



**POINT LONELY SRRS
ALASKA**

**ADMINISTRATIVE RECORD
COVER SHEET**

AR File Number 40

INSTALLATION RESTORATION PROGRAM
PHASE II - CONFIRMATION/QUANTIFICATION
STAGE 1

FINAL REPORT

FOR

DEW LINE STATIONS
ALASKA

ALASKAN AIR COMMAND
ELMENDORF, ALASKA 99506

FEBRUARY 27, 1986

PREPARED BY

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PREFACE

As part of the U.S. Air Force Installation Restoration Program (IRP), investigations were undertaken at five DEW Line stations, Alaska, to determine whether hazardous material contamination is present. This report, prepared by Dames & Moore under Contract No. F33615-83-D-4002, Order 0021, presents the results of the Phase II, Stage 1 IRP investigations. The period of work reported on herein was 21 August through 23 August 84. The field investigations were directed by Dr. Kenneth J. Stimpfl. Mr. J. Michael Stanley, Senior Engineering Geologist, supervised field activities and collected surface water and soil samples. Ms. Carol J. Scholl, Staff Geologist, assisted in data interpretation and report preparation. Dr. Dee Ann Sanders, Technical Services Division, USAF Occupational and Environmental Health Laboratory (OEHL), was the Technical Monitor.

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<p>As part of the USAF IRP, 13 sites at five DEW Line stations, Alaska, were investigated determine the presence of hazardous material contamination resulting from past handling and disposal practices. Eight of the sites investigated were old dump sites, two are current dump sites, two are petroleum storage or spill sites, and the remaining site is a wastewater discharge area. Field investigations consisted of collecting grab samples of soil at two sites and surface water samples at 11 sites. Soil and surface water samples were subjected to chemical analyses for lead, phenols, TOX, PCBs, TOC, and oil and grease. Contamination of surface water by halocarbons, lead, oil and grease, and phenols and of soil by PCBs was indicated. Additional sampling and analyses are recommended to define the nature, extent, and potential for migration of contaminants.</p>				
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SUMMARY

The Distant Early Warning (DEW) Line Stations investigated in this study are located along the seacoast of the North Slope, Alaska. The Alaskan section of the DEW Line went into operation in 1953. The DEW System is part of the Alaskan Air Command (AAC). The stations have been operated by a civilian contractor since 1957. At present, FELEC Service, Inc. operates the sites, under the supervision of AAC personnel.

The Phase II field evaluation of the Installation Restoration Program (IRP) consisted of investigations at the following 13 sites that were identified during the Phase I records search:

BAR-M Station Kaktovik/Barter Island

- Site 1 - Old Dump Site
- Site 3 - Waste Petroleum Disposal
- Site 4 - Current Dump Site
- Site 8 - Drainage Cut Contamination
- Site 9 - Old Dump Site, N.W.

POW-3 Station Bullen Point/Flaxman Island

- Site 13 - Old Dump Site, East

POW-2 Station Point Oliktok

- Site 16 - Old Dump Site, N.W.

POW-1 Station Point Lonely

- Site 28 - POL Storage Area
- Site 31 - Old Dump Site
- Site 32 - Husky Oil Dump Site

LIZ-2 Station Point Lay

- Site 40 - Current Dump Site
- Site 43 - Old Dump Site, North
- Site 44 - Suspected Dump Site

The field investigation consisted of collecting soil grab samples at Sites 1 and 4 and collecting surface water samples at the remaining sites.

The water samples were analyzed for total organic carbon (TOC), total organic halogens (TOX), lead, phenols, oil and grease, polychlorinated biphenyls (PCBs), pH, and specific conductance. Soil samples were analyzed for lead, phenols, TOX, percent moisture, and PCBs.

The water quality analyses from the surface water samples indicate that lead levels were at the primary drinking water standard at Site 13 and elevated at Site 16. All water samples had elevated levels of TOX; the highest levels encountered were at Sites 32, 40, 3, 31, and 13. Phenols at Sites 32 and 40 and oil and grease at Sites 3 and 28 were elevated above the anticipated background levels. PCBs in soil at Site 1 were above the anticipated background level. The background levels for the contaminants detected would be extremely low for a remote, pristine environment such as the DEW Line stations. These results indicate minor surface water quality degradation caused by station landfills and petroleum storage and handling facilities. No drinking water supplies are threatened by contamination at these sites, since all drinking water is taken from freshwater lakes upgradient of these sites.

The following summarizes our recommendations and rationale:

Site	Recommended Action	Rationale
General	Resample surface water at all 11 sites sampled during the Stage 1 investigation, and sample surface water at Sites 1 and 4. Analyze for volatile halocarbons. Obtain one background surface water sample at each base (total of five). The samples should be obtained at locations upgradient of the sites under investigation. Analyze for volatile halocarbons.	To confirm the presence of contamination and define the particular halocarbons responsible for the elevated TOX levels found in Phase II, Stage 1. To ascertain whether contaminants may be migrating off site. To establish comparative background chemistry data.
BAR-M Site 1	Obtain three soil samples in fill material near the edge of the small stream sampled during Stage 1. Collect a soil sample from a nearby undisturbed area. Analyze for PCBs.	To confirm the presence of the contaminant detected during Stage 1 and to better define the magnitude and extent of this contaminant. To establish comparative background chemistry data.
BAR-M Site 3	Obtain a water sample from the pond adjacent to the storage tanks and analyze for oil and grease. Collect and analyze for oil and grease one surface water sample upgradient from the site.	To confirm the presence of this contaminant. To establish comparative background chemistry data.

Site	Recommended Action	Rationale
POW-3 Site 13, POW-2 Site 16	Resample lagoon waters at each site and analyze for lead. Collect and analyze for lead a surface water sample upgradient from each lagoon.	To confirm the presence of this contaminant and to ascertain whether there is a trend in contaminant concentration with time. To establish comparative background chemistry data.
POW-1 Site 28	Resample the ponded water adjacent to the tank farm and analyze for oil and grease. Collect and analyze for oil and grease one surface water sample upgradient from the site.	To confirm the results of the Stage 1 analysis. To establish comparative background chemistry data.
POW-1 Site 32	Resample the pond adjacent to the site and test for phenols. Collect and analyze for phenols one surface water sample upgradient from the site.	To confirm the presence of this contaminant. To establish comparative background chemistry data.
LIZ-2 Site 40	Resample the water ponded at the edge of this dump and test for phenols. Collect and analyze for phenols one surface water sample upgradient from the site.	To confirm the presence of this contaminant. To establish comparative background chemistry data.

I. INTRODUCTION

A. BACKGROUND

The Department of Defense (DOD) initiated the Installation Restoration Program (IRP) to investigate environmental contamination that may be present at DOD facilities as a result of past operations and waste disposal activities. Based upon the Resource Conservation and Recovery Act of 1976 (RCRA) and the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA, or "Superfund"), DOD issued the Defense Environmental Quality Program Policy Memorandum (DEQPPM) 80-6 in June 1980. DEQPPM 80-6 mandated that hazardous waste disposal sites on DOD facilities be identified, and the United States Air Force (USAF) implemented DEQPPM 80-6 in December 1980. DOD revised and expanded existing IRP directives through DEQPPM 81-5 in December 1981, and the USAF implemented it in January 1982. The IRP has been developed as a four-phased program:

- Phase I Problem Identification/Records Search
- Phase II Problem Confirmation and Quantification
- Phase III Technology Base Development
- Phase IV Corrective Action Development

The Phase I study at the Distant Early Warning (DEW) Line sites, North Slope, Alaska, was completed by CH2M Hill (1981). Dames & Moore has been retained by the USAF under Contract Number F33615-83-D-4002, Order 0021, to conduct the Phase II, Stage 1 field evaluation.

This report presents the results of Dames & Moore's field and laboratory investigations in the vicinity of waste disposal and handling areas of the DEW Line sites. Chemical analyses were performed by UBTL, Inc., of Salt Lake City, Utah, as subcontractor to Dames & Moore.

B. PURPOSE AND SCOPE

The purposes of the field evaluation portion of Phase II of the IRP were to:

1. Determine whether environmental contamination has resulted from hazardous material handling and disposal practices at the DEW Line sites;
2. Provide estimates of the magnitude and extent of contamination, if contamination was found; and

3. Identify any additional investigations and their attendant costs necessary to identify the magnitude, extent, and direction of movement of discovered contaminants.

The scope of work as outlined for Phase II, Stage 1 of the IRP consisted of the following activities:

1. Collection of surface water samples from shallow ponds and streams and near-surface soil samples near the sites identified;
2. Analyzing selected soil samples for lead, polychlorinated biphenyls (PCBs), phenols, and total organic halogens (TOX);
3. Analyzing selected water samples for total organic carbon (TOC), TOX, total dissolved solids (TDS), lead, phenols, PCBs, pH, and oil and grease; and
4. Preparing this report, which presents our findings.

Field work began on 21 August 84 and continued through 23 August 84.

C. HISTORY OF THE DEW LINE AND WASTE DISPOSAL OPERATIONS

The Alaska section of the DEW Line went into operation in 1953. After successful operation of the Alaska section, the remainder of the line extending across Canada and Greenland was constructed. The DEW Line was designed to detect and report all airborne vehicles operating within the designated detection capabilities of the surveillance radars (a total of 31, of which 6 are located in Alaska). Also included is the operation and maintenance of the DEW Communications System. The DEW System is part of the Alaskan Air Command (AAC); however, the system has been operated by a civilian contractor since 1957. At present, Felec Service, Inc. operates the sites. The contractor is monitored by AAC personnel.

Wastes generated at the DEW Line sites include Klystron tubes, mercury and low-level radioactive tubes, lead storage batteries, solvents (such as 1,1,1-trichloroethane, dichloroethane, methyl ethyl ketone, trichloroethylene, and acetone), dielectric fluids containing PCBs, waste petroleum, oil and lubricants (POL), spilled POL, paint thinners, and miscellaneous scrap metals. In the past, these wastes were disposed of in landfills or shoreline ravines or dumped on the sea ice, where they sank when the ice melted in the spring. Now liquid or solid wastes inappropriate for incineration are drummed or packaged and shipped to Seattle for disposal or are transferred to the Defense Property Disposal Office (DPDO) at Elmendorf Air Force Base (near Anchorage, Alaska). Some open burning still continues at a few of the sites (CH2M Hill, 1981).

