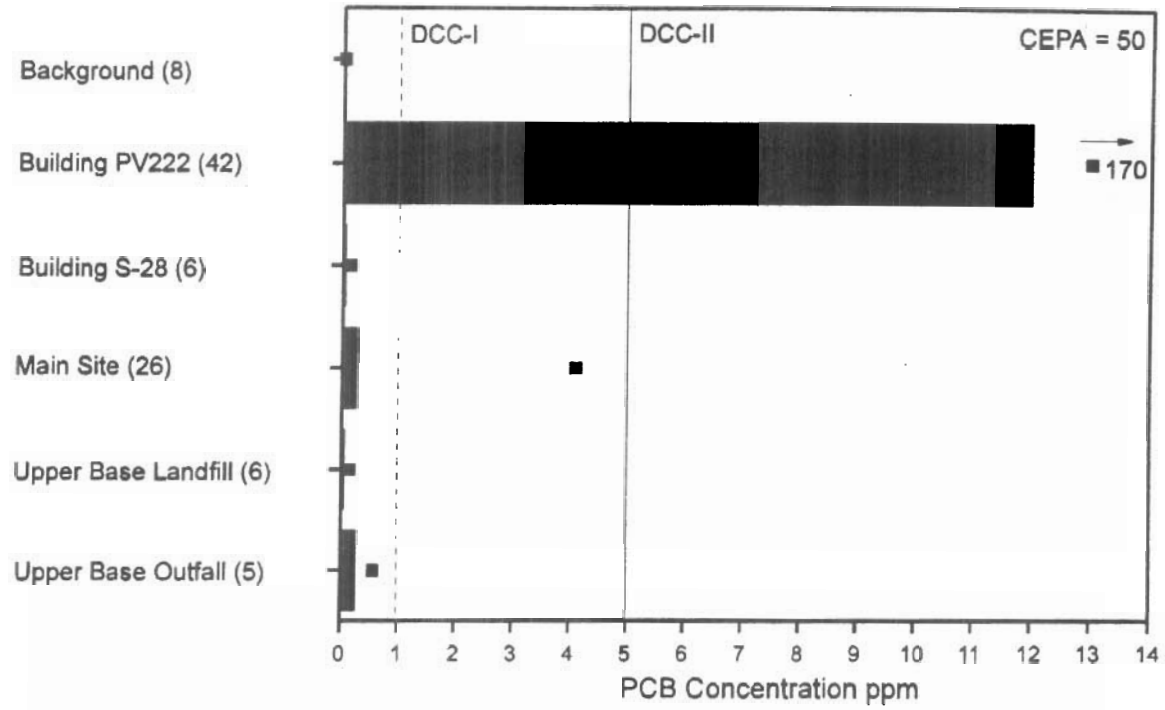


Figure II-1: PCB Mean and Maximum in Soil for Areas at the Upper Base

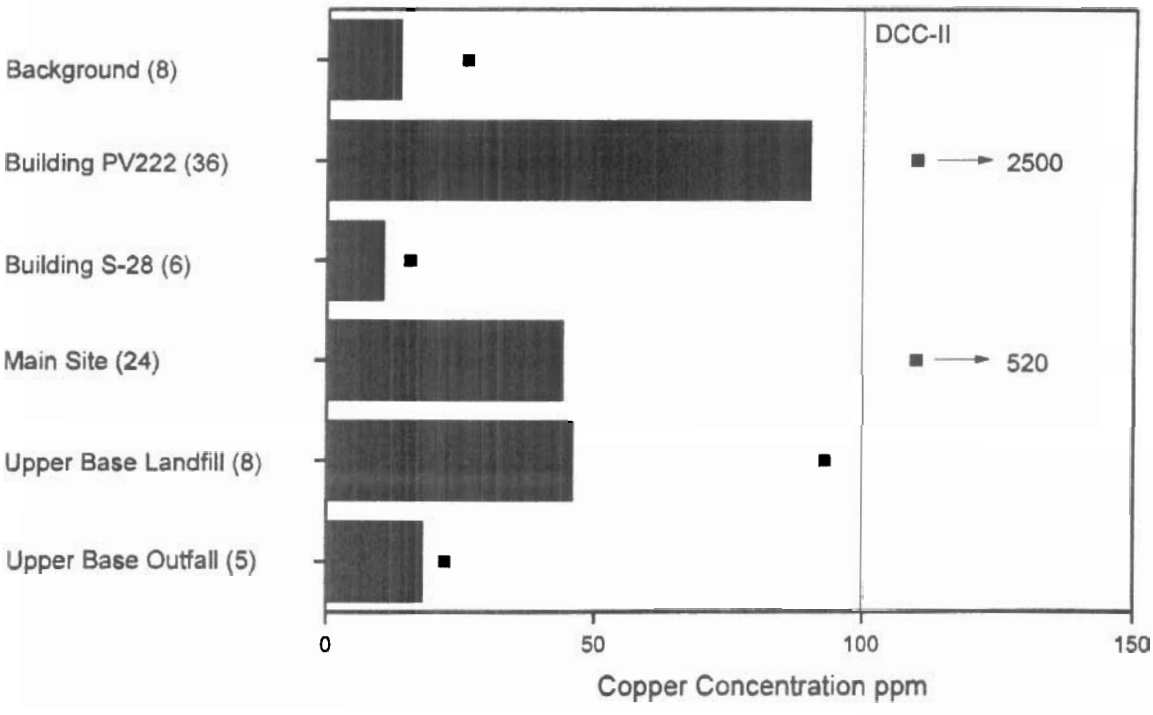


Figure II-2: Copper Mean and Maximum in Soil for Areas at the Upper Base

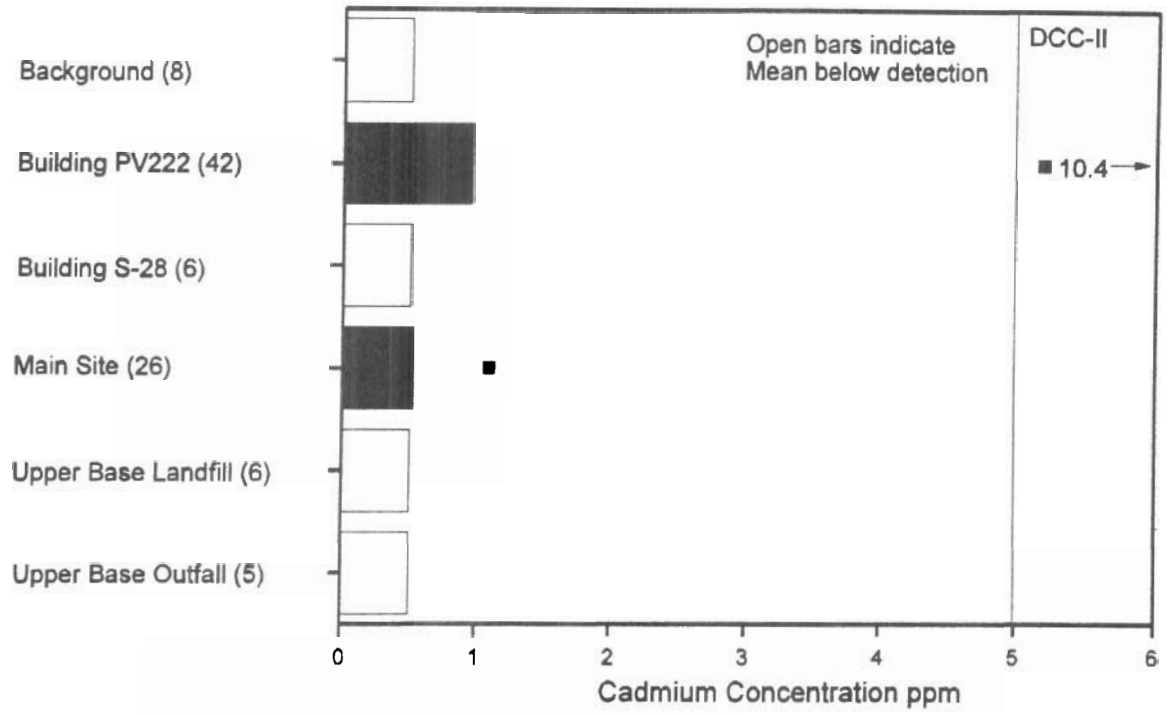


Figure II-3: Cadmium Mean and Maximum in Soil for Areas at the Upper Base

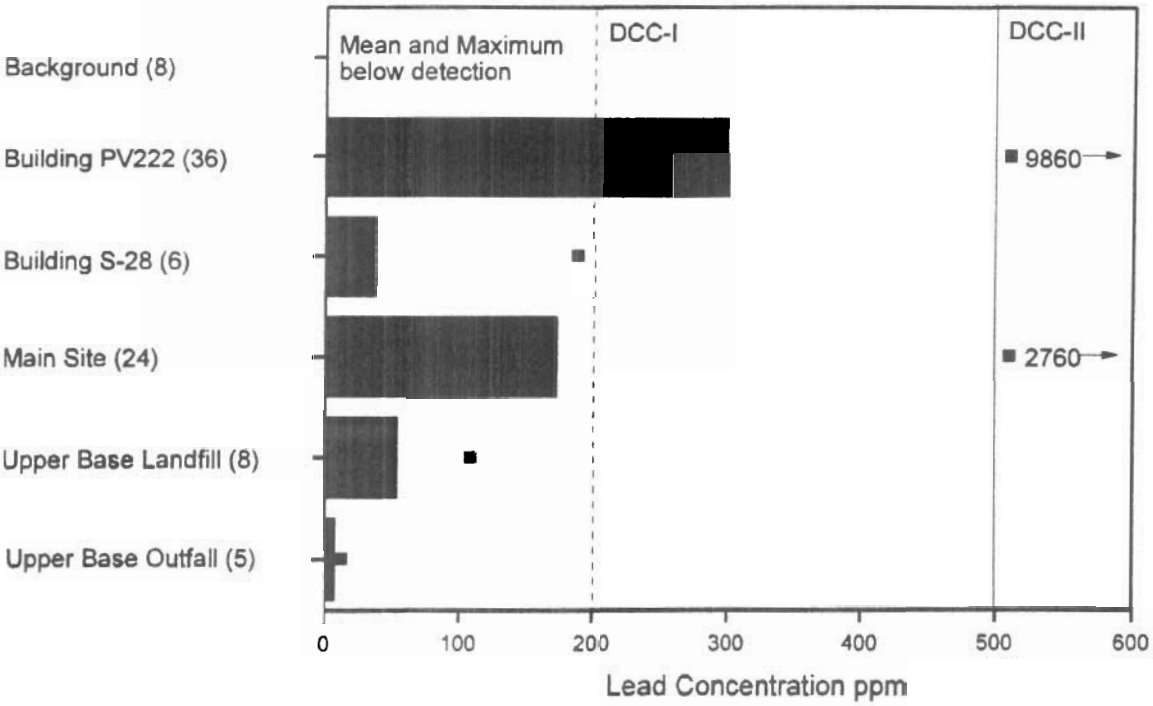


Figure II-4: Lead Mean and Maximum in Soil for Areas at the Upper Base

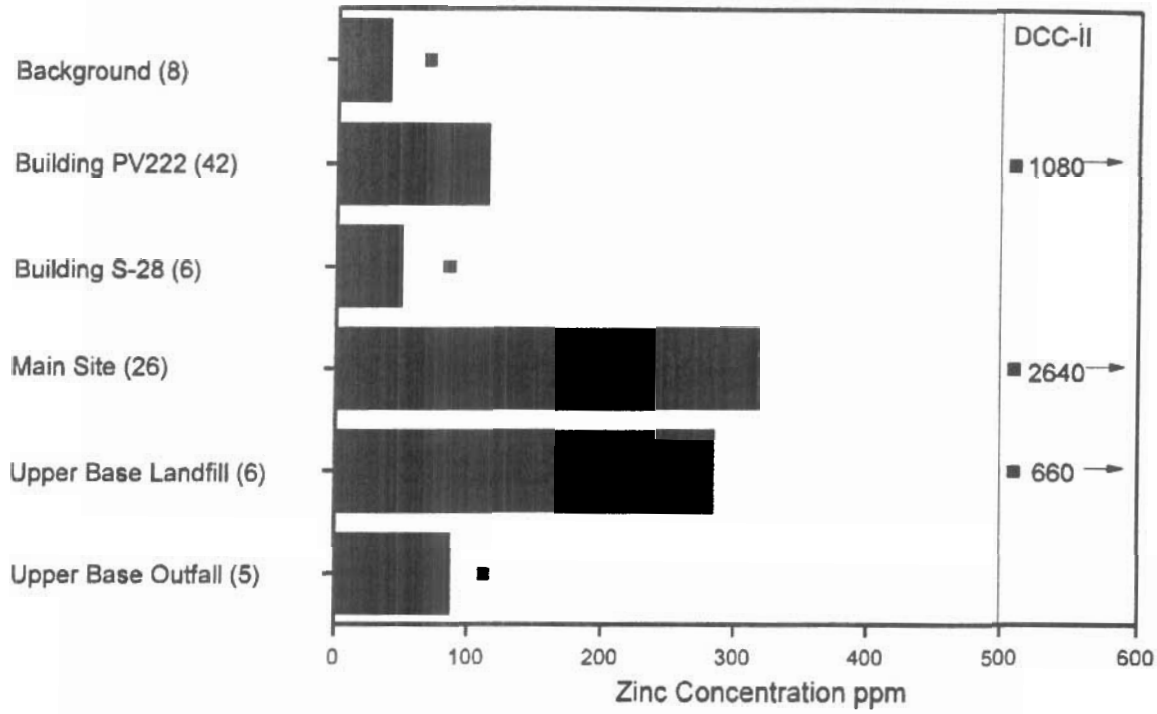


Figure II-5: Zinc Mean and Maximum in Soil for Areas at the Upper Base

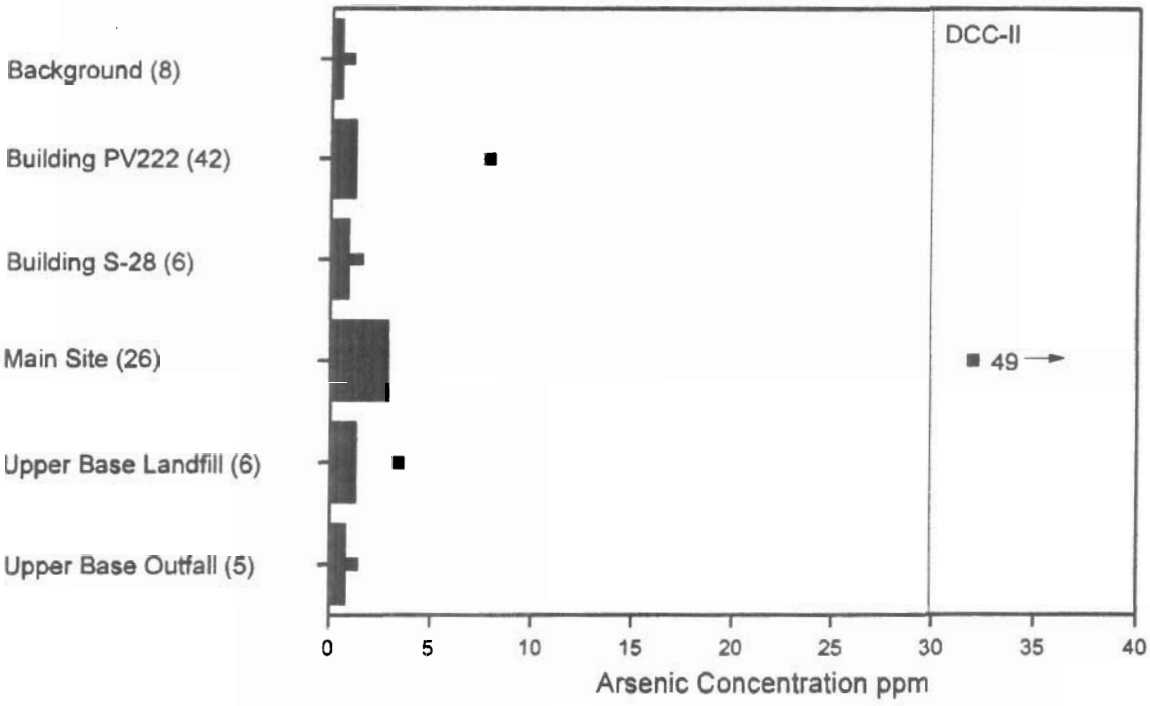


Figure II-6: Arsenic Mean and Maximum in Soil for Areas at the Upper Base

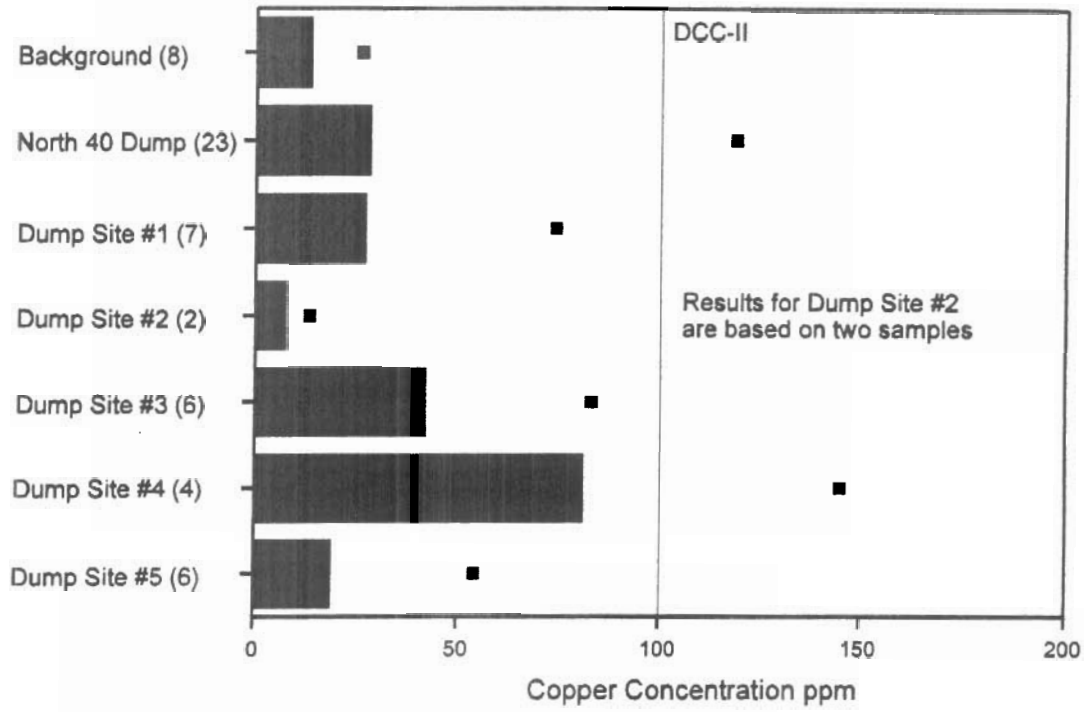


Figure II-7: Copper Mean and Maximum in Soil collected at the Dump Sites

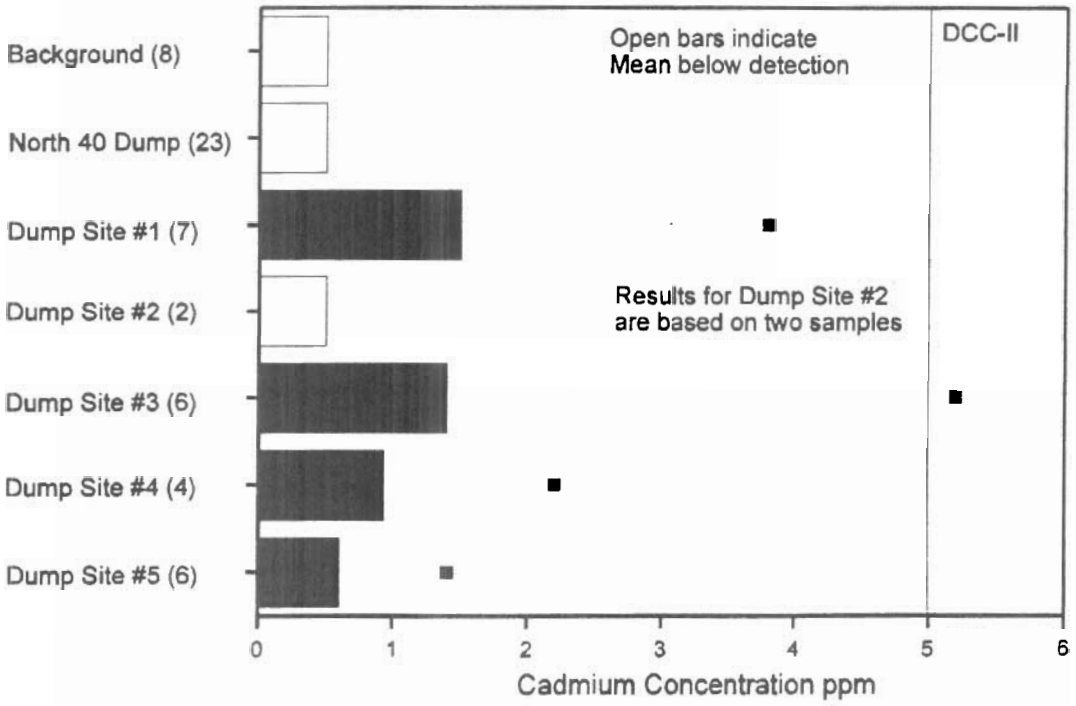


Figure II-8: Cadmium Mean and Maximum in Soil collected at the Dump Sites

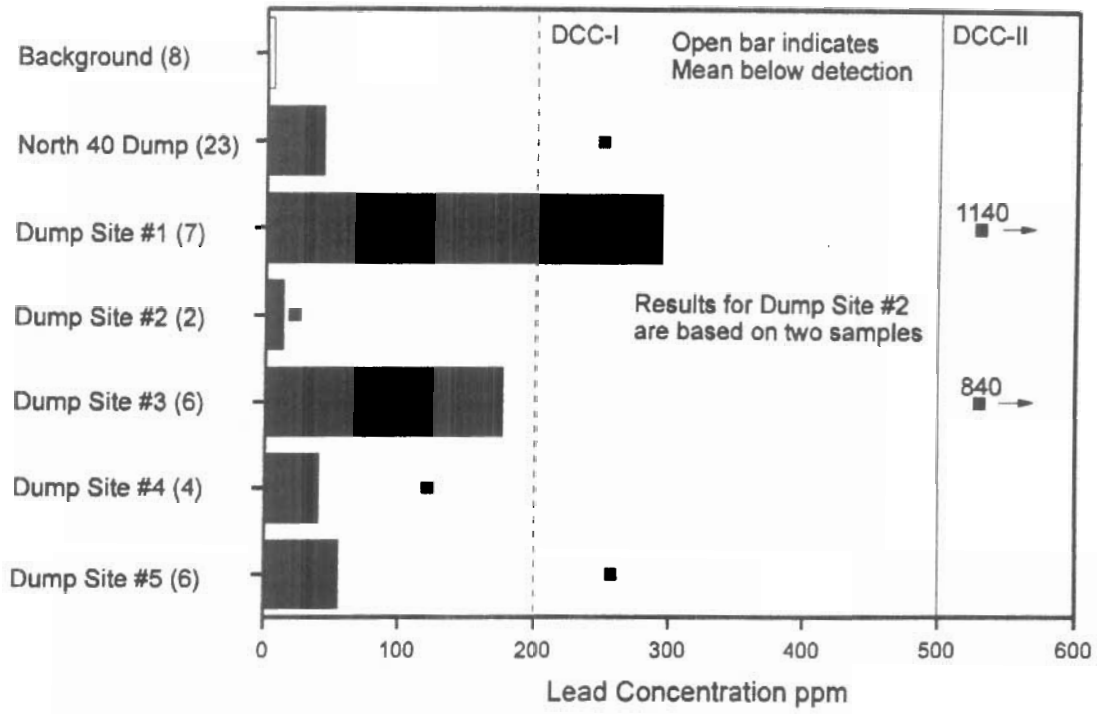


Figure II-9: Lead Mean and Maximum in Soil collected at the Dump Sites

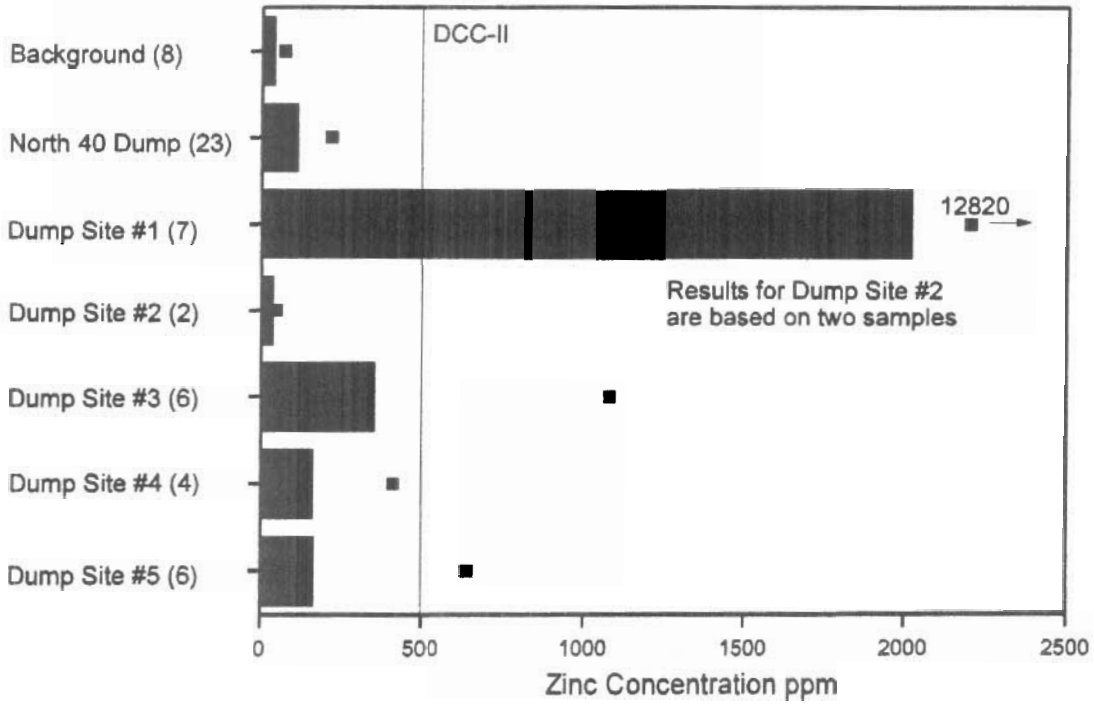


Figure II-10: Zinc Mean and Maximum in Soil collected at the Dump Sites

III. BACKGROUND

A. General

1. Location

