihydroheptachlor	372	2
18	unknown	?	1
19	dihydroheptachlor + heptachlor isomer	372/394	1
20	dihydroheptachlor	372	1
21	unknown	?	3
22	trans-chlordane	406	10
23	octachordane+heptachlor isomer	406/370	4
24	cis-chlordane	406	8
25	trans-nonachlor	440	9
26	octachlordane	406	1
27	octachlordane + unknown	406/420	2
28	C ₁₁ H ₃ Cl ₉	454	1
29	C ₁₁ H ₇ Cl ₉ isomer	454	2
30	octachlordane	406	2
31	C ₁₁ H ₇ Cl ₉ isomer	454	2
32	nonachlordane	440	1
33	nonachlor + octachlordane	406	4
34	octachlordane + unknown	406/454	3
35	octachlordane + unknown	406/454	3
36	nonachlordane + unknown	440/406	3
37	unknown	406/?	1
38	C ₁₁ H ₇ Cl ₉	454	1
39	nonachlordane	440	1
40	C ₁₁ H ₇ Cl ₉	454	2

¹ The following section was added on 11 April 1996 as the result of receipt of additional analytical results which were pending at the time of publication of this report (31 March 1996). A total of four addenda have been inserted following pages III-40, IV-4, VI-120 and VI-134.

² Relative abundance, 10 = major component, RIC > 90 % FS, 1 = minor component, RIC < 10%