D. DESCRIPTION OF SITES

CH2M Hill (1981) identified 44 sites along the Alaska DEW Line at which hazardous materials were generated, disposed of, or used in some activity. Each site was rated during the Phase I study using the Hazard Assessment Rating Methodology (HARM) developed by JRB Associates, Inc. (1980). This rating procedure utilizes site characteristics, waste characteristics, the potential for contaminant migration, and waste management practices to identify sites warranting further investigation. Ranking scores of 13 of the sites were deemed sufficiently high to warrant field investigation. A scope of work was issued to Dames & Moore on 19 July 84 under Contract F33615-83-D-4002, Order 0021, for Phase II, Stage 1 investigations at the following 13 sites:

BAR-M Kaktovik/Barter Island

- Site 1 - Old Dump Site
- Site 3 - Waste Petroleum Disposal
- Site 4 - Current Dump Site
- Site 8 - Drainage Cut Contamination
- Site 9 - Old Dump Site, N.W.

POW-3 Bullen Point/Flaxman Island

- Site 13 - Old Dump Site, East

POW-2 Point Oliktok

- Site 16 - Old Dump Site, N.W.

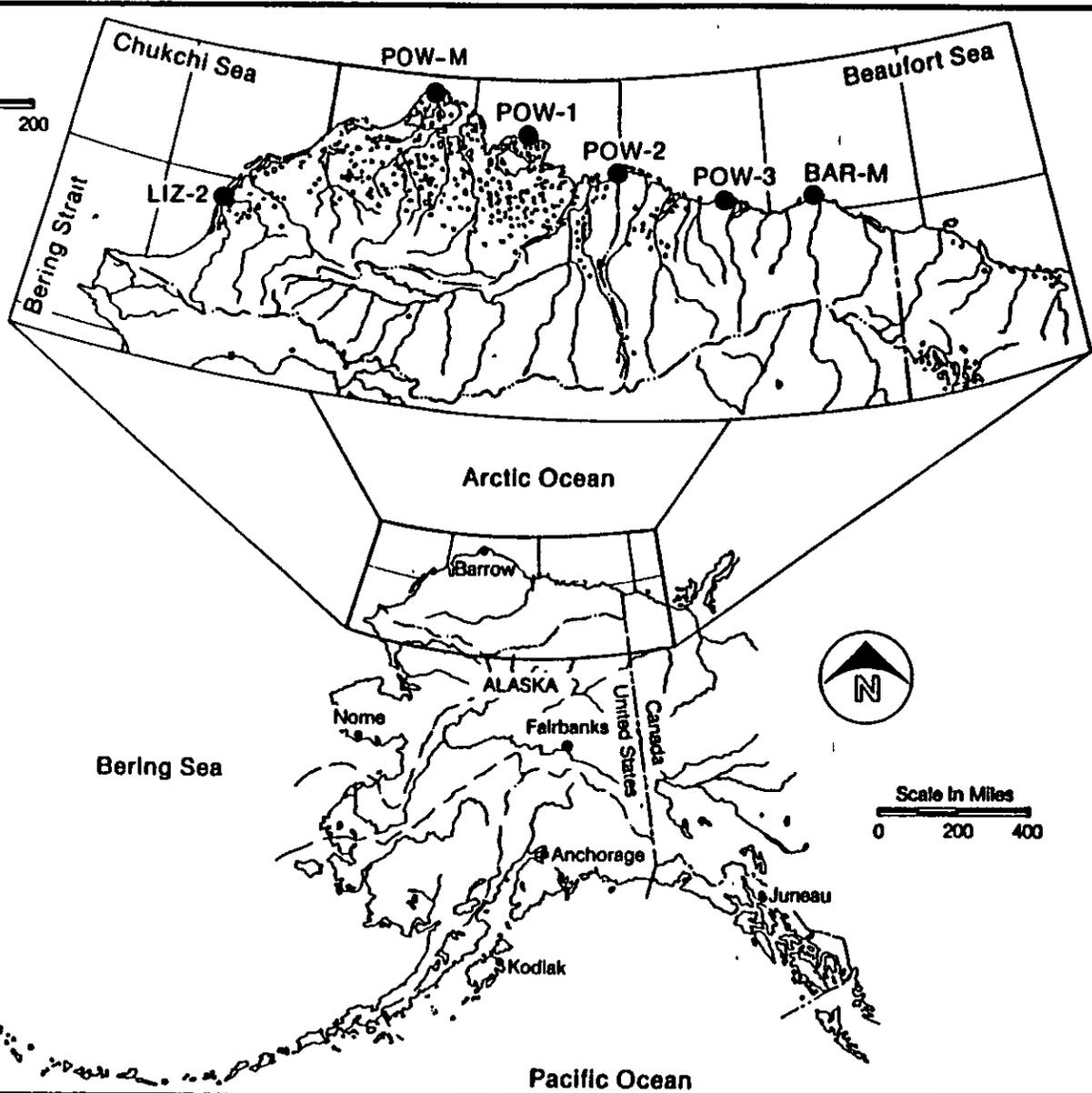
POW-1 Point Lonely

- Site 28 - POL Storage Area
- Site 31 - Old Dump Site
- Site 32 - Husky Oil Dump Site

LIZ-2 Point Lay

- Site 40 - Current Dump Site
- Site 43 - Old Dump Site, North
- Site 44 - Suspected Dump Site

These sites are shown in Plates 1, 2, 3, 4, 5, and 6 and are described below.



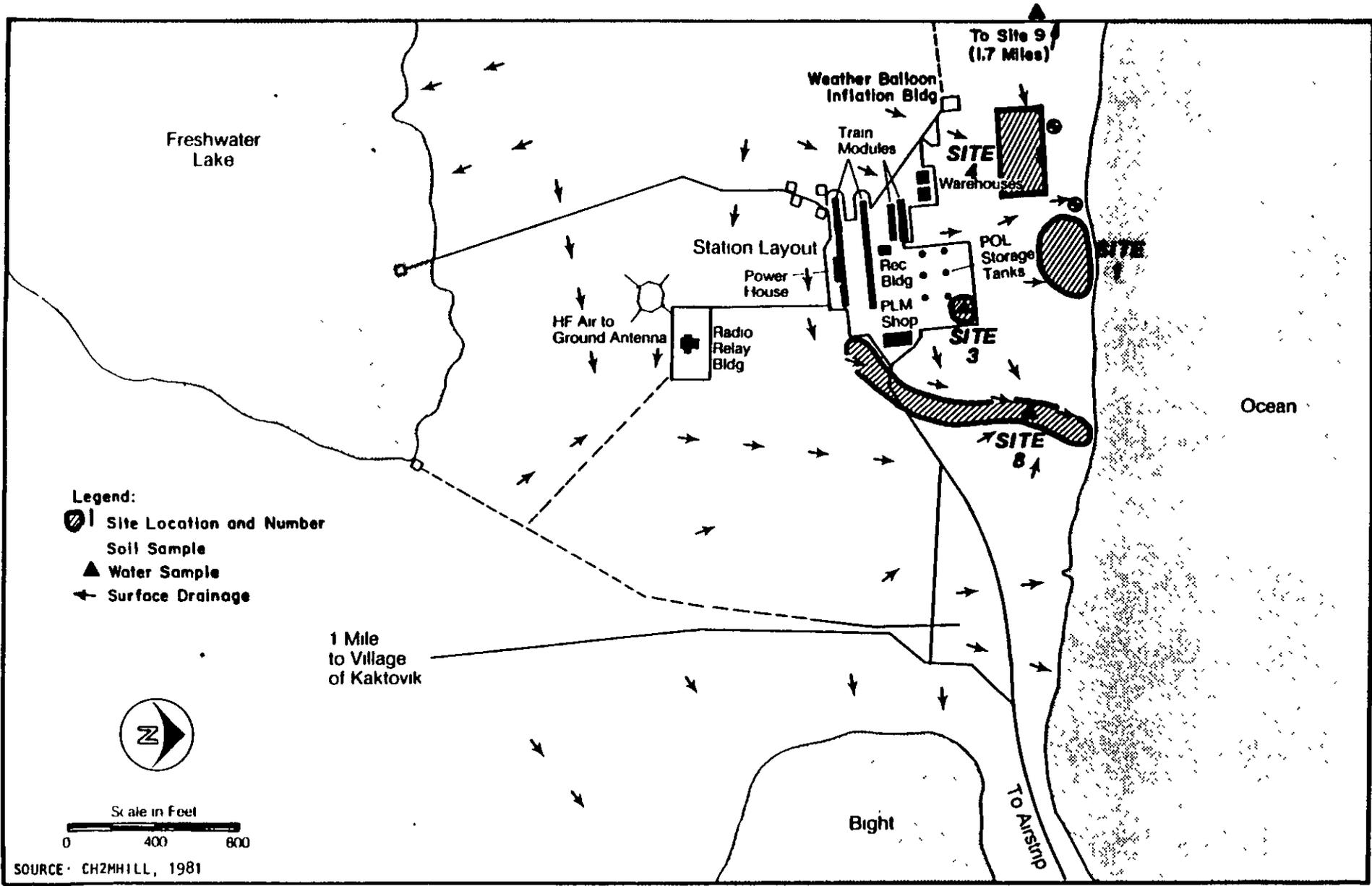
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Dames & Moore