Iqaluit overlooks the western end of Frobisher Bay at the southern tip of Baffin Island, in the Nunavut region of the Northwest Territories (63° 45' N, 68° 31' W, 29 m asl, Heming 1986; Map III-1). The town is situated on a fluvial plain on the north shore of the mouth of Koojesse Inlet, surrounded on three sides by the rolling hills of Hall Peninsula. The hills, consisting largely of Pre-Cambrian granite outcrops, form part of the Canadian Shield. Scattered at various points on the outskirts of the town are the six dump sites and the former radar site which are the subject of this report.

Dump Site #1, also known as the Sylvia Grinnell Park Dump, is in the West 40 area of Iqaluit off the southwest end of the old gravel runway, overlooking Sylvia Grinnell River. Dump Site #2 borders Frobisher Bay, near the West 40 Summer Camp area. Just north of Dump Site #2 and east of the causeway access road is Dump Site #3, the site of one of the old USAF dumps, and the site of the new municipal landfill. The current municipal dump, which is slated for closure in the spring of 1995 - Dump Site #4 - overlooks Koojesse Inlet to the northeast. The Apex Dump, used by the town and by Apex village until 1979, occupies a steep cliff over Tarr Inlet in Apex, approximately 3 km from Iqaluit. The North 40 Dump is a large waste metal disposal site which lies in the fluvial plain of Carney Creek in the North 40 area of the town. The former radar communications facility known as the Upper Base is located above and north of Iqaluit on the highest peak in the area.

2. History

The present-day town of Iqaluit (the word for "fish" in Inuktitut) is located near the site of a traditional Inuit fishing camp (Heming 1986). Archeological sites in the vicinity indicate a long history of Inuit occupation of the area (Hamilton 1993).

The first Europeans to arrive in the area were Martin Frobisher and his crew in 1576. This group of Englishmen were on an early journey of exploration in search of the elusive Northwest Passage. The objective of this voyage, and others like it, was to find a trade route through the Arctic Archipelago to China. Frobisher's first meeting with the South Baffin Inuit was not a friendly one. After five of his crewmen "disappeared", he

retaliated by kidnapping an Inuk, and taking him and his kayak back to England to be displayed as curiosities. It was reported that the Inuk later entertained Queen Elizabeth I by staging an exhibition hunt of royal swans in a palace pond (Heming 1986).

