U.S. AIR FORCE

INSTALLATION RESTORATION PROGRAM

DECISION PAPER

FOR

NO FURTHER ACTION

AT

CAPE NEWENHAM AIR FORCE STATION, ALASKA

FEBRUARY 5, 1988

Proponent:

11th Tactical Control Group
Alaskan Air Command
Elmendorf AFB, Alaska
99506

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DEPARTMENT OF
ENVIRONMENTAL CONSERVATION

RECORD OF DECISION

Installation: The Cape Newenham AFS, is located in the Southern Bering Sea Province of Alaska. The area is surrounded by rocky terrain supporting an alpine tundra habitat.

Scope of Decision: This record of decision and supplemental support document applies to six potential hazardous waste sites identified at Cape Newenham AFS. The recommendations for all six sites are the same; therefore, a single document for the entire installation is warranted.

Statement of Basis:

The findings and decisions on the Cape Newenham AFS presented in this report are based on the following:

- 1987 site visit by personnel of Woodward-Clyde Consultants and the U.S. Air Force.

- Comprehensive literature search and review.

- Information gathered from governmental regulatory agencies and a review of active environmental permits issued by state and federal agencies. The following permits or approvals have been issued for sites identified during Phase I:

  Solid Waste Disposal Permit (site 1b)
  Dredge and Fill Permit (site 1b)

- Review of the physical, chemical and toxicological characteristics of suspected or known contaminants.

- Preliminary Assessment Form submitted by EPA.

Regulatory Agency Concerns:

No written comments on Cape Newenham AFS were received from ADEC or U.S. EPA which expressed concerns after the 1987 site visit. However, informal comments and suggestions from both agencies have been included in this document.

Description of Selected Remedy:

For all six sites at Cape Newenham the selected remedy is "No Further Action." The reasons for this decision are:

- For all six (6) sites at the Cape Newenham AFS the risk of significant adverse effects to human health and the environment is negligible, acceptably low, or offset by other considerations.

- Based on an evaluation of alternatives, the benefits of remedial action or further study do not significantly outweigh the risks presently existing at each site.

- The costs of remedial action on further study is excessive relative to the derived benefit.

It is noted that a seventh site (the current landfill, identified as part of site 1 in the Phase I report) is a facility which is currently permitted by the Alaska Department of Environmental Conservation and subject to stringent regulation. This site is not included in the scope of studies funded by the Defense Environmental Restoration Account (DERA). Mention of the site (as site 1b) is included in this document for informative purposes only and recommendations or conclusions concerning the site are not part of the No Further Action decision.

Information presented in this document supports a finding that there is no significant impact on human health or the environment from

suspected or confirmed past contamination at the Cape Newenham AFS. The recommended remedy is no further action with regard to investigation or clean-up of six (6) sites identified as possible areas of contamination at the Air Force station.

Declarations:

The Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA) as amended, and the National Contingency Plan Act (NCP) as amended, provide for Trustee and Regulatory Agencies to determine the appropriate actions at Federal facilities where oil or hazardous substances may have been used or disposed.

Based on the best, currently available information for all six (6) sites at Cape Newenham AFS, the risk of significant adverse effects to human health and the environment is negligible, acceptably low, or offset by other considerations. Such considerations include avoidance of environmental damage resulting from further investigations or clean-up and absence of exposure to human receptors due to remoteness of the installation. In all cases, further clean-up activities would create a disproportionate amount of damage, especially to the fragile tundra ecosystem, relative to the amount of contamination which could be recovered and to other derived benefits. Other considerations include the absence of significant exposure to human receptors due to remoteness of the installation. In summary the "No Further Action" alternative will adequately protect public health, welfare, and the environment.

The Air Force determines that the action being taken is appropriate when balanced against the availability of Defense Environmental Restoration Act (DERA) or other monies for use at potentially contaminated sites. Specific attributes of the site that suggest or support the "No Further Action" alternative are as follows:

- Deep permafrost and frozen soils preclude the possibility of significant vertical migration of potential contaminants.

- The absence of significant migration pathways indicates that the mobility of potential contaminant is extremely limited.
- Human health risks are negligible.
- Contamination was not observed at any site.
- No threatened or endangered species are known to use or exist on the installation.
- No economically or commercially important species use or exist on the installation.
- Unique or sensitive environmental areas and receptors will not be affected.

Thomas T. Walker, Colonel, USAF
Commander
11 Tactical Control Group

2/9/88
Date

REVIEW AND CONCURRENCE:

State of Alaska
Department of Environmental Conservation

2/5/88
Date

United States Environmental Protection Agency
Region 10, Alaska Operations Office

2/5/88
Date

Final

Technical Support Document For Record Of Decision

Cape Newenham, AFS

Prepared for

USAF OEHL
Brooks, AFB, Texas

January 18, 1988

FINAL

INSTALLATION RESTORATION PROGRAM
TECHNICAL SUPPORT DOCUMENT
FOR RECORD OF DECISION
CAPE NEWENHAM

Prepared for:

USAF OEHL
Brooks AFB, TX

Prepared by:

Woodward-Clyde Consultants
701 Sesame Street
Anchorage, AK 99503

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1.0 SUMMARY

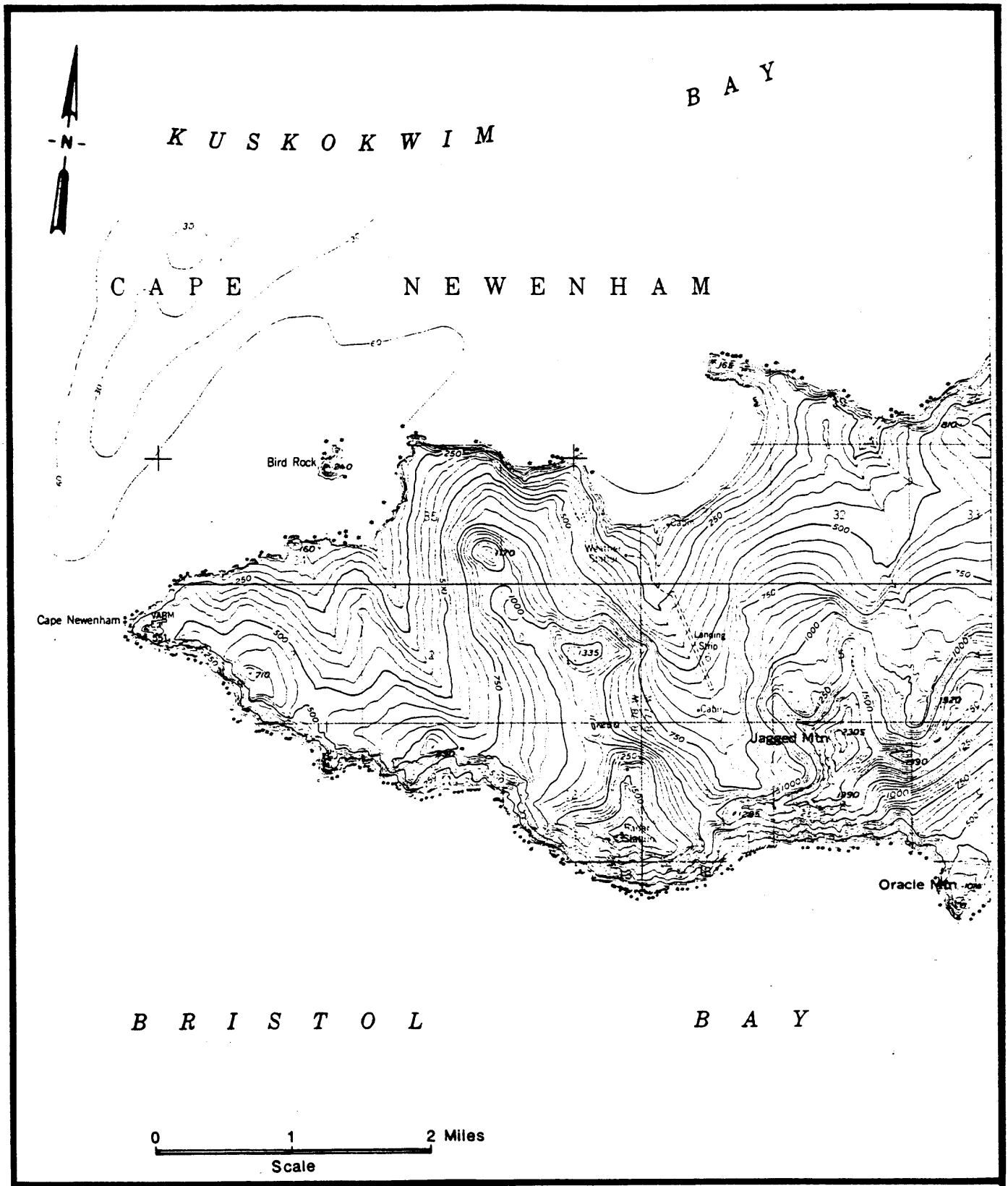
1.1 INTRODUCTION

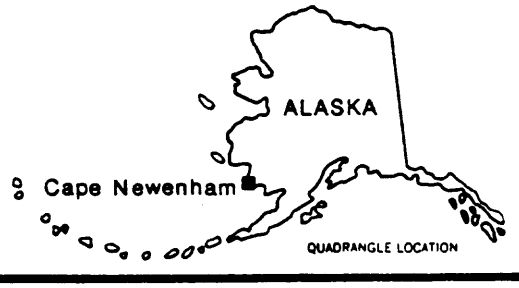
The Cape Newenham AFS, located in Alaska's Bering Sea Province, was investigated under Phase I of the Installation Restoration Program (IRP). The findings of that study indicated six potentially contaminated areas at the installation (Eng. Sci. 1985). The report recommended follow-up action for all sites. A 1987 field visit verified that cleanup activities at all six sites had occurred. The following document presents the information collected in support of no further action at Cape Newenham AFS.

1.2 SITE DESCRIPTION AND SETTING

The Cape Newenham AFS is located on a small peninsula on the southwest coast of Alaska about 770 km southwest of Anchorage (Figure 1). The Air Force Station consists of approximately 950 hectares surrounded by the Togiak National Wildlife Refuge (NWR). The nearest settlement is Platinum, a Native Alaskan mining community about 50 km to the northwest. The topography in the vicinity of the cape is steep and rocky. One unnamed drainage is found within the boundaries of the installation. The creek flows through the valley, past the airstrip and into Kuskokwim Bay. The rugged terrain of the area supports a dwarf, shrubland, alpine tundra.