VICINITY MAP
DEW LINE SITES, ALASKA

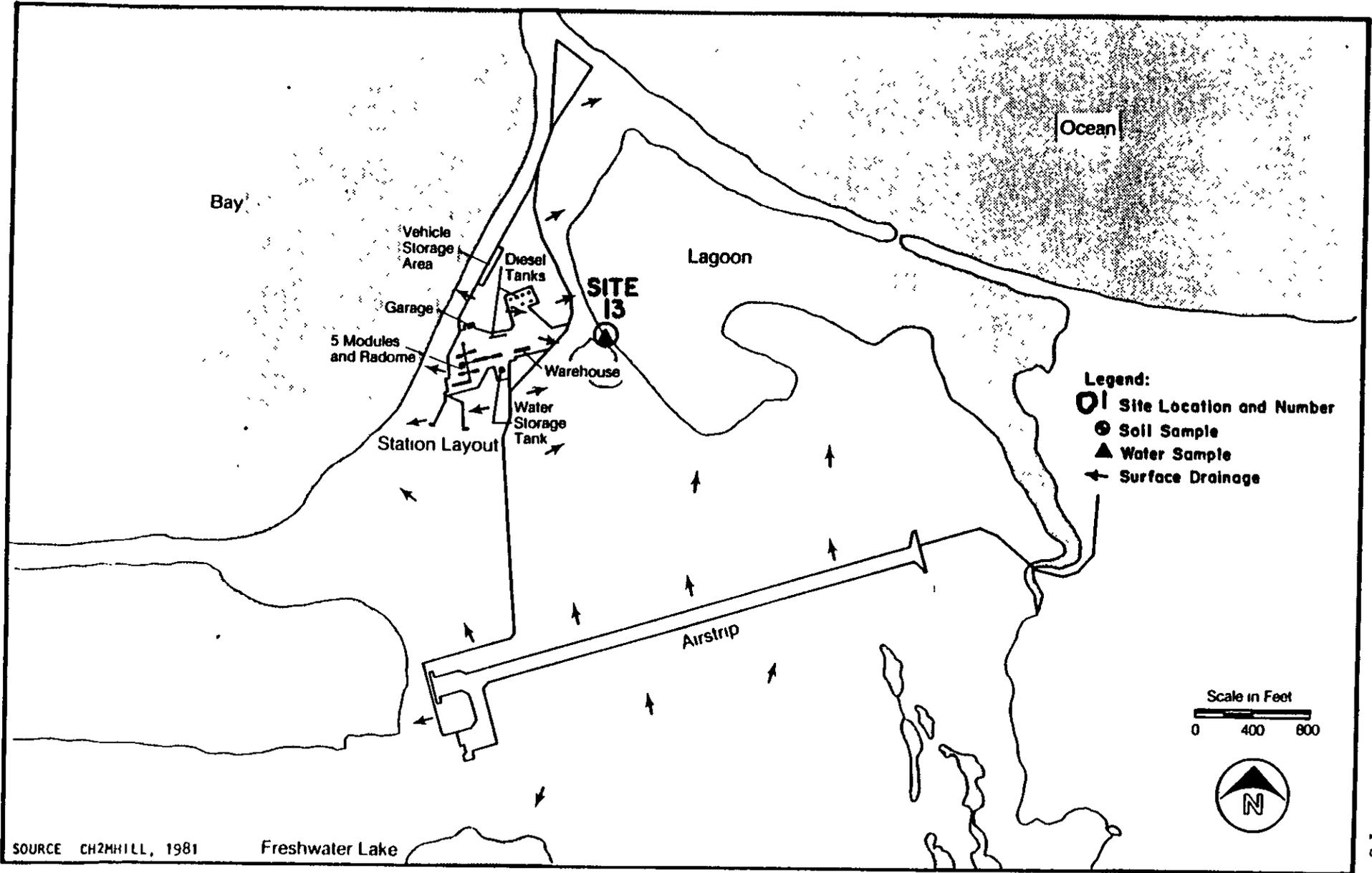
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LOCATIONS OF WASTE DISPOSAL, SPILL SITES, AND SAMPLING LOCATIONS
BAR-M

Dames & Moore



SOURCE CH2MHILL, 1981

Freshwater Lake

LOCATIONS OF WASTE DISPOSAL SITE AND SAMPLING LOCATION
POW-3

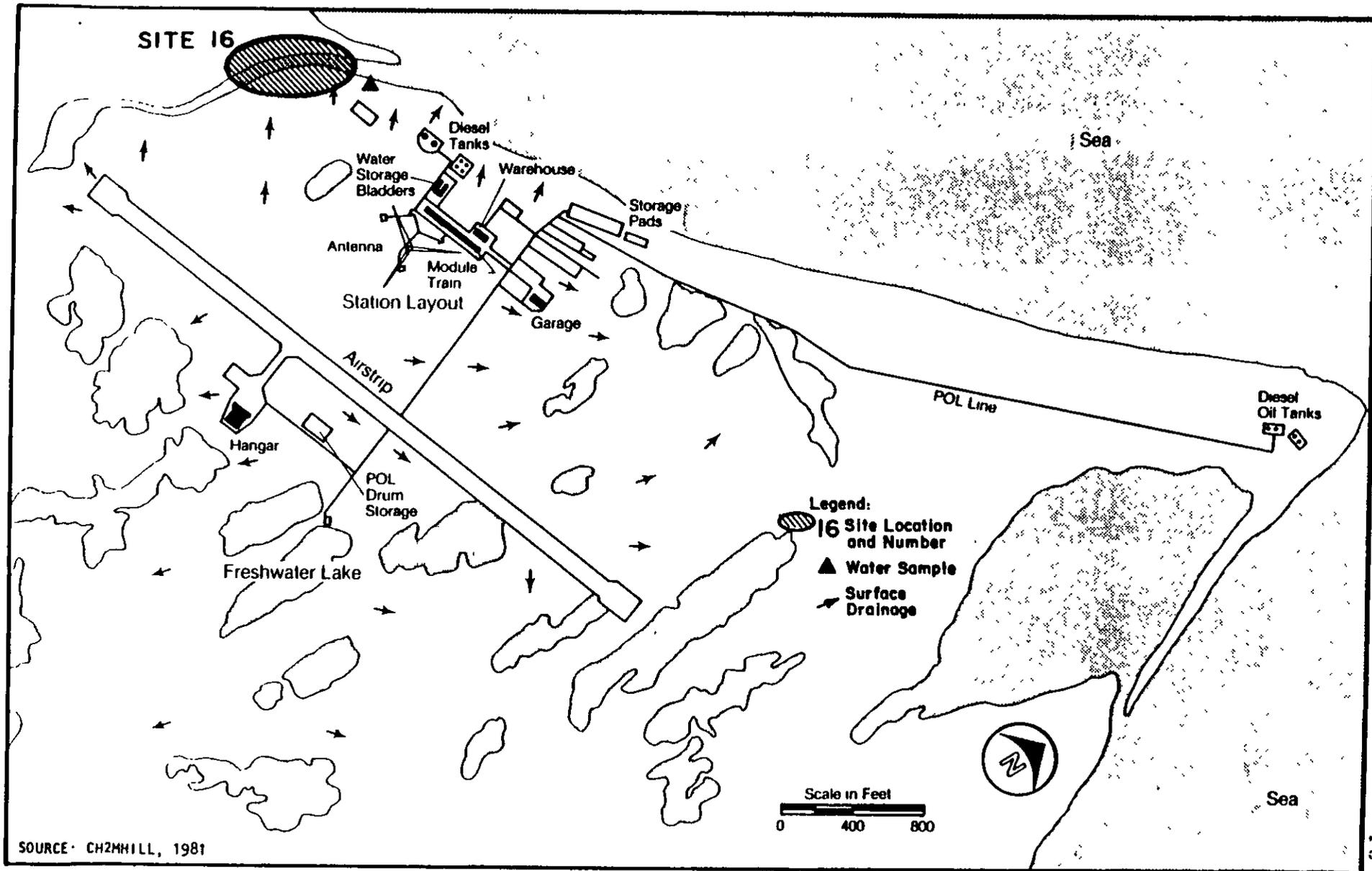
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LOCATIONS OF WASTE DISPOSAL SITE AND SAMPLING LOCATION
POW-2

Dames & Moore

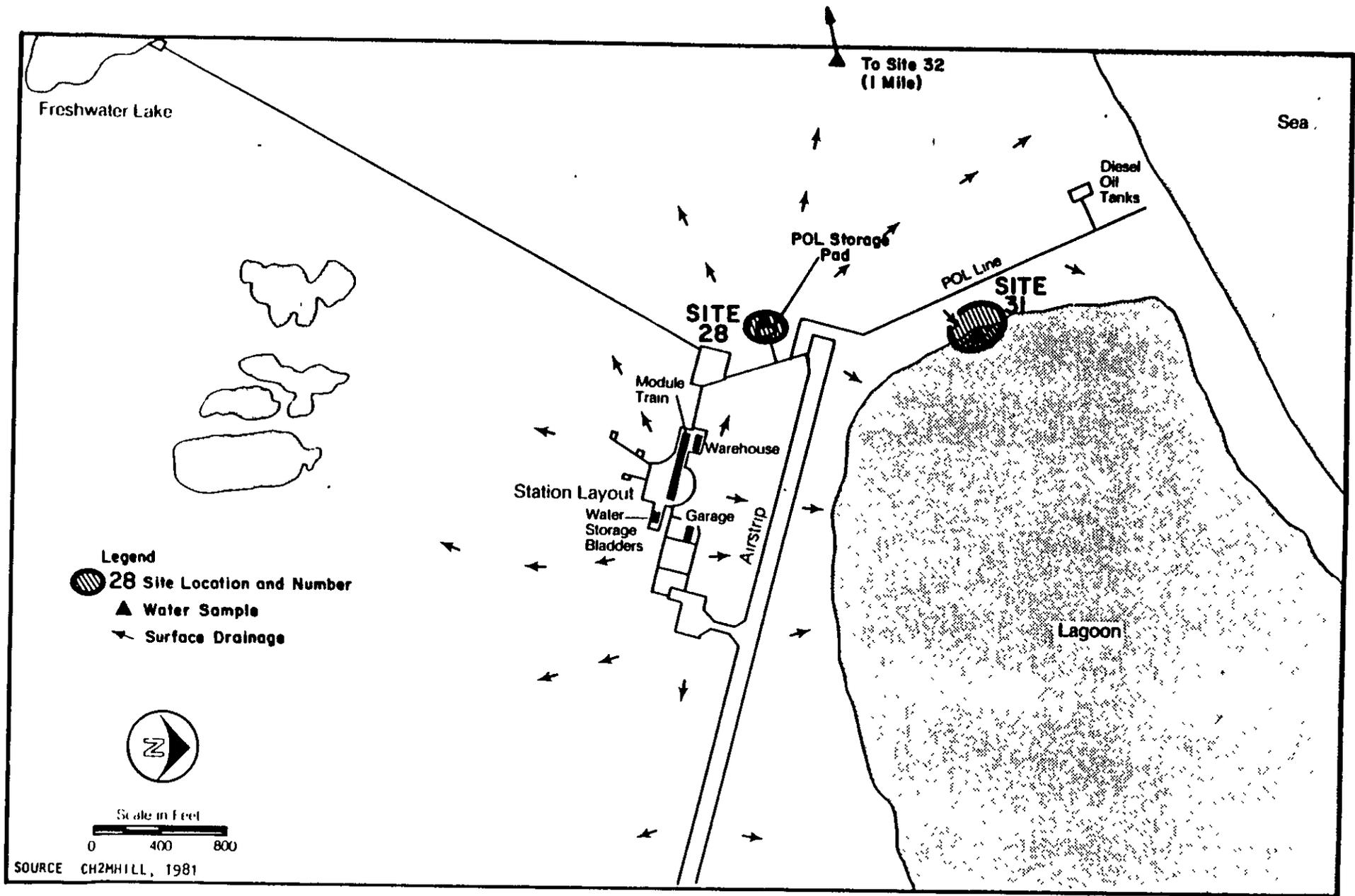
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PLATE 2