Frobisher ventured only about two thirds of the way into Frobisher Bay, which he believed to be a strait. He found some ore on a small island, and loaded his ship with it, convinced that it was gold. In 1578 he made a second voyage to the area with 15 ships, in order to set up a mining colony. He brought with him settlers, miners and a large prefabricated wooden house (Heming 1986), but most of his ships sank in a storm. When the remnants of the expedition returned to England, they found that the ore was not the hoped-for gold, but worthless iron pyrites.

During the eighteenth and nineteenth centuries, the Frobisher Bay area was frequently visited by British and American whalers, who were to have a lasting impact on the Inuit communities. The development of trade and the adoption of such customs as square dancing and a taste for the music of the concertina are examples of some of the lasting influences of these visits (Heming 1986). C.F. Hall travelled to the end of the bay in 1861, finally proving - to Europeans at least - that it was, in fact, a bay and not a strait (Heming 1986).

Early this century, the London-based Sabellum Company maintained a small trading post in the area at Mingoatuk. The area was eclipsed in importance by the emergence of Pangnirtung to the North and Lake Harbour to the south, and the trading post closed in 1927. As a result, few Inuit camped in the vicinity of Iqaluit for long. Despite the small local population, in 1914 the Hudson's Bay Company set up a trading post on the shores of Frobisher Bay, and in 1948, after several moves, the post was finally established at Apex (Hamilton 1993).

Most of the development associated with Iqaluit - the most important of which was the construction of an airstrip - was a direct result of the activities of the United States Army Air Force during the Second World War. The rationale for building an airstrip in such a remote area was that Iqaluit (then Frobisher Bay) was a strategically advantageous location. The Americans feared that the German army might attack North America via Greenland, especially if Britain were to capitulate. Also, it was felt that the airstrip at Frobisher Bay could serve as a treatment area for soldiers evacuated from the front lines (Grant 1988). Most importantly, though, the airstrip at Frobisher Bay was to be part of the North Atlantic Ferry Route.