Cape Newenham AFS is divided into an Upper and Lower Camp (Figure 2). They are connected by a tramway and a road. An airstrip is located at the Lower Camp and several gravel roads connect the buildings of the

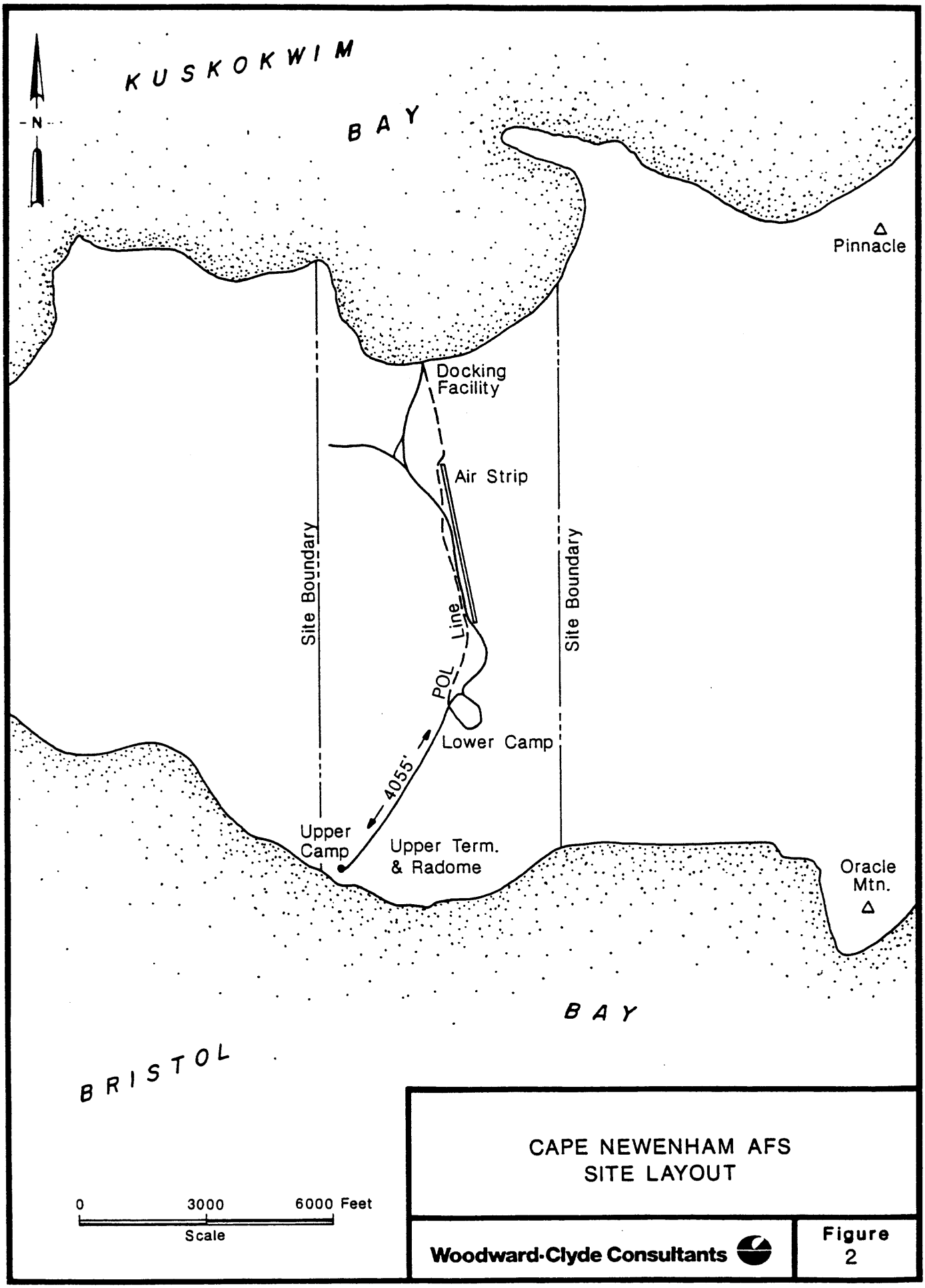




CAPE NEWENHAM AFS
TOPOGRAPHIC MAP

Woodward-Clyde Consultants

Figure
1



CAPE NEWENHAM AFS
SITE LAYOUT

Woodward-Clyde Consultants

Figure 2

camp (Figure 3). A 10-cm POL line crosses the land to the beach. The Upper Camp contains a terminal and radar facility (Figure 4).

1.3 SITE HISTORY

Cape Newenham AFS was one of the original Aircraft Control and Warning sites constructed in Alaska as part of the Air Defense System; it became operational in 1954. In 1957 a White Alice station was added. In 1979, an Alascom satellite earth terminal system replaced the White Alice facility; all White Alice structures were demolished and buried by 1987.