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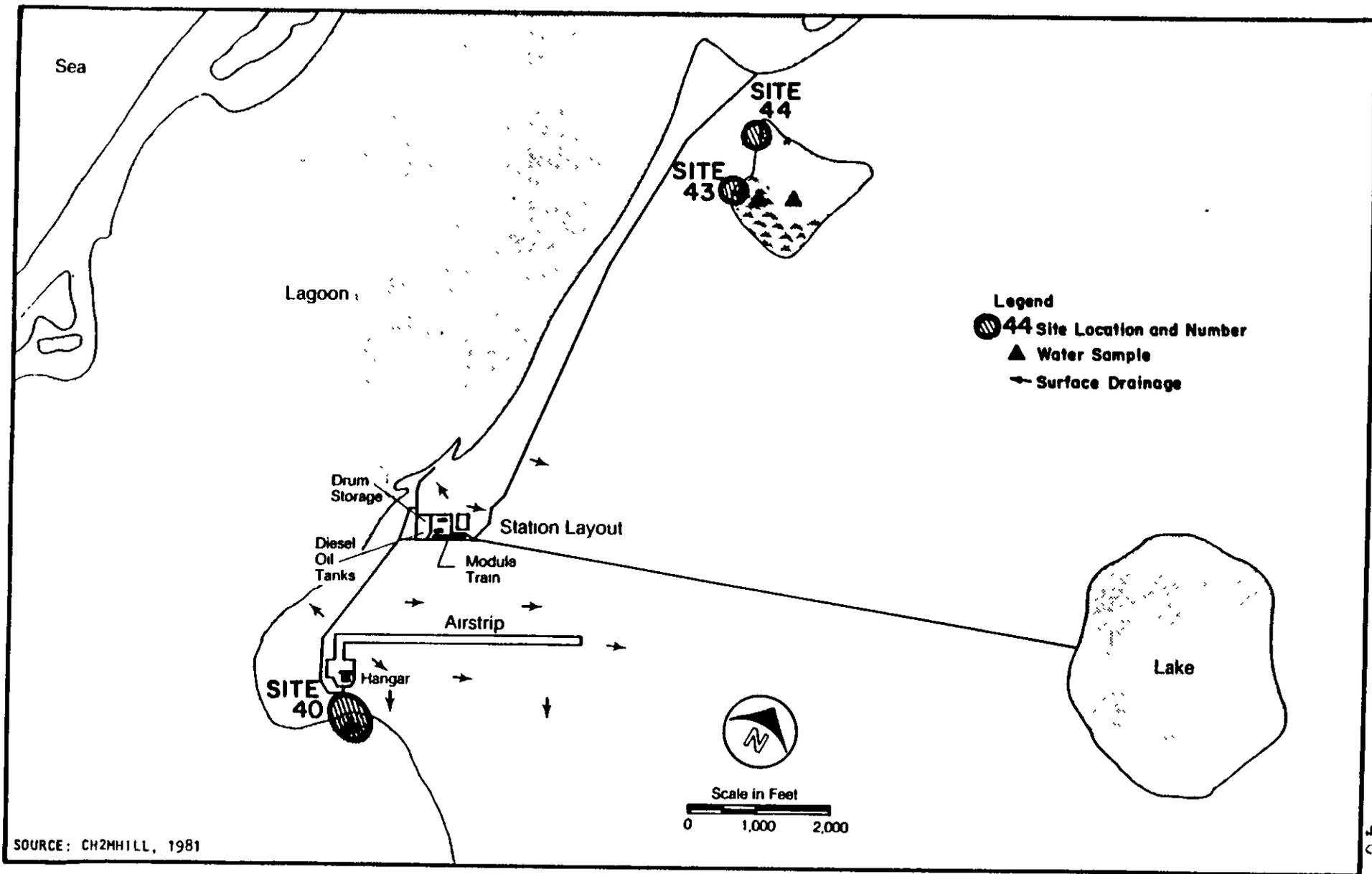


LOCATIONS OF WASTE DISPOSAL, SPILL SITES, AND SAMPLING LOCATIONS
POW-1

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[12]



SOURCE: CH2MHILL, 1981

LOCATIONS OF WASTE DISPOSAL, SPILL SITES, AND SAMPLING LOCATIONS
LIZ-2

Dames & Moore

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1. BAR-M

a. Site 1 - Old Dump Site

This is the site of a closed dump that received all wastes generated at BAR-M and the nearby village of Kaktovik from 1956 to 1978 (Plate 2). The wastes included domestic garbage, human and animal waste, waste POL products, scrap metal, batteries, drums, vehicles, electronic equipment, food waste, and trash. In addition to land disposal, wastes were also dumped onto the Beaufort Sea ice. The site was approximately 2 acres in size and was cleaned up in 1979, when most of the materials dumped at the site were removed. At present, there is still a considerable amount of debris evident on the ground surface.

b. Site 3 - Waste Petroleum Disposal

This site is described in the Phase I IRP report (CH2M Hill, 1981) as a small, circular pond approximately 20 feet in diameter, 2 to 3 feet deep, and saturated with diesel fuel and waste oil products. The location of this site was not apparent to the field team during the Phase II, Stage 1 investigation. Instead, a pond inside the POL storage tank farm contaminant berm downgradient of the tanks was investigated. Contaminants from inside the bermed area discharge directly onto the tundra surface through a breach in the dike near the northeast corner of the bermed area. A sheen was observed on the water surface of the pond located inside the berm. It appeared that water had flowed from the pond in the past through the breach in the dike onto the tundra.

c. Site 4 - Current Dump Site

The current dump site, approximately 2 acres in size, is used by both BAR-M personnel and the villagers of Kaktovik. It has been in operation since June 1978. The disposal of wastes at this site by BAR-M personnel is in accordance with appropriate regulations, but the use of the site by the villagers is uncontrolled. Because of this, it is likely that hazardous wastes are disposed of at this site. Wastes are burned and covered with excavated or imported materials or simply covered. Although some debris was evident on the ground surface at the time of the field visit, the site appeared to be fairly well controlled.

d. Site 8 - Drainage Cut Contamination

This is the site of wastewater discharge to a natural drainage that flows to the Beaufort Sea. It has been reported that contaminated liquid, possibly antifreeze, is discharged into the ditch. At the time of the field visit, no obvious contaminants (other than natural iron staining) were observed in the water. There was a considerable amount of debris in the ditch and along the banks.

e. **Site 9 - Old Dump Site, N.W.**

This locality, approximately 1.7 miles west of BAR-M, was used briefly by station personnel for disposal of crushed drums and steel from a burned building. The site was less than 1 acre in size and was cleaned up in 1979. During the site visit, numerous crushed and uncrushed barrels were found in a stream gully that ends at the Beaufort Sea. No evidence of contamination (other than natural iron staining) was observed in the water.

2. **POW-3**

Site 13 - Old Dump Site, East

The location of the station dump from 1956 to 1971 (when the station was deactivated) is less than 1 acre in size. This dump site was evidently located on the shoreline of a lagoon that is open to the sea (Plate 3). Little debris was observed above water, but some debris was seen in the water.

3. **POW-2**

Site 16 - Old Dump Site, N.W.

This old dump site received all wastes generated by the station that were not incinerated from 1956 to approximately 1978 (Plate 4). It was cleaned up in 1978, 1979, and 1980. The site was less than 1 acre in size. At the time of the site visit, wastes from the current dump site were entering the lagoon adjacent to the site, so water samples were taken between Sites 16 and 17 in an attempt to get a representation of the present problems, if any, at this station.

4. **POW-1**

a. **Site 28 - POL Storage Area**

The petroleum storage area is comprised of several medium-size tanks west of the main site (Plate 5). Fuel/oil has been observed collecting in an adjacent pond next to the storage tanks (CH2M Hill, 1981). At the time of the site visit, no fuel/oil sheens were noted in the vicinity of the tank farm, but some evidence was found that cleanup attempts had been made to the west of the farm adjacent to the gravel pad and dikes. It is not certain that the location sampled is that identified in the cited report, but it should be representative of the site.

b. Site 31 - Old Dump Site

The POW-1 dump, in use prior to about 1976, received all of the wastes generated by the station and is less than 1 acre in size. At the time of the site visit, the site had been covered with gravel and graded flat. There is still considerable waste exposed in the filled area at and above the water's edge adjacent to the lagoon. It appears that wave action in the lagoon may be eroding the bank at the site and exposing the waste material.

c. Site 32 - Husky Oil Dump

The POW-1 and Husky Oil dump receives wastes from the site that are not incinerated and all of the other wastes generated in the area. It is located approximately 1 mile southwest of the station on USAF property and is operated and maintained by Husky Oil Company. It has been in use since 1976 and is less than 1 acre in size. At the time of the site visit, it was evident that all wastes were being placed in or on the edge of a fresh water lake on the west edge of Husky Oil's camp. Some putrefaction of the lake was apparent, and an oil sheen was observed.