The idea of an "Atlantic Bridge" of airstrips was put forward in July 1940 when it became apparent that additional bases were needed in order to ferry short-range aircraft to the European theater of operations (Dziuban 1954). As part of this objective, Captain Elliot Roosevelt, son of President Theodore Roosevelt, led a survey party along the coast of Labrador and on to Baffin Island, reaching the site of Frobisher Bay in July 1941. By this time the season was too far advanced to undertake any significant airfield construction, but the American government nonetheless asked permission of Canada to build a meteorological station on the site, to be code-named Crystal II. Permission was granted, and the weather station was in operation by the end of the year (Dziuban 1954).

The United States Army Air Force estimated that air traffic would reach its peak in 1943. With this in mind, the North Atlantic Ferry Route was designed to handle 100 combat and 40 transport aircraft daily. To accommodate this amount of traffic, and to meet foreseeable future needs, the airfields had to be between 400 and 500 miles apart and suitable for expansion (Dziuban 1954). Approval was subsequently given to a plan called the Crimson Project, calling for the construction of nine airbases to be built and financed by both the American and Canadian governments. The agreement stipulated that all facilities in Canada would become Canadian property six months after the cessation of hostilities (Dziuban 1954).

The establishment of an airbase at Frobisher Bay was considered an urgent matter. Despite the logistic and transportation problems of undertaking construction in the Arctic, building progressed quickly: the runway was useable but unpaved, and the planned housing was 50% completed by January 1943 (Dziuban 1954), at which time construction operations were abruptly halted.

Ironically, rapid advancements in aviation and marine technology had led to a dramatic re-appraisal of the North Atlantic Ferry Route: the flying range of aircraft had increased tremendously, and transport of aircraft by water had greatly improved (Dziuban 1954). By April 1943 it became apparent that, as a result of these advances, the need for such a route had greatly diminished. The upshot was that Frobisher Bay was downgraded to an emergency airfield; although meteorological activity was curtailed, the runway was paved (Dziuban 1954).

Overall, the North Atlantic Ferry Route achieved its intended purpose. The numbers of aircraft traveling over the route increased yearly from 26 in 1940 to 1,450 in 1943. The route also proved useful at the end of the war in Europe by hastening the return

of servicemen awaiting discharge, and by redeploying tactical aircraft into other theaters of operation (Dziuban 1954).

Despite the fact that Frobisher Bay was the largest and most active of the Crimson bases, fewer aircraft used the airbase than had been previously anticipated, due it its changed role as part of the Ferry Route. Only 323 aircraft arrivals were recorded for 1943. That number includes aircraft carrying out resupply, aerial photography and other miscellaneous missions (Dziuban 1954).

The expense and effort required to create and maintain the extensive facilities at Frobisher Bay were great, particularly considering this small volume of air traffic. Aside from the airstrip, hangars, workshops and other buildings necessary to the operation of an airfield, there were mess halls, a movie theater, soda fountain, hospital, Turkish bath house and laundry to accompany the extensive officers' housing and enlisted men's barrack quarters that were never more than partly occupied (Grant 1988).

The airfield at Frobisher Bay was released to Canada on September 1, 1950. The United States Government to that time had invested a total of $8,065,700 in the base (Dziuban 1954). From that figure $6,833,190 was assessed as being of permanent value and therefore repayable by Canada. Prior to the release date, the airfield at Frobisher Bay had been entirely financed, maintained and controlled by the United States.

Handing over the base seems to have been a post-war formality more than anything else, since the American forces were re-occupying the base by 1951. This was due in large part to the flourishing Cold War and the threat of an airborne nuclear attack from the Soviet Union.

During this time the relatively long airstrip at Frobisher Bay was utilized by aircraft under the aegis of the Strategic Air Command. The base was used primarily as a refueling stop for aircraft destined for Greenland (Hamilton 1993), and also proved useful during the construction of the DEW Line, which began in 1955. Frobisher Bay was to become the administrative and logistical centre for the eastern Arctic portion of that project (Hamilton 1993).

Communication from remote Arctic sites to locations in the South was a major concern during the early days of electronic surveillance. In 1954-55 the Upper Base at Iqaluit was constructed as part of the Pole Vault Tropospheric Scatter Line which extended from Frobisher Bay to Gander, Newfoundland and was built to serve as a

reliable voice and teletype link to the South (Map III-2). The Upper Base was considered a large station on the Pole Vault Line. It included both search and height finding radar, and was manned by approximately 130 personnel (Fletcher 1990). In 1956 the Pole Vault Line was extended to Cape Dyer, the easternmost site of the DEW Line (Fletcher 1990).