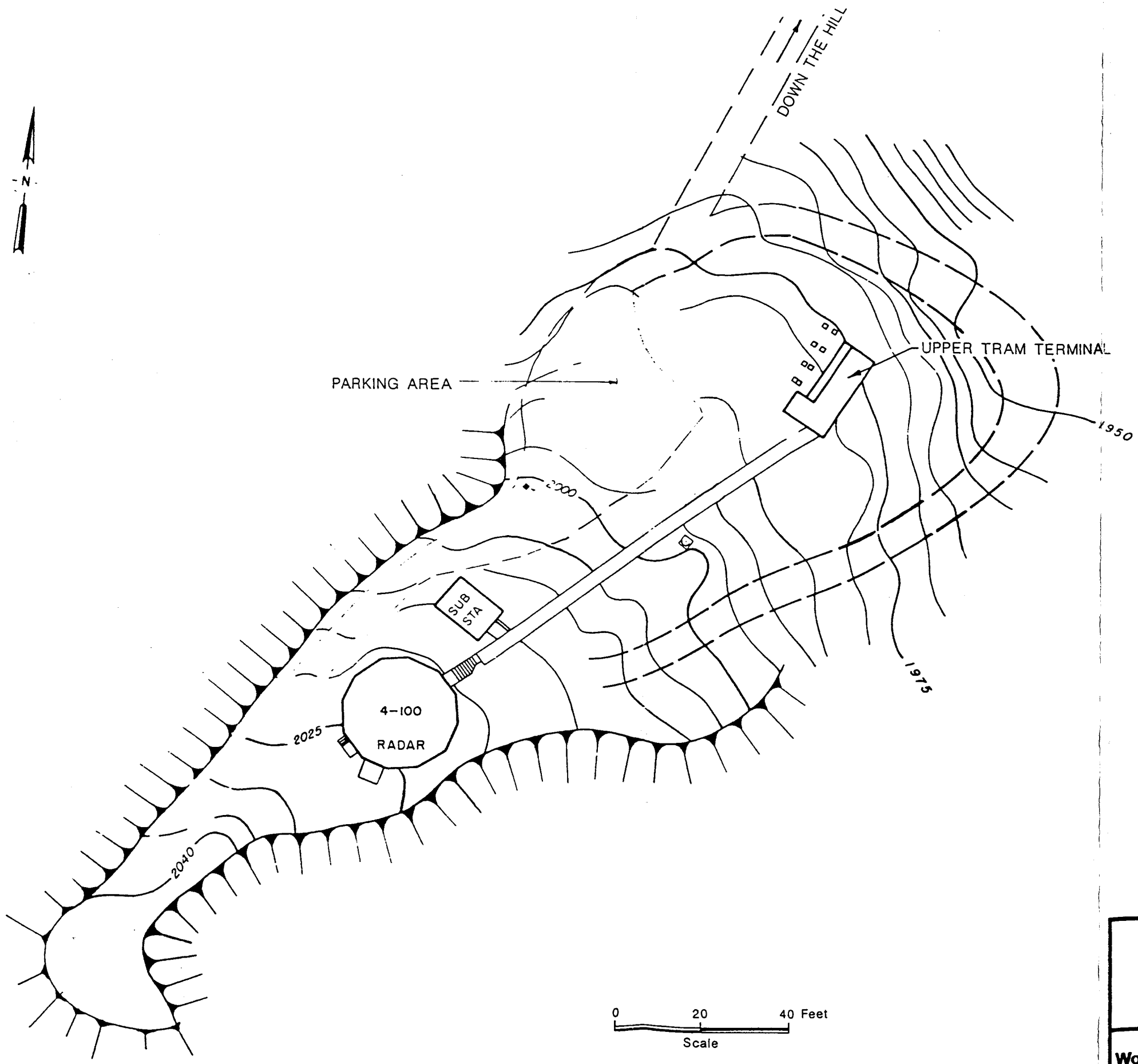
The Phase I report identified six potential sites of contamination at Cape Newenham (Table 1). Site 1 includes two waste accumulation areas at the presently active landfill. Sites 2, 4 and 5 are previously used dumpsites or waste accumulation areas, site 3 is an area of past road oiling, and site 6 is the abandoned, demolished and cleaned up White Alice site.

1.4 CURRENT SITE STATUS

1.4.1 Site Visit

The Cape Newenham AFS was visited by representatives from the U.S. Air Force and Woodward-Clyde Consultants. The visit took place on August 26, 1987 and was part of a trip to other LRRS installations in Alaska. A written synopsis of the visit is on file with the Alaska Air Command, Elmendorf AFB, AK.

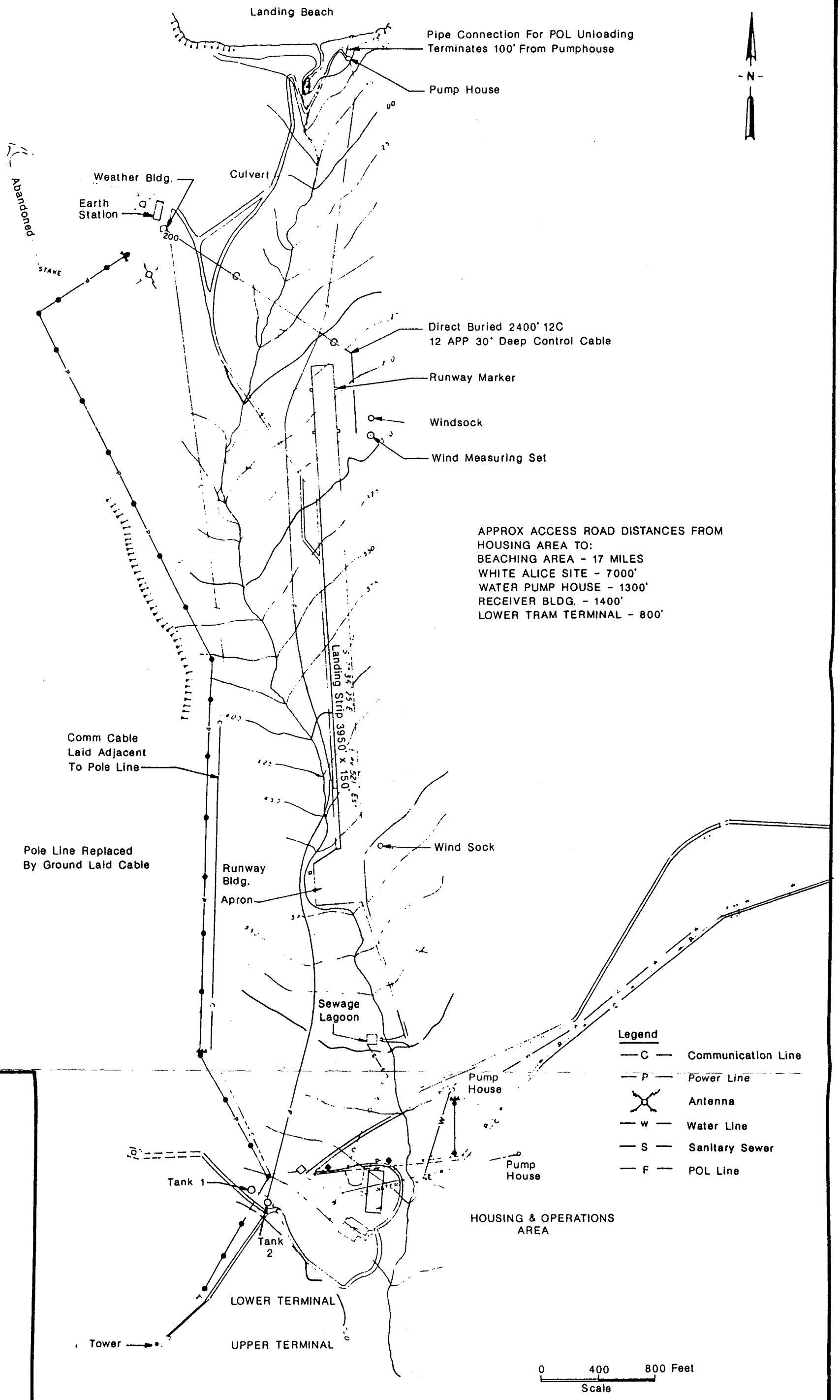
Sites visited at Cape Newenham AFS (Table 2) include a landfill and a waste accumulation area (both in site 1), an upper camp dump area (site 2), and a White Alice site (site 6). An area of road oiling (site 3), another waste accumulation area (site 4), and an abandoned landfill (site 5), all identified in the Phase I report had either been cleared and graded or could not be located by the field survey crew.