5. LIZ-2

a. Site 40 - Current Dump Site

The current dump receives wastes generated at the station that are not incinerated and all those generated by the village of Point Lay (Plate 6). The site is located immediately behind the airport hangar. The wastes are dumped over a bank into a lagoon. At the time of the site visit, wastes were being burned, and the dump was not being covered on a regular basis. Debris was scattered over a wide area around the dump. A small stream runs through the dump and enters the lagoon.

b. Site 43 - Old Dump Site, North

This old dump site was used by the station and villagers from about 1956 to 1978. It was cleaned up in 1979-1980. The site, which has no established road access, is located on the bank of a lake that has partially filled in with vegetation. Only two small portions of the lake area indicated in the CH2M Hill (1981) report actually have water at the surface. At the time of the site visit, a few pieces of scrap metal and some debris on the surface were the only evidence that this had been a dump site. It apparently had originally been a ravine into which garbage was dumped. Vegetation has grown back over the site.

c. Site 44 - Suspected Dump Site

This is the suspected site of a dump used by villagers and the DEW station from about 1956 to 1980. It was reportedly located near the northeastern portion of the marshy lake shown in Plate 6, and was cleaned up in 1979-1980. The site has no established road access. At the time of the site visit, the field team was unable to determine the location of this site. However, subsequent review of photographs taken from the air during the visit indicate that a trail was once used that extended from the village to the northwest tip of the marshy lake just north of Site 43. The location reported by CH2M Hill (1981) for Site 44 apparently is in error. It is suspected that garbage was dumped over the edge of the embankment surrounding the lake, and that vegetation has since grown over the debris, as it appears to have done at Site 43. Because the location of Site 44 could not be identified, this investigation was conducted in coordination with that for Site 43.

E. IDENTIFICATION OF POLLUTANTS SAMPLED

Based on the wastes present in the above sites, potential contaminants include TOX, lead, phenols, PCBs, and oil and grease. The analysis scheme is provided in Table 1.

F. IDENTIFICATION OF THE FIELD TEAM

The field work for Phase II, Stage 1 was accomplished by Mr. J. Michael Stanley, Senior Engineering Geologist. Accompanying Mr. Stanley on the trip were LTC David A. Nuss, HQ AAC/SGPB; Elmendorf AFB, Alaska; and Maj. George R. New, USAF OEHL/TS, Brooks AFB, Texas. Air charter services were provided by Audi Air Service of Kaktovik and Prudhoe Bay, Alaska. Appendix H contains biographies of key personnel.

TABLE 1

**IRP PHASE II SAMPLING PARAMETERS
ALASKAN DEW LINE STATIONS**

	BAR-M		POW-3		POW-2		POW-1			LIZ-2			
	SITE 1	SITE 3	SITE 4	SITE 8	SITE 9	SITE 13	SITE 16	SITE 28	SITE 31	SITE 32	SITE 40	SITE 43	SITE 44
TOC	--	1W	--	1W	1W	1W	1W	1W	1W	1W	1W	1W	1W
TOX	2S	1W	2S	1W	1W	1W	1W	1W	1W	1W	1W	1W	1W
Lead	2S	--	2S	1W	1W	1W	1W	--	1W	1W	1W	1W	1W
Phenols	2S	--	2S	1W	--	1W	1W	--	1W	1W	1W	1W	1W
PCBs	2S	--	2S	1W	1W	1W	--	--	1W	1W	--	--	--
pH (field)	--	1W	--	1W	1W	1W	1W	--	1W	1W	1W	1W	1W
Oil and grease	--	1W	--	1W	--	--	--	1W	--	--	--	--	--
Specific conductance	--	1W	--	1W	1W	1W	1W	--	1W	1W	1W	1W	1W

S = soil sample, W = water sample.

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II. ENVIRONMENTAL SETTING

A. PHYSICAL GEOGRAPHY

The Alaska DEW Line stations are located on the western and northern coasts of Alaska in the Arctic region. Of the sites addressed in this report, two are located near native villages, with the villages established after the station was constructed, and three are at remote locations. BAR-M encompasses approximately 4353 acres, POW-3 approximately 620 acres, POW-2 approximately 2325 acres, POW-1 approximately 2830 acres, and LIZ-2 approximately 1442 acres. Land surface elevations are within a few tens of feet of sea level at all of the stations investigated.

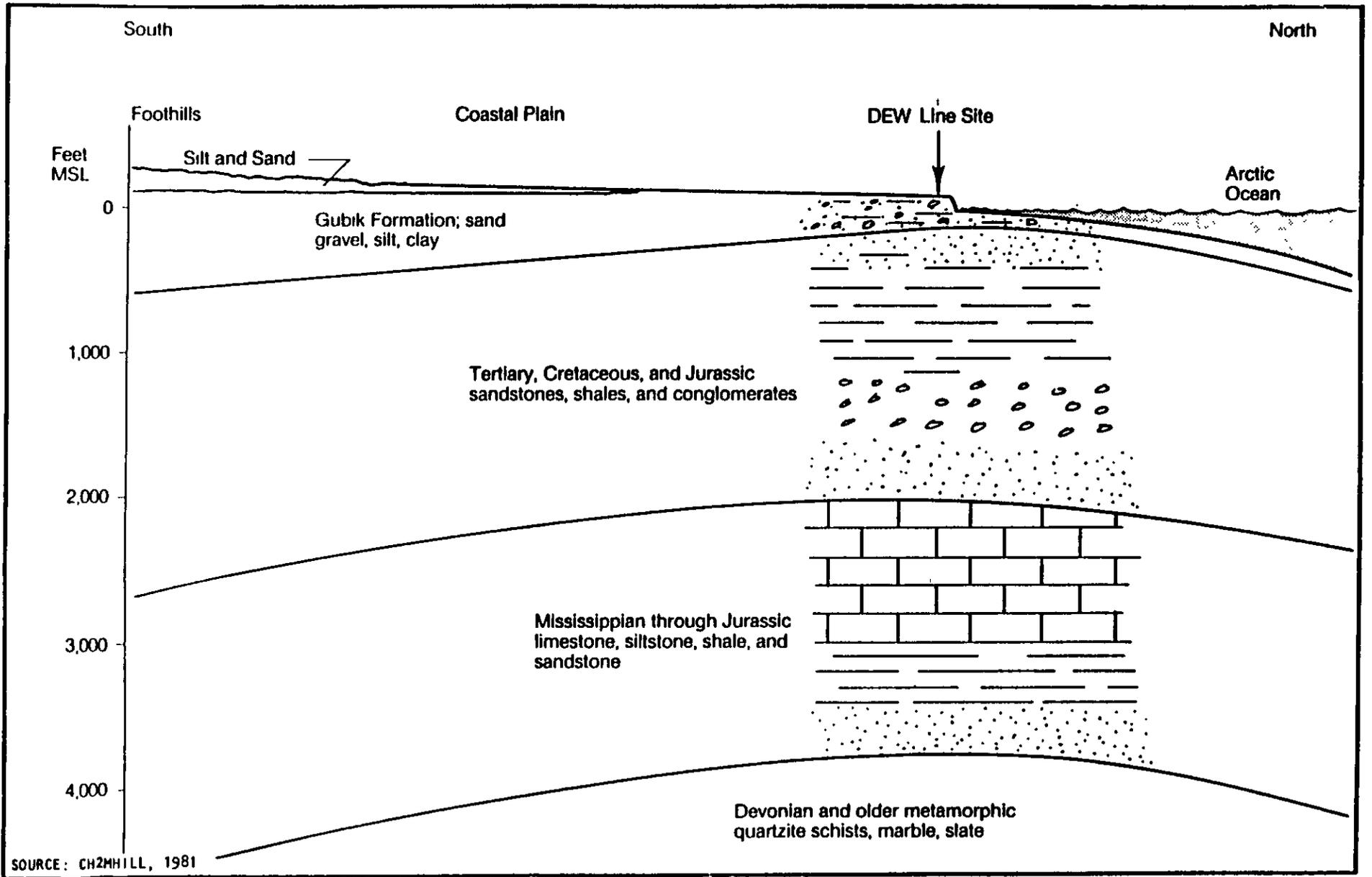
The stations are located on the Arctic Coastal Plain, a smooth surface showing little relief, which slopes downward to the north from the foothills of the Brooks Range. The coastline is characterized by low banks with narrow gravel and sand beaches. All regional drainage is north and west toward the coast.

The average annual precipitation at the stations ranges from 5 to 7 inches (which includes 12 to 49 inches of snow), making this area an Arctic desert. The average monthly temperatures range from a maximum of 46°F at BAR-M and 53°F at LIZ-2 to a minimum of -20°F at BAR-M and -27°F at LIZ-2. Extreme temperatures range from -59°F to 75°F at BAR-M and -55°F to 78°F at LIZ-2 (CH2M Hill, 1981).

B. REGIONAL GEOLOGY AND HYDROGEOLOGY

The Arctic Coastal Plain is underlain by poorly indurated Pleistocene and Recent sand, gravel, silt, and clay. Beneath these deposits, Tertiary, Cretaceous, and Jurassic sandstones, siltstones, shales, and conglomerates form a 2000- to 12,000-foot thick sequence that thickens towards the mountains to the south. At greater depths, limestone, siltstone, shale, and sandstones give way to metamorphic rocks of Devonian and older periods. These older systems of rocks, predominantly quartzite schists, marble, and slate, form the regional basement rock. A generalized north-south geologic section is presented in Plate 7.

Thin accumulations of peat and silty loam overlie the bedrock deposits. Polygonal ground, beaded drainage, thermokarst lakes, and other periglacial features are common throughout the area, all indicative of fine-grained, permanently frozen ground.



**GENERALIZED NORTH-SOUTH GEOLOGIC SECTION
DEW LINE SITES, ALASKA**

Dames & Moore

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Due to the presence of permafrost throughout the area to great depths (as much as 2,000 feet), ground water is generally absent except under and at the margins of lakes (CH2M Hill, 1981).

C. GENERAL HYDROGEOLOGY

Numerous rivers, originating in the Brooks Range and the northern foothills, cross the coastal plain and drain into the Arctic Ocean. Surface drainage occurs as sheetflow and shallow creek runoff to rivers or directly to the ocean. Infiltration to very shallow depths occurs during summer months when the active layer thaws.

Numerous large and small lakes occur on the coastal plain. They are generally less than 10 feet deep, and most remain frozen during the winter and early summer months. Very few wells are used on the North Slope due to the general absence of ground water. Nearly all water supplies are drawn from nearby freshwater lakes.

The estimated permeability of the near-surface soils within the active layer ranges from 1×10^{-1} to 1×10^{-4} cm/sec (CH2M Hill, 1981).

D. SITE-SPECIFIC GEOLOGY AND HYDROGEOLOGY

This section presents the results of the surface and subsurface investigations conducted during Phase II, Stage 1 at the 13 previously listed sites along the DEW Line. The field program is described in Section III, and the results of the chemical analyses are presented in Section IV.