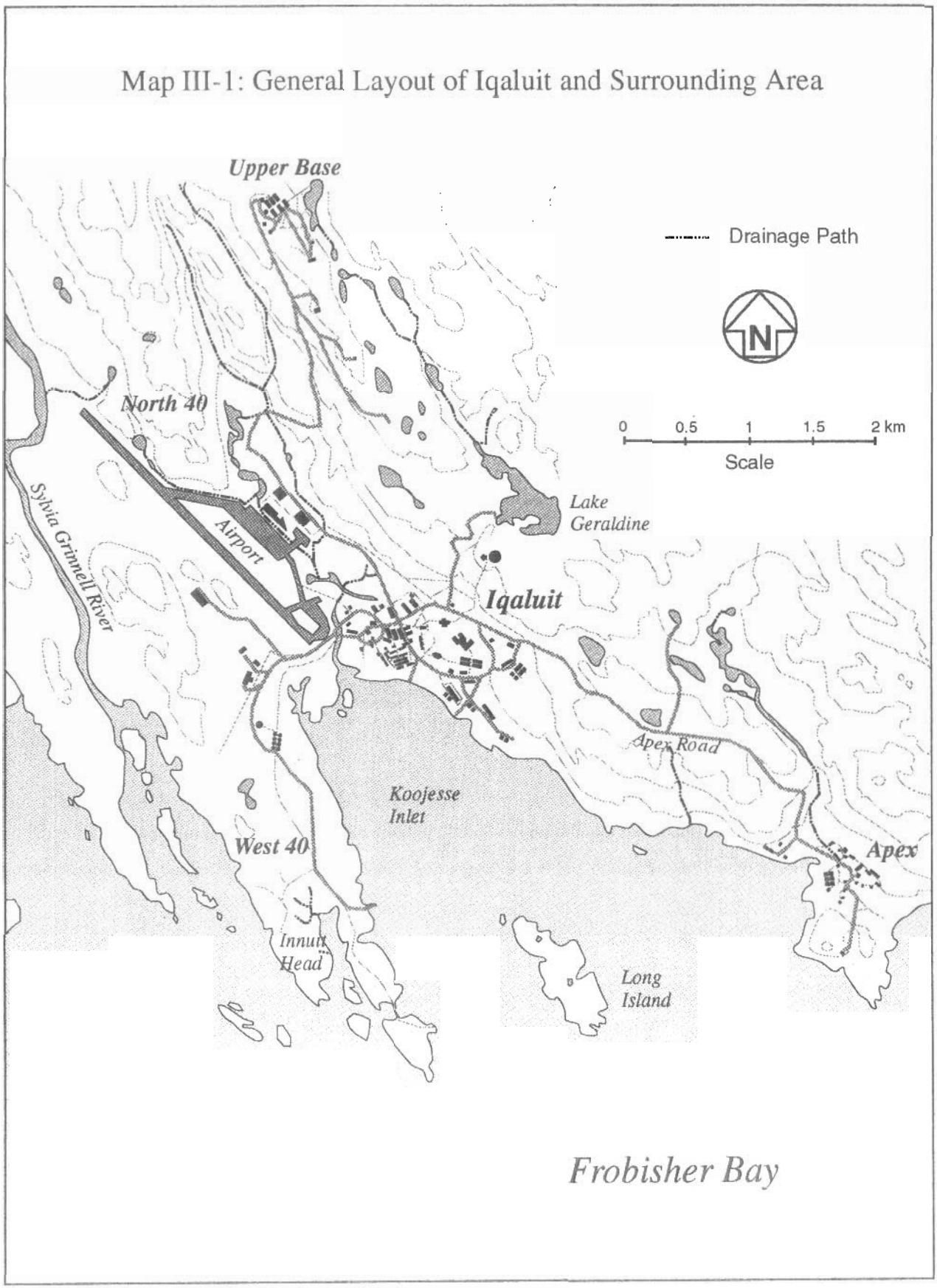
Despite serious outbreaks of measles and influenza, Inuit continued to join the small community adjacent to the Strategic Air Command base. By 1955 there were about 100 people living there, in an area that was off-limits to military personnel (Hamilton 1993). People were settling there in part due to a decline in the number of animals to trap for furs in the area and because Frobisher Bay offered the opportunity for short term wage employment, and the possibility of obtaining some modern amenities (Heming 1986).

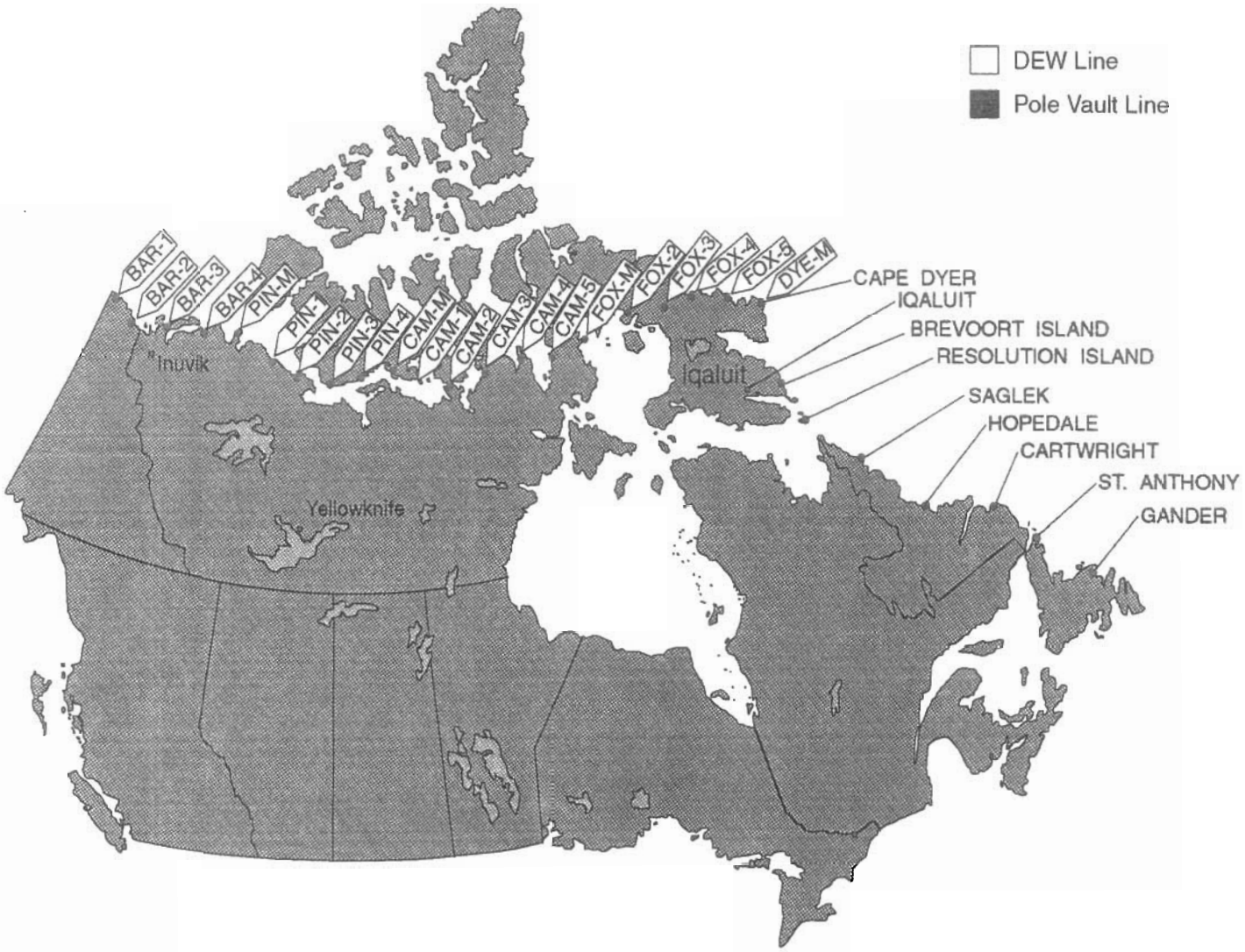
In 1955 the federal government established a model community at Niaqunngut (Apex) approximately 3 km from the Strategic Air Command base. The government built a school, nursing station, laundry, a social services centre and a garage. The Hudson's Bay Post had moved to the site seven years earlier. After the Americans left Frobisher Bay, however, attention gradually shifted back to the vicinity of the base (Hamilton 1993).