CAPE NEWENHAM AFS
UPPER CAMP FACILITIES

Woodward-Clyde Consultants

Figure 4



LOWER CAMP FACILITIES
CAPE NEWENHAM AFS

Figure 3

Woodward-Clyde Consultants

TABLE 1

PHASE I SITES (ENG. SCI. 1985)

Site Name/No.	Description of Potential Contamination Problem	Remedial History	Recommended Action
Waste Accumulation Areas 1 and 2; Landfill No. 2 (all site 1)	Spills and leaks of stored wastes.	Waste Accumulation - early 70's to 1987.	Follow-on Action: sample and monitor area. Possible clean-up.
		Waste Accumulation - 1950's to 1960's.	
	Landfill disposal of some shop wastes; fill operations with 10 to 15 ft.	Landfill operations - 1950's to 1987.	
Dump area at Upper Camp (site 2)	Shop wastes (i.e. ethylene glycol and waste oils from Upper Camp) and other debris disposed of on the steep N.W. side of mountain.	Discontinued in 1970's. Operational from 1950's to 1970's.	Follow-on Action: sample and monitor area. possible clean-up.
Road oiling in Lower Camp (site 3)	Waste oils and other shop wastes applied to road for dust control.	Discontinued in 1970's. Road oiling took place from the 1950's to 1970's.	Follow-on Action: sample and monitor area. Possible clean-up.
Waste Accumulation Area 3, Lower Camp (site 4)	Evidence of minor spills and leaks from stored wastes (oils, thinners, etc.).	Discontinued in 1970's. Operational from 1950's to 1970's.	Follow-on Action: sample and monitor area. Possible clean-up.
Landfill 1, Lower Camp (site 5)	Disposal site for refuse and shop wastes. Has been filled to depths of 6 to 8 ft.	Discontinued. Operational during the 1950's.	Follow-on Action: sample and monitor area. Possible clean-up.
White Alice Site (site 6)	Suspected spills, leaks, and disposed of oils containing PCBs.	Abandoned. Operational 1957 to 1979.	Follow-on Action: sample area. Possible clean-up.

TABLE 2

CAPE NEWENHAM SITES VISITED IN 1987

Site Name/No.*	Description of Potential Contamination Problem	Remedial History	Status	Recommended Action
Waste Accumulation Area (site 1a)	Waste area located adjacent to landfill near drainage. Some small dark stains noted on dry dirt resulting from previous spills. No visible contamination nearby or in stream bed.	Discontinued in 1987. Operational from 1950's to 1987. (Nothing stored here at time of visit.)		No Action.
Landfill (site 1b)	Landfill area located along the runway near a drainage. Part was cleaned up and covered over in 1987. A contiguous section remains active. No visible contamination nearby or in stream bed.	Operational from 1950's to present.		Not applicable.
Upper Camp Dump (site 2)	Debris and wastes have been deposited here in the past. Since deposition has ceased, high winds and severe weather have disseminated most all the debris and waste.	Discontinued in the 1970's. Operational from the 1950's to 1970's.		No Action.
White Alice Site (site 6)	Phase I noted that transformers were stored here, although it is not evident and unknown. Entire site has been buried. No visible contamination is present.	Entire site demolished, covered over and graded by 5099th in 1987.		No Action.

*Sites 3, 4, 5 were not found by site visit team.

There are no wastes currently stored in the waste accumulation area (site 1a) adjacent to the landfill. Evidence of a few small spills was seen, appearing as dark stains generally less than 1 m in diameter. The storage area is dry and well drained. The surrounding vegetation and waters do not show signs of contamination.