1. BAR-M

a. Site 1

This is the location of the old dump at BAR-M which was in use from 1956 to 1978. One soil sample was collected near the edge of a small stream adjacent to the landfill in fill material, and one sample was collected from sand and gravel in the stream channel. No water samples were collected at this site (see Plate 2).

b. Site 3

This is the location of a pond adjacent to the petroleum storage tanks for this site. Sand and gravel fill material has been placed directly on the tundra mat to form a pad for the tanks and to form berms for POL spill containment. One water sample was collected from the ponded surface water. An oil sheen was present on the surface, and more petroleum products were released from disturbed sediments at the water's edge.

c. Site 4

This is the location of the current dump that has been in operation since 1978. Two soil samples were taken approximately 25 feet north of the edge of the dump in a swampy area downgradient of the site, one sample at approximately 1 foot below the ground surface and one at approximately 2 feet below the surface. The soil consisted of a peaty loam. Permafrost with a very high ice content was encountered at approximately 2 feet below the surface.

d. Site 8

This is the site of a wastewater discharge to a natural, deeply incised drainage that flows to the Beaufort Sea. One water sample was collected from the stream. No evidence of contamination was noted, other than debris in the water and along the stream banks.

e. Site 9

This is the location of an old dump site approximately 1.7 miles west of the station. One water sample was taken near the mouth of the deeply incised stream that empties into the Beaufort Sea. No evidence of contamination was found, other than rusted barrels (some of which are crushed) in the stream channel and along its banks.

2. POW-3

Site 13

This is the location of the old station dump that was in use from 1956 to 1971. One water sample was taken from lagoon waters adjacent to the site, where debris was observed in the water. No evidence of contamination was noted other than the submerged debris (see Plate 3).

3. POW-2

Site 16

This is the location of an old dump that was in use from 1956 to 1978. One water sample was collected from lagoon waters between Sites 16 and 17, since ongoing waste disposal operations at the current dump site include dumping into the water and burning of wastes. Considerable debris was found in the lagoon water, but no oil sheens were observed at this site (see Plate 4).

4. POW-1**a. Site 28**

This is the location of the POL tank farm. One water sample was collected from ponded water adjacent to the dike and pad around the tank farm. No direct evidence of contamination was observed (see Plate 5).

b. Site 31

This is the location of an old dump used prior to 1976. One water sample was collected from the lagoon waters adjacent to the site. No evidence of contamination was observed other than debris on the beach and exposed in the fill bank.

c. Site 32

This is the site of the Husky Oil Company dump, which is currently used by the DEW Line station and others. One water sample was collected from the pond adjacent to the site. An oil sheen was observed on the water surface and was released from disturbed shore sediments. Considerable debris was observed in the water, and ongoing operations apparently include burning and pushing waste into the water.

5. LIZ-2**a. Site 40**

This is the location of the active dump for the station and the village of Point Lay. One water sample was collected from water ponded at the edge of the dump and adjacent to a lagoon. An oil sheen was observed on the water, and wastes are entering the water from the dump (see Plate 6).

b. Site 43

This is the location of an old dump in use from about 1956 to 1978. Debris was believed to be dumped over the edge of an embankment that appears to have enclosed a large thaw lake. The lake has apparently had one wall breached and has partially drained and filled with vegetation. One water sample was collected downgradient of the site from a depression in the tundra mat, created by pulling up peat moss and allowing the excavation to fill with water. No evidence of contamination was observed at the site itself other than scrap metal and a small amount of debris on the ground surface.

c. Site 44

Evidence was not found of a dump site near the location indicated by CH2M Hill (1981). One water sample was collected from the small lake nearest to Site 43. It is believed that any contamination from either Site 43 or Site 44 would ultimately migrate to this lake.

E. HISTORIC GROUND WATER PROBLEMS

No ground water problems have been identified in this area because of the very few wells that have been developed. No problems, other than salt water contamination, have been identified for the surface water supplies at any of the sites (CH2M Hill, 1981).

F. LOCATIONS OF WELLS ON AND OFF BASE

No wells have been located in the vicinity of these sites. Most of the fresh water lakes used for water supplies are identified in Plates 2, 3, 4, 5, and 6.

III. FIELD PROGRAM

A. FIELD PROGRAM DEVELOPMENT

The field program portion of this study consisted of:

1. Collecting surface water samples from shallow ponds and streams and collecting soil and/or sediment samples from near 13 sites at five DEW Line stations on the north and west coasts of Alaska; and
2. Measuring pH, temperature, and specific conductance in the field on all water samples. At some sites, salinity was also measured to provide a measure of its effect on conductivity.

B. FIELD PROGRAM IMPLEMENTATION

All water samples were taken by placing prepared sampling containers directly into the stream or pond. The sample containers were immediately stored in insulated shipping containers. Soil samples were taken by excavation with a hand shovel. The soil samples were placed in prepared glass containers and immediately placed in insulated shipping containers. At the end of each of the two sampling days, the water and soil samples were shipped via air freight to the testing labs (UBTL in Salt Lake City, Utah, and OEHL at Brooks AFB, Texas), where the samples were received the following day.

All field instruments functioned well and were calibrated before and during use to ensure accuracy. The instruments and containers used during field testing were thoroughly rinsed before and after each use.

Chain-of-custody forms were prepared and accompanied the samples from the field to the laboratory. These records document the integrity of the samples at each point of transfer, from field personnel to shippers and couriers to the laboratory staff. The signatures of the individuals relinquishing and accepting custody of the samples and the date and time appear on the records at each point of transfer (see Appendix G).

The soil and surface water samples were analyzed in accordance with U.S. Environmental Protection Agency (USEPA) methods. Table 2 lists each parameter and its analytical method. Details of the analytical procedures are provided in Appendix D.

TABLE 2
 PARAMETERS, LIMITS OF DETECTION FOR SOIL AND WATER ANALYSES,
 AND WATER QUALITY CRITERIA

PARAMETER	LIMIT OF DETECTION, SOIL ($\mu\text{g/g}$)	LIMIT OF DETECTION, WATER ($\mu\text{g/L}$)	PRIMARY DRINKING WATER STANDARD* ($\mu\text{g/L}$)
TOC	—	1000	NE
TOX	5	10	NE
Lead	6	10	50
Phenols	5	10	NE
PCBs	0.5	0.5	NE
Oil and Grease	8.0	500	NE

*State of Alaska, Sec. 18 AAC 80.050.

Note: NE = no criterion established
 $\mu\text{g/L}$ = micrograms per liter
 $\mu\text{g/g}$ = micrograms per gram

IV. DISCUSSION OF RESULTS AND SIGNIFICANCE OF FINDINGS

A. DISCUSSION OF RESULTS

This section presents a discussion of the chemical analyses of soil and surface water samples collected at the sites depicted on Plate 1. The significance of the findings is presented in Section IV.B. Site-specific geology is discussed in Section II, and the field investigations are described in Section III.

Water samples were analyzed for TOC, TOX, lead, phenols, oil and grease, and PCBs. Field measurements of water temperature, pH, and conductance were made at the sites. Table 3 lists the results of these analyses. These results are compared, where applicable, to primary drinking water standards. If no drinking water standard is established, results are compared to inferred background levels.

Soil samples were analyzed for lead (by acid digestion), phenols, TOX, percent moisture, and PCBs, and the analytical results are presented in Table 4. Results of these analyses are compared to inferred background levels, which are expected to be zero for all the above parameters except percent moisture and lead.

1. BAR-M

a. Site 1

Both soil samples from this site had TOX levels below the limit of detection. One soil sample, collected from the edge of a small stream adjacent to the landfill, had a lead level of 76 $\mu\text{g/g}$ (dry weight), whereas the other sample collected in the stream channel had a lead level below the detection limit. PCBs were at 0.72 $\mu\text{g/g}$ (dry weight) at the surface and below the limit of detection in the stream channel sample. Phenols were below the limit of detection in both samples.

b. Site 3

TOX at 1200 $\mu\text{g/L}$, specific conductance at 720 $\mu\text{mhos/cm}$, and oil and grease at 36 mg/L were found to be elevated in the water sample collected from the pond surface. The TOC, analyzed at 51 mg/L , and a pH of 7.70 were within the expected background levels for these parameters.

TABLE 3

CHEMICAL ANALYSIS RESULTS
DEW LINE - WATER ANALYSES

PARAMETER	METHOD	UNITS	DETECTION LIMIT	BAR-M			POW-3	POW-2	POW-1			LIZ-2		
				SITE 3	SITE 8	SITE 9	SITE 13	SITE 16	SITE 28	SITE 31	SITE 32	SITE 40	SITE 43	SITE 44
TOC	415.1 ^a	mg/L	1.	51.	19.	31.	6.	13.	20	4.	52.	44.	15.	16.
TOX	9020 ^b	µg/L	10.	1200.	180.	190.	1,100.	890.	170	950.	8400.	1400.	130.	150.
Lead	239.2 ^a	mg/L	0.01	--	0.01	d	0.05	0.03	--	d	d	d	d	d
Phenols	420.2 ^a	µg/L	10.	--	d	--	d	d	--	d	25.	13.	d	d
Oil and Grease	413.2 ^a	mg/L	5.	36.	d	--	--	--	7	--	--	--	--	--
PCBs	608 ^c	µg/L	0.5	--	d	d	d	--	--	d	d	--	--	--
pH (field)	--	--	--	7.70	7.05	7.10	8.05	8.50	--	6.85	9.2	7.35	7.25	7.65
Specific Conductance @ 25°C	--	µmhos/cm	--	720.	315.	275.	11,496.	7818.	--	2414.	1856.	952.	294.	364.
Salinity	--	‰	--	--	--	--	7.5	5.2	--	17.2	1.3	--	--	--

^aEPA SW-846, modified for use with an O.I. Model 610 TOX Analyzer.

^bEPA Manual 600/4-82-057, July 1982, "Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater."

^cEPA 600/4-79-020, March 1983, "Methods for Chemical Analysis of Water and Wastes."

^dDenotes value less than the limit of detection.

TABLE 4

SOIL ANALYSIS RESULTS^a
BAR-M STATION, DEW LINE

PARAMETER	METHOD	UNITS	DETECTION LIMIT	SITE 1 0'	SITE 1 STREAM BED	SITE 4 1.0'	SITE 4 2.0'
Lead	239.1 ^{b,c}	µg/g	10.	76.	g	g	52
Phenols	420.2 ^b	µg/g	1.	g	g	g	g
TOX	9020 ^d	µg/g	5.	g	g	g	g
% Moisture	grav.	%	--	26.	9.3	76	75
PCB	608 ^e	µg/g	0.5 ^f	0.72	g	--	--
PCB	608 ^e	µg/g	5. ^f	--	--	g	g

^aResults corrected for percent moisture.