The American forces left Frobisher Bay in 1963. The Federal government instituted an Eastern Arctic Regional Headquarters office there in 1959, in an effort to create a stable economic base after the Americans departed (Heming 1986).

Frobisher Bay rapidly became the transportation, education, and communication centre for the Eastern Arctic. The first school was built in 1955, and the first hospital in 1964. Subsequently, the RCMP chose Frobisher Bay as their eastern Arctic subdivision headquarters (Heming 1986). Frobisher Bay achieved town status in 1980, and on January 1, 1987 the town name was officially changed to Iqaluit (Heming 1986).

Map III-1: General Layout of Iqaluit and Surrounding Area





Map III-2: Location of Iqaluit in Relation to the DEW and Pole Vault Lines

B. Previous Studies

A great deal of information concerning the seven sites addressed in the current investigation has accumulated, from municipal monitoring programs, from studies into the state of solid waste disposal practices in Iqaluit, and from environmental assessments commissioned by the municipality and federal agencies. Aside from the removal of PCB-containing electrical equipment resulting from the activities of the PCB Inter-Agency Committee, no remediation of the sites has been undertaken as a direct result of these studies. A new municipal landfill was built in Dump Site #3 in October 1994 following the specifications outlined in the 1991 report by UMA Engineering Limited, and will permit closure of the current municipal dump (Dump Site #4) as recommended in several of the reports outlined below. The current study addresses the unanswered questions regarding the environmental impact of these sites. Previous work is described in greater detail on a site-by-site basis in Chapter V.

1. Municipal Monitoring Programs

i. Iqaluit Watershed Monitoring Program

In 1981, in recognition of the potential for contaminant migration to the community's water supply lake in drainages from the Upper Base, a watershed monitoring program was initiated by Indian and Northern Affairs Canada (DIAND), in conjunction with the Government of the Northwest Territories Department of Public Health (DIAND File #B5565-5-F15, 9 Nov. 1994). To date 49 water samples have been collected as part of this program and PCBs have been detected in only two of these (detection limit 0.020 ppb) - the 1985 and 1987 samples collected from the Water Treatment Plant - and PCB levels in these did not exceed the Canadian Drinking Water Quality Criteria.

In addition to the water samples, soil/sediment has been collected on nine occasions from locations above the water lake as part of the watershed monitoring program; one of these contained PCBs at a concentration which was detectable. The sample, collected in 1985 from the site of the 1983 PCB fluid spill outside Pole Vault Building 222 at the Upper Base, contained 174 ppm PCBs - a violation of the PCB regulations under the Canadian Environmental Protection Act.

ii. Iqaluit PCB Inter-Agency Committee

In conjunction with the Watershed Monitoring Program, a committee was struck in the early 1980s to oversee the removal of PCB-containing equipment from community buildings, dumps and the Upper Base, and to address concerns regarding environmental contamination by PCBs. The committee consists of representatives from six government agencies including Indian and Northern Affairs Canada, Environment Canada, the Renewable Resources branch of GNWT, Department of Transport, the Baffin Regional Board of Health and the Department of Fisheries and Oceans. The Iqaluit PCB Inter-Agency Committee has overseen the removal of hundreds of pieces of electrical equipment from buildings, warehouses and dumps in Iqaluit, and the collection of soil, water, vegetation and wall swab samples, to assess the degree of contamination resulting from the presence of said equipment. Details of the committee's activities with respect to each of the sites considered in the current environmental assessment are outlined on a site-by-site basis in Chapter V.

iii. Leachate Monitoring Program

The municipality of Iqaluit has, as part of its water license agreement, periodically collected leachate from both the current municipal dump (Dump Site #4) and the North 40 Dump to monitor a suite of water quality parameters. Leachate from these two active waste disposal sites ultimately drains into the northeast end of Koojesse Inlet. Elevated levels of inorganic elements and some organic contaminants have been detected in leachate collected from both sites.

2. *Waste Disposal Management Studies*

i. Evaluation of Solid Waste Disposal: Town of Frobisher Bay (OMM 1983)

A 1983 report by the engineering firm of Oliver, Mangione, McCalla and Associates, prepared for the Town of Iqaluit, outlines historical and current waste disposal practices in the town and presents two alternatives for future waste disposal.

A brief history of the use of each dump site in the West 40, the Apex Dump and the North 40 Dump is provided, followed by an assessment of the site's impact on the environment and recommendations for their cleanup. No sampling for chemical contamination was undertaken as part of this study. It was recommended that the active municipal dump be closed and that none of the dump sites be considered for future use as

a waste disposal site. The North 40 Dump did, however, figure in one of their recommendations for future waste disposal as described below.

The recommended waste disposal option was for the construction and design of a solid waste incinerator. This was to be placed adjacent to the Federal Building in order to take advantage of heat recovery. It was proposed that incineration residue and bulk wastes could be disposed of in part of the North 40 Dump. An alternative option was to establish a new landfill in an inactive pond and gravel pit northeast of the town and north of the road to Apex. The report contained costing for both these options as well as projections of volumes of disposable material that the town was expected to generate.

ii. Preliminary Engineering Report: Iqaluit Solid Waste Disposal Site (UMA 1991)

This report, commissioned by the Town of Iqaluit, provides details for the development of the historical USAF dump in the West 40 (Dump Site #3) into a solid waste disposal site for Iqaluit. The plan was to provide a waste disposal site for the community for a five year period, during which the search for a longer term solution to the town's waste disposal problems could be investigated. The report includes details of an analysis of the site's physical characteristics and the results of contaminant analyses for soil collected in the area. Requirements for the development of the site into a municipal landfill are outlined, and include regulatory considerations and environmental constraints. Operation procedures of the site and the costs of its construction, operation and reclamation are also provided.

The results of an environmental assessment are summarized in the site analysis section of the report and are outlined in detail in appendices at the end of the report. This assessment, subcontracted by UMA to the engineering firm Hardy BBT Limited, was undertaken as part of a geotechnical investigation to determine the physical and chemical properties of the fill and native subsoil present in the area of the dump. Results of analyses of nine soil samples collected from twenty bore holes of 1 to 5 metres depth are included in the appended report. The samples were analyzed for PCBs, hydrocarbons and a suite of metals including barium, chromium, copper, lead, mercury, molybdenum, nickel and zinc. Five samples were analyzed for BTEX and three for ABNs.

Samples from boreholes located only at the north end of the dump had concentrations of primarily PCBs (Aroclor 1260), copper, lead, zinc, PAHs and phenols