The current landfill (site 1b), located along the western side of the runway, was examined by the survey team. However, this site is currently permitted by the Alaska Department of Environmental Conservation and is, therefore, beyond the scope of this document. The landfill appears to be mostly dry, with no obvious effluent (Figure 5). Contamination was not apparent during the site visit, and a small stream flowing along the eastern margin was also free from any signs of contamination.

The Upper Camp dump area (site 2) is situated on a steep slope subject to high winds and severe weather. Two or three large metal structural pieces were observed by the field team. No signs of contamination were apparent. It is likely that any debris noted during Phase I investigations, has since been blown from the site.

The entire White Alice site (site 6) was recently demolished and buried. The field survey team did not observe any signs of contamination, and there is no evidence of structures, wastes, or debris visible on the surface (Figure 5). This observation does not agree with the Phase I report which indicates the presence of transformers. The disposition of the transformers is not known.

1.4.2 Risk Screening

Environmental and health risks were assessed at the six sites identified in the Phase I. As stated above, assessment of the landfill (site 1b) is beyond the scope of this report. Risks associated with the remaining sites were determined to be negligible or not high enough to warrant further action.

LANDFILL AND WHITE ALICE SITES

Figure
5

1.5 ALTERNATIVES

Alternative actions were considered for all six sites at Cape Newenham AFS. No further action is the preferred alternative at all sites.

1.6 CONSISTENCY WITH ENVIRONMENTAL LAWS

The Cape Newenham AFS was found to be in compliance with the following environmental laws:

- Resource Conservation and Recovery Act (RCRA)
- Clean Water Act
- Safe Drinking Water Act
- Coastal Zone Management Act.

1.7 CONCLUSION

Based on a comprehensive literature search, observations made during a site visit in 1987, information gathered from government regulatory agencies, and the characteristics of suspected or known contaminants, the health and environmental risks at all five sites assessed at Cape Newenham were judged to be negligible to low. An analysis of action alternatives determined that no further action was the preferred alternative for all five sites.

2.0
TECHNICAL ATTACHMENTS

2.1 SITE DESCRIPTION

2.1.1 Location

Cape Newenham is a small peninsula on the southwest coast of Alaska, located in the Bering Sea province about 770 km southwest of Anchorage. The cape is situated at the southern terminus of the Ahklun Mountains between Bristol Bay and Kuskokwim Bay (Figure 1). The Air Force Station (AFS) at Cape Newenham consists of 950 hectares surrounded by the Togiak National Wildlife Refuge (NWR). The installation is located at latitude 58°39' North and longitude 162°04' West, and is only accessible by sea or air. The nearest settlement is Platinum, a Native Alaskan mining community 50 km northwest with a population of about 55 (Eng. Sci. 1985, U.S. Dept. of Interior 1986).

2.1.2 Environmental Setting

2.1.2.1 Geology

The Togiak NWR area is reportedly a jumbled, remnant ophiolite sequence (i.e., ancient continental subduction zone) of mafic and ultramafic rock (i.e., rock type high in magnesium and iron). Cape Newenham is described as representing a high pressure metamorphism and terrain juxtaposition of Late Triassic - Early Jurassic time (200 million years). The cape is cut by a north-south trending, low angle, normal fault at Security Cove (Box 1984).

The bedrock geology of the Cape Newenham AFS consists of metagabbro, greenstone, and serpentinized ultramafic rock (Hoare and Coonrad 1978). Engineering Science describes the bedrock at the installation as a dense, fractured volcanic greenstone. In the valley where the Lower Camp is located (Figure 2), the bedrock is reportedly overlain with 27 m of poorly-sorted sediments and talus consisting of boulders, broken rock, gravel, and silt. The sediments have developed as a result of weathering of the bedrock. Bedrock outcrops are common on the steep valley walls and escarpments (Eng. Sci. 1985).

2.1.2.2 Hydrology

The upper valley in section 7 of Cape Newenham AFS (see Figure 1) is the principal recharge zone of ground water for the installation. Water collects and drains northward, downslope, into shallow aquifers and surface streams. The valley near the Lower Camp (el. 212 m) consists of a thick zone (approx. 30 m) of permeable, course grained talus and alluvium. This material generally contains ground water at shallow depths which may occur under artesian conditions (Eng. Sci. 1985). Permafrost may occur as isolated lenses, but is restricted to fine-grained, unconsolidated sediments (Eng. Sci. 1985).

The topography of Cape Newenham is steep, rugged and rocky. The southern shore consists of high rocky escarpments, which plunge from 240 to 600 m, directly into Bristol Bay. All streams on the peninsula run north through steep-sided, U-shaped valleys into Kuskokwim Bay.

One unnamed drainage is found within the boundaries of the installation. The headwaters are a small lake at a 230-m elevation. The creek flows through the valley, past the airstrip and into Kuskokwim Bay (USGS map, 1971).

2.1.2.3 Biota

The Cape Newenham AFS is surrounded by the Togiak NWR. In 1969, 107,000 hectares were set aside to establish the Cape Newenham NWR.

In 1980, the Cape Newenham NWR became part of the Togiak NWR which encompasses 1.9 million hectares. The Cape Newenham area is prime habitat for pelagic birds and sea mammals. Cliffs on the Bristol Bay side of Cape Newenham maintain one of the largest nesting colonies of seabirds in the eastern Bering Sea. Field observations estimate that 1 to 2 million murres (Uria spp.), kittiwakes (Rissa spp.) and puffins (Puffinus spp.) nest here (U.S. Dept. of Interior 1974). Cormorants (Phacrocorax spp.), bald eagles (Haliaectus leucocephalus), guillemots (Ceppus spp.), auklets (Aethia spp.), and endangered peregrine falcons (Falco peregrinus) are also sighted frequently.