^bMethods for Chemical Analysis of Water and Wastes, EPA 600/4-79-020, Revised March 1983, modified for use with soil samples.

^cSoil samples were acid digested for lead analysis.

^dTest Methods for Evaluating Solid Waste, SW-846, 2nd Ed., July 1982, modified for use on O.I. Corp. Model 610 TOX Analyzer, with soil samples.

^eEPA Manual 600/4-82-057, July 1982, modified for use with soil samples.

^fBecause of interferences, the following dilutions were made to analyze the samples:

Site 1, 0'	1:10
Site 1, stream bed	1:10
Site 4, 1.0'	1:100
Site 4, 2.0'	1:100

^gDenotes value less than the limit of detection.

c. Site 4

These peaty loam soils, taken at 1 foot and 2 feet below the ground surface, downgradient of the current dump, exhibited moisture contents of 76 and 75 percent. At a depth of 2 feet, permafrost was encountered. Lead was below the limit of detection in the shallow sample and at 52 $\mu\text{g/g}$ (dry weight) in the sample immediately above the permafrost. TOX, phenols, and PCBs were found to be below the limits of detection. Because of interferences that necessitated dilution during analyses, the detection limit for PCBs was 5 $\mu\text{g/g}$.

d. Site 8

The water sample from this drainage ditch had an elevated TOX level of 180 $\mu\text{g/L}$ and a lead level at the limit of detection. TOC, at 19 mg/L , pH, and specific conductance were within the range of anticipated background levels. Phenols, oil and grease, and PCBs were below the detection limits.

e. Site 9

The water sample obtained from the stream downgradient of the old dump site, N.W., indicated an elevated level of TOX at 190 $\mu\text{g/L}$, whereas TOC was within the anticipated background level. Lead and PCBs were below detection limits.

2. POW-3

Site 13

The surface water sample from the lagoon near the old dump site had an elevated level of TOX (1100 $\mu\text{g/L}$) and a lead level of 0.05 $\mu\text{g/L}$, which is the maximum level permitted by the primary drinking water standard. A high salinity, 7.5 percent, corresponds to the high specific conductance at 11,496 $\mu\text{mhos/cm}$. TOC was low, and both phenols and PCBs were below detection limits.

3. POW-2

Site 16

Moderately high levels of TOX (890 $\mu\text{g/L}$) were found in the water sample obtained from the lagoon downstream of the dump site. Lead, analyzed at 0.03 mg/L , was elevated but below the primary drinking water standard. The pH, at 8.5, was slightly high, as was the salinity at 5.2 percent and the specific conductance of 7818 $\mu\text{mhos/cm}$.

4. POW-1**a. Site 28**

The water sample taken from the ponded water adjacent to the dike and pond around the tank farm had a low level of TOC. Elevated levels of TOX (170 µg/L) and oil and grease (7 mg/L) were reported for this sample.

b. Site 31

Although lead, phenols, and PCBs were below the limits of detection, a moderately high level of TOX (950 µg/L) was found in the water sample obtained from the salt water lagoon adjacent to the old dump site. A slightly acidic pH (6.85) and a high specific conductance (2414 µmhos/cm) can probably be attributed to the fact that this is a salt water lagoon.

c. Site 32

The water sample from the pond adjacent to the Husky Oil Company dump had a high level of TOX (8400 µg/L) and a moderately high level of phenols (25 µg/L). TOC, at 52 mg/L, was within assumed background levels. Both the pH (9.2) and specific conductance (1856 µmhos/cm) were above anticipated background levels. PCBs were below the detection limit.

5. LIZ-2**a. Site 40**

The water sample taken from Kasegaluk Lagoon adjacent to the dump site had an elevated TOX level of 1400 µg/L and a slightly elevated level of phenols (13 µg/L). TOC was within the expected background range, and lead was found to be below the limit of detection. The specific conductance, at 952 µmhos/cm, was above anticipated background levels.

b. Sites 43 and 44

These two localities, which are approximately 2000 feet apart and are downgradient of old dump sites, had background levels of TOC and lead and phenols levels below the limits of detection. The TOX levels of 130 and 150 µg/L were somewhat elevated. The pH and specific conductance were within anticipated normal background levels.

6. Background Concentrations

No historic analyses of the organic content of surface water or ground water beneath the stations were available, and the absence of any water quality criteria for TOX and TOC precludes any regulatory basis for comparing the concentrations obtained from water samples. However, the following information provides some basis for interpreting the quality of water indicated by TOX and TOC measurements.

TOC is a measure of the organic carbon in a sample, regardless of whether the source is natural or man-made. Organic carbon in uncontaminated ground water and surface water is derived from humic and fulvic acids dissolved from sediments, dissolution of carbonates containing organic carbon, and other dissolved organic materials. Background concentrations are typically less than 10 mg/L, especially in an aquifer in which ground water would be relatively aerated and oxidizing conditions probably prevail. In an aquifer in which there is little ground water movement, organic-rich aquifer material, and relatively anaerobic or reducing conditions, TOC concentrations could be expected to range up to 100 mg/L. Industrial wastes may contain as much as 200,000 mg/L, and consequently, highly contaminated ground water may yield any concentration including several thousand milligrams of TOC per liter.

TOX is a measure of organic halogens containing chlorine, bromine, and iodine that can be adsorbed by activated carbon. Although chlorinated and brominated organic chemicals are generally regarded solely as man-made chemicals such as pesticides, PCBs, and solvents, there are reports in the literature of related natural compounds. Certain polybromomethanes, alkyl monohalides, and alkyl dihalides appear to be natural products of some temperate marine macroalgae (Gschwend, MacFarlane, and Newman, 1985). The macroalgae studied contain volatile halogenated organic compounds and release them to seawater in significant quantities.

In a terrestrial environment, virtually any concentration of TOX is believed to be an indication of organic contaminants. There are no established safe levels of TOX because of the wide variety of compounds that contribute to TOX. The area of the DEW Line sites cannot be categorized as a strictly terrestrial environment because of proximity to the Beaufort Sea. In this near-shore hydrogeologic environment, there is a constant influx of saline water from sea spray and tides.

There is a slight possibility of two separate factors contributing to a background TOX level at the DEW Line sites. An interference effect by salts, particularly chlorides, could contribute to an elevated reading. Secondly, there is a very remote possibility that a natural source, such as marine macroalgae, might be contributing to the total TOX level. Both of these ambiguities will be clarified by

analyzing for purgeable halocarbons (USEPA Method 601). Thereby, the particular halocarbons responsible for the TOX will be defined. Pesticides are not believed to be a contributing factor to the TOX values, as the Phase I records search did not conclude that they were among the possible materials deposited in the disposal sites.

7. Reliability of the Surface Water and Soil Analyses

The surface water quality and soil quality analyses are considered to be reliable by virtue of the sampling measures taken in the field to ensure that the samples were representative and by virtue of the quality control procedures in the laboratory.

All water samples were taken by placing prepared sampling containers directly into the stream or pond. The sample containers were immediately stored in insulated shipping containers. Soil samples were taken by excavation with a hand shovel. The soil samples were placed in sterile glass containers and immediately placed in insulated shipping containers. At the end of each sampling day, the water and soil samples were shipped via air freight to the testing laboratories (UBTL in Salt Lake City and OEHL at Brooks AFB, Texas), where the samples were received the following day.

All field instruments functioned well and were calibrated before and during use to ensure accuracy. The instruments and containers used during field testing were thoroughly rinsed before and after each use.

The laboratory quality control (QC) program is described in detail in Appendix D. In general, analyses of duplicate and spiked samples were satisfactory. The recoveries of spikes for TOX in both soil and water samples, 68.3 and 5.2 percent, respectively, are low, and an interference effect is suspected in the case of the water sample. By analyzing for purgeable halocarbons using USEPA Method 601 (1978) during the second stage of Phase II, the specific halocarbons contributing to the TOX values will be resolved.

The average of the three recoveries of lead spiked water samples was 120.9 percent, which is slightly high but still within the acceptable range. The recovery of lead in a spiked soil sample was 82.7 percent, which is slightly low but also within the acceptable range.

B. SIGNIFICANCE OF FINDINGS

Based on the results derived from the chemical analyses of surface water and soil samples described in the previous section and the hydrogeology presented in Section II, this section will present an estimate, to the degree possible, of the

extent of contamination at each site. The risk to human health, if any, that contamination poses will also be discussed. Human health would be affected if an area water supply were in danger of being contaminated.

1. Extent of Contamination at BAR-M

a. Site 1

The surface soil sample taken at Site 1, closed dump, had a lead content of 76 $\mu\text{g/g}$ (dry weight), which is within the expected range for soils. The PCBs (72 $\mu\text{g/g}$ dry weight) detected in the same soil sample indicate minor contamination of the surface. It is not possible to determine the extent of contamination from a single sample, and areas of high PCB concentration may exist at the site.

b. Site 3

Surface water samples from this waste petroleum site appear to be contaminated with high levels of TOX (1200 $\mu\text{g/L}$) and moderately high levels of oil and grease (36 mg/L).

c. Site 4

The current dump site had a soil lead reading of 52 $\mu\text{g/g}$, within the anticipated background range of soils. The relatively high detection limit for PCB analyses at this site may have masked low-level PCB contamination (i.e., less than 5 $\mu\text{g/g}$).

d. Sites 8 and 9

Water samples from Site 8, a drainage ditch, and Site 9, a stream downgradient of an old dump, had TOX values of 180 and 190 $\mu\text{g/L}$, respectively. These values indicate contamination of surface water.

Because potable water supplies for BAR-M are obtained from fresh water lakes upgradient of the sites, human health is not directly affected by the minor contamination detected in this investigation. There is the possibility, however, that whatever contaminants are contributing to the TOX and PCB levels may migrate off base into the Beaufort Sea, particularly from Sites 1, 3, 8, and 9.

2. Extent of Contamination at POW-3

Site 13

High TOX concentrations and lead levels at the maximum concentrations permitted by the primary drinking water regulations appear to be migrating off base from the old dump site. These contaminants were detected in a sample from a salt water lagoon connected to the open sea. The potable water supply from fresh water lakes is not affected by these contaminants; however, the lagoon environment may possibly be affected by these contaminants.