The northern Kuskokwim Bay side of Cape Newenham supports abundant growths of eelgrass (Zostera marina) which thrive in the shallow bays and coves. Waterfowl from all over the world stop here to feed on the eelgrass during migratory travels. Common sightings include several species of eiders (Somateria spp.), Canadian geese (Branta canadensis), emperor geese (Philacte canagica), brant geese (Branta bernicla), pintails (Anas spp.), greenwinged teal (Anas carolinensis), golden eyes (Bucephala spp.), and many other species of geese and ducks (U.S. Dept. of Interior 1974). Marine mammals, which thrive in the bays and rocky shores of Cape Newenham, include walrus (Obodenus rosmarus), Stellar sea lions (Eumetopias jubata), harbor seals (Phoca vitulina), ringed seals (Pusa hispida), ribbon seals (Histriophoca fasciata), bearded seals (Erignathus barbatus), and the endangered gray whale (Eschrichtus glaucus) (U.S. Dept. of Interior 1986).

The rugged, rocky terrain at Cape Newenham supports a dwarf, shrubland alpine tundra. This habitat is typically low shrubby plants scattered with barren rock, and is generally dominated by arctic willow (Salix arctica), dwarf willow (Salix herbacea), forked woodrush (Luzula divaricata), crowberry (Empetrum nigrum), bearberry (Arctostaphylos alpina), labrador tea (Lectum groenlandicum), mountain avens (Geum alpine), and a variety of mosses and lichens (U.S. Dept. of Interior 1986). Vegetative cover is more common on the sediments and alluvium of drainage paths and valleys. One plant species which is only known to occur at Cape Newenham and Kagati Lake is under investigation for

endangered species eligibility (Murray 1987). The plant is a type of wormwood (Artemisia glomerat var. subglabra). It is not known if it occurs within the boundaries of the Cape Newenham facility.

2.1.3 Site History

In 1943, the U.S. Dept. of Interior withdrew 5,780 hectares at Cape Newenham for military purposes. The United States Air Force relinquished all but 950 hectares to the Bureau of Land Management in 1958. The USAF maintained a 2-km wide strip of land that dissects the peninsula. In 1969 all of Cape Newenham except the AFS became part of the Cape Newenham NWR (BLM records).

Archaeological evidence indicates that various cultures have periodically inhabited Cape Newenham for 4000 to 5000 years (U.S. Dept. of Interior 1986). Consequently, the Calista Native Corporation has submitted applications to obtain several small sites in the Cape Newenham area for protection under historical site status (ANCSA 1971, section 14(h)). One of the sites pending adjudication is located within the station boundaries. The site is approximately 1/2 by 1/4 km at Kuskokwim Bay, near the boat dock. The Bureau of Land Management received an amended application for this land from Calista Corporation in 1987.

Cape Newenham AFS was one of the ten original Aircraft Control and Warning (AC&W) sites constructed in Alaska as part of the Air Defense System. The installation became operational in 1954 and maintained a military staff of 94. In 1957 a White Alice station was built on a ridge near the center of section 5, on a separate parcel of land (Figure 1). In 1979 the White Alice station was deactivated and replaced with the Alascom satellite earth terminal system; in 1987 all structures were demolished and buried. Eighty military positions were eliminated when RCA was contracted to provide support services. The installation of a Joint Surveillance System (JSS) in 1982, which transmitted radar and beacon data by satellite directly to Elmendorf Regional Operation and Control Center (ROCC), eliminated all military

positions and permitted total operation by RCA. The installation of Minimally Attended Radar (MAR) in 1984 allowed the RCA staff to be reduced to a total of seventeen (Eng. Sci. 1985).

The nearest community to Cape Newenham AFS is Platinum, located 50 km northwest on the shores of Goodnews Bay. The village is located within a major hard metal province. The Goodnews Bay Mining Co. located near Platinum, is the only domestic producer of platinum (U.S. Dept. of Interior 1974).

2.1.4 Site Operations

Cape Newenham AFS is divided into an Upper and Lower Camp. They are connected by a 1230-m tramway and a road (Figure 2). The radar facility and upper terminal are located at the Upper Camp (Figure 4). Facilities in use at the Lower Camp include the airstrip, power plant, composite building for housing and operations, 10-cm POL line extending from the Lower Camp to the beach landing, and two POL tanks (Figure 3). Some of the facilities have been abandoned, including the White Alice site and the sewage lagoon.

A diesel-burning power plant provides electricity for the installation (see Figure 3). A septic system treats the sewage. Until 1986 sewage was treated in the sewage lagoon by an extended aeration process. The resulting sludge was deposited in the solid waste landfill. In 1986 the station switched to a septic system because the sewage lagoon proved impractical for only 17 personnel (Humphrey 1987).

Drinking water is obtained at Cape Newenham AFS from a gallery system. The gallery consists of a vertical pipe, 1.2 m in diameter and 5.5 m long, connected underground to a perforated lateral pipe, 1.2 m in diameter and 25 m long. Water collects in the lateral pipe and is pumped into holding tanks for station use. The water can then be pumped around the site to various locations. The drinking water is chlorinated prior to use (USGS Water Resources 1966).

2.1.5 Chemicals Used

Standard operating procedures at Cape Newenham AFS have the potential to generate hazardous material. Table 3 supplies a list of hazardous materials on inventory at the installation in 1985. The list was compiled by the operator, RCA. Activities using the items in Table 3 include building construction and maintenance, power plant operation and maintenance, vehicle and aircraft maintenance, water purification, use of solvents for cleaning, heat exchange processes, fuel storage and dispensing, tram maintenance and operation, and others.