3. Extent of Contamination at POW-2

Site 16

Relatively high levels of TOX and a lead concentration of 0.03 $\mu\text{g/L}$ in a water sample may be affecting lagoon waters and possibly migrating off base. Fresh water lakes, the potable water supply, do not appear to be affected by this site.

4. Extent of Contamination at POW-1

a. Site 28

Oil and grease at 7 mg/L and TOX at 170 $\mu\text{g/L}$, detected in the ponded water adjacent to the POL storage pad, do not appear to be a potential source of contamination for the potable fresh water supply. The fresh water lake is approximately three-quarters of a mile from the site. There is a possibility that this site could drain into the lagoon.

b. Site 31

A sample of lagoon waters adjacent to this site had TOX values of 950 $\mu\text{g/L}$. These contaminants appear to be migrating off base. This site does not appear to have the potential for affecting potable water supplies.

c. Site 32

The water sample from the pond adjacent to the Husky Oil Company dump had high levels of TOX (8400 $\mu\text{g/L}$) and phenols (25 $\mu\text{g/L}$). These contaminants may migrate off base into the Beaufort Sea, but they do not appear to be a potential contaminant of the potable fresh water supply.

5. Extent of Contamination at LIZ-2

a. Site 40

The water sample taken from the water ponded at the edge of the active dump had a high level of TOX (1400 µg/L) and 13 µg/L of phenols. These contaminants, by virtue of their location, could potentially migrate off base and enter Kasegaluk Lagoon. It is very unlikely that the station water supply would be affected by this site.

b. Sites 43 and 44

The water samples from both of these sites have elevated TOX values (130 and 150 µg/L). Although the water supply does not appear to be threatened by this contaminant, the possibility exists that the contaminant might migrate off base into Kasegaluk Lagoon.

V. ALTERNATIVE MEASURES AND CONCLUSIONS

A. ALTERNATIVE MEASURES

This section describes several alternatives for further investigating the existence of surface water contamination and the potential for human health hazards at the five DEW Line stations investigated. The alternatives include resampling surface waters, including ponds, lagoons, streams, and drainage ditches; and resampling soils in which contaminants have been detected. In addition, upgradient samples should be collected and analyzed from the five DEW Line stations to acquire comparative background chemistry data.

Several other monitoring methods have been considered as potential options for elucidating contamination at the DEW Line stations. Surficial resistivity surveys (used to define contaminant plumes), lysimeters (used for unsaturated zone monitoring), and monitoring wells (used for ground water quality monitoring) were all considered. The presence of permafrost, in some cases only 2 feet from the surface, and the hydrologic position of many of the sites adjacent to and upgradient of surface water bodies preclude the use of these three investigative methods.

1. BAR-M

a. Site 1

By resampling the surface soil in the same general area investigated in this study and analyzing for PCBs, positive confirmation of this contaminant would be provided. Additional sampling of surface water drainage downstream of this site and testing for volatile halocarbons would confirm the presence of contaminants. One soil sample collected from a nearby undisturbed area and one water sample collected upgradient of the dumps would provide comparative background chemistry data.

b. Site 3

By resampling of surface water at this site and testing for oil and grease and volatile halocarbons, these contaminants would be confirmed and the particular halocarbons present would be defined. A water sample collected upgradient of Site 3 would provide comparative background chemistry data.

c. Site 4

Additional sampling of surface water drainage from this site and testing for volatile halocarbons would confirm the presence of contaminants. A water sample collected upgradient of Site 4 would provide comparative background chemistry data.

d. Sites 8 and 9

By resampling surface waters draining these sites and testing for volatile halocarbons, the presence of these contaminants would be confirmed and the particular halocarbons present would be defined. One water sample from upstream of potential contamination should be collected at each of these sites to establish comparative background chemistry data.

2. POW-3

Site 13

Additional sampling of waters from lagoons adjacent to the old dump, Site 13, and testing for lead and volatile halocarbons would confirm contaminants detected in the present investigation and determine which particular halocarbons are present. Collection of a water sample at this site to provide comparative background chemistry data is not thought possible, as the dump area is in communication with adjacent bodies of water.

3. POW-2

Site 16

A resampling of water from the lagoon adjacent to Site 16 and testing for lead and volatile halocarbons would confirm these contaminants and define the particular halocarbons present. If possible, a water sample should be collected upgradient of the dump for comparative background chemistry data.

4. POW-1

a. Site 28

By resampling the ponded water adjacent to the POL storage pad and analyzing the sample for oil and grease and volatile halocarbons, the presence of these contaminants would be confirmed. If possible, a water sample should be collected upgradient from nearby surface water for comparative background chemistry data.

b. Site 31

The lagoon waters adjacent to the site would be resampled and analyzed for volatile halocarbons to confirm these contaminants and define the halocarbons present. Collection of a water sample at this site to provide comparative background chemistry data is not thought possible, as the dump is in a large body of water connected to the Beaufort Sea.

c. Site 32

By resampling the pond waters adjacent to Husky Oil Company dump and analyzing for phenols and volatile halocarbons, the presence of contaminants would be confirmed and the halocarbons contributing to the high TOX level would be determined. If possible, a water sample should be collected upgradient of the dump for comparative background chemistry data.

5. LIZ-2

a. Site 40

The resampling of waters ponded at the edge of the active dump and analyzing for phenols and volatile halocarbons would confirm the presence of these contaminants, and the halocarbons responsible for the high TOX levels could be determined. A water sample should be collected from the stream upgradient of the dump for comparative background chemistry data.

b. Sites 43 and 44

A resampling of surface waters and testing for volatile halocarbons would confirm the presence of these contaminants and define the halocarbons present. Collection of a water sample from an upland lake should be considered for comparative background chemistry data.

B. CONCLUSIONS

This section contains a summary of the conclusions reached after completion of the first stage of Phase II of the IRP. Recommendations for the next phase are given in Section VI, and attendant costs are presented under separate cover in Appendix J.

The potential for environmental contamination at the DEW Line stations is moderated by the absence of refueling and defueling as part of the stations' mission and by the fact that an ongoing environmental cleanup program has been in effect for the last several years.

The potential for risk to potable water supplies is very small because fresh water lakes are used rather than ground water. These lakes are located inland, and hence upgradient of most of the dump sites.

Unconfirmed Stage 1 analytical data indicate that TOX is present in water samples at all five DEW Line stations investigated. Other contaminants present in water samples included lead levels at the primary drinking water standard at Site 13 and at an elevated level at Site 16. Oil and grease at Sites 3 and 28 and phenols at Sites 25 and 13 were also elevated above expected background levels. For a remote area such as the DEW Line stations, one would anticipate extremely low background levels. PCBs at low concentrations were found in a soil sample from Site 1.

Certain hydrologic and geologic conditions at the DEW Line stations may promote lateral transport of contaminants off site. These include moderately low permeability soils, an impermeable permafrost layer occurring only several feet below ground surface, and surface drainage of many of the sites into seas or lagoons. Sites 1, 4, 8, 9, 13, 16, 31, 32, 40, 43, and 44 have a high probability of discharging contaminants off site.

VI. RECOMMENDATIONS

The recommendations presented in this section have two primary purposes:

1. To identify those sites at which further action is deemed warranted, and
2. To confirm the contaminants indicated during the first round of chemical analyses.

Various alternative measures for achieving these purposes, along with a discussion of the information that would be obtained, are presented in Section V. The following are our recommendations for sites requiring further action and investigation.

A. SITES WHERE FURTHER ACTIONS ARE DEEMED UNWARRANTED

Based on the results of sampling and analysis of water and soil samples at the DEW Line stations, it is recommended that further investigations be considered at all 13 sites.

B. SITES WARRANTING FURTHER INVESTIGATION

1. General

Because all sites at which water samples were obtained were found to have moderate to high levels of TOX, it is recommended that Sites 1, 3, 4, 8, and 9 at BAR-M; Site 13 at POW-3; Site 16 at POW-2; Sites 28, 31, and 32 at POW-1; and Sites 40, 43, and 44 at LIZ-2 be resampled for surface water. These samples should be tested for volatile halocarbons (USEPA Method 601) to help define the parameters responsible for the TOX levels found in Phase II, Stage 1. It is also recommended that surface water samples be collected from Sites 1 and 4 and analyzed for volatile halocarbons (USEPA Method 601), as these sites were not screened for these parameters during Stage 1. Water samples collected upgradient of each of the sites should be collected where possible and analyzed for volatile halocarbons (USEPA Method 601) to establish comparative background chemistry data.

2. BAR-M

a. Site 1

It is recommended that three surface soil samples be taken in fill material near the edge of the small stream sampled during Stage 1. The samples should be analyzed for PCBs to confirm the Stage 1 results. Three samples are recommended to better define the magnitude and extent of contamination. Collection of one surface soil sample from a nearby undisturbed area is recommended to establish

comparative background PCB levels in the soil. Collection of one water sample upgradient of the dumps (Sites 1 and 4) is recommended to establish comparative background levels of PCBs in the water.

b. Site 3

The pond adjacent to the petroleum storage tanks should be resampled and analyzed for oil and grease to confirm the results obtained during Stage 1. An upgradient water sample should be collected and analyzed for oil and grease to establish comparative background data.

2. POW-3

Site 13

The lagoon waters adjacent to the site should be resampled and analyzed for lead to confirm the results of the Stage 1 investigation.

4. POW-2

Site 16

The lagoon waters should be resampled as close to Site 16 as possible and analyzed for lead to confirm the Stage 1 results. An upgradient water sample should be collected and analyzed for lead to establish comparative background lead concentrations.

5. POW-1

a. Site 28

The ponded water adjacent to the dike and pad around the tank farm should be resampled and tested for oil and grease to confirm the results of the Stage 1 investigation. An upgradient water sample should be collected and analyzed for oil and grease to establish comparative background data.

Site 31
b. Site 32

It is recommended that the pond adjacent to the site be sampled and tested for phenols to confirm the Stage 1 results. An upgradient water sample should be collected and analyzed for phenols to establish comparative background data.

6. LIZ-2

Site 40

The water ponded at the edge of the dump and adjacent to the lagoon should be resampled and tested for phenols to confirm the Stage 1 results. An upgradient water sample should be collected and analyzed for phenols to establish comparative background data.

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