2.1.6 Previous Studies

The IRP (Installation Restoration Program) was set up as a four-phase program:

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

Phase I was completed by Engineering Science in 1985 for the Long Range Radar Stations (LRRS). The report divided the LRRS into a northern and a southern region. Cape Newenham AFS is one of five southern region LRRS' considered. The Phase I investigations were prepared for the Air Force Engineering and Service Center in 1985.

A water supply study was done in 1964-65 by USGS Water Resources Division for the USAF/ACC. The data from this study is on file with the USGS.

TABLE 3

LIST OF HAZARDOUS MATERIALS ON SITE MAY 1985
AT CAPE NEWENHAM AFS

MATERIAL NAME	CONTAINER TYPE
Adhesive spray-on	Aerosol 17 oz. can
Paint, unused	1-Gallon can
Paint, unused	Quart can
Paint, unused	5-Gallon can
Paint, unused	Aerosol can
Paint remover	1-Gallon can
Paint thinner	5-Gallon can
Paint thinner	1-Gallon can
Alkali cleaning compound	1-Gallon can
Alkali cleaning compound	12-oz. bottle
Alcohol, denatured	1-Gallon can
Propane (hand held)	Cylinder
Cutting fluid	1-Gallon gan
Wood filler	1-Pint can
Corrosion preventative	1-Pint can
Penetrating oil	1-Pint can
Metal polish	1-Pint can
Cleaning compound	1-Gallon can
Cleaning compound	5-Gallon can
Antiquing solvent	1-Quart bottle
Electrolite acid	1-Gallon[1]
Windshield cleaner	1-Quart[1]
Calcium hypochlorite	1-Quart[1]
ARCFT lube oil	1-Gallon can
ARCFT lube oil	1-Quart[1]
Sealing compound	1-Quart[1]
Mold cleaner, ceramic	1-Pint[1]
Epoxy resin	1-Pint[1]
Plastic filler	1-Pint[1]
Chlorinator pellets	10-Gallon drum
Casket seal compound	1-Pint[1]
Celite 28	24" x 36" bags
De-icer	Aerosol spray can
Oxygen (full)	225-CF cylinder
Acetylene (full)	225-CF cylinder
Oxygen & acetylene (empty)	225-CF cylinder
Brake fluid	1-gallon[1]
Acetic acid	Vase
Oil, lube HD030	55-Gallon drum
Antifreeze, glycol (unused)	55-Gallon drum
Civil Air Patrol jet fuel	55-Gallon drums
Ether	Aerosol can
Light grease, unused	1-Pound[1]
Aircraft grease, unused	1-Quart[1]
Refrigerant (Freon unused)	30-lb cylinder

[1]Type of container unknown.

The above itemized hazardous materials include the White Alice site.

Note: These substances are not expected to be found at any Cape Newenham disposal sites. Hazardous waste materials and substances for retrogradation are transported to Elmendorf AFB. Used oils are containerized to await shipment off site.

Source: RCA/OMS Cape Newenham

2.2 CURRENT SITE STATUS

2.2.1. Findings from Previous IRP Studies

Phase I (Eng. Sci. 1985) considered six potential contamination areas at Cape Newenham AFS (see Table 1 for site descriptions). Site 1 is Waste Accumulation Areas 1 and 2 and Landfill 2 at the Lower Camp. Site 2 is the Upper Camp Dump Area. Site 3 is an area of Lower Camp road oiling. Site 4 is Waste Accumulation Area 3 at the Lower Camp. Site 5 is Lower Camp Landfill 1. Finally, the White Alice Site is designated as site 6. Engineering Science rated all 6 areas/sites as Follow-up Action Warranted. Their assessment was based on field inspections, file data, interviews, environmental setting and HARM rating scale.

2.2.2 Observations from Site Visit

Cape Newenham was visited in August 1987 by representatives of the U.S. Air Force and Woodward-Clyde Consultants. The purpose of the visit was to observe current conditions at the six potential contamination sites and to evaluate the conclusions of the Phase I report. Many of the potential contamination areas/sites identified in the Phase I report have been since covered over and/or cleaned up. The 5099th Civil Engineering Operations Squadron (CEOS) buried and graded both the landfill (site 5) and waste accumulation area (site 4) near the Lower Camp, both of which had not been operational for some time (see Figure 3). The 5099th CEOS also recently cleaned and covered the landfill and waste accumulation areas (site 1) near the airstrip. The White Alice Site (site 6) was demolished and buried as well.

Because of the recent cleanup, Woodward-Clyde personnel were able to visually locate only three of the six sites identified in Phase I. These were sites 1, 2 and 6. Engineering Science (1985) classified Waste Accumulation Areas 1 and 2, and Landfill 2 as one site (site 1). Woodward-Clyde assessed the waste accumulation areas and the landfill

separately and designated them as sites 1a and 1b, respectively. Thus, for purposes of this report only four sites (1a, 1b, 2 and 6) could be identified. The covered and graded, abandoned landfill and waste area (sites 4 and 5) near the Lower Camp Complex could not be located during the 1987 site visit. Furthermore, road oiling (site 3) was discontinued in the 1970's. No evidence of contamination from road oiling could be found. Each of the sites is described below:

Site 1a is adjacent to the landfill (identified in Phase I as Waste Accumulation Areas Nos. 1 and 2 of site 1). No wastes are currently stored in this location. Much of the site is revegetated, particularly the peripheral areas. Several small dark stains were visible (generally less than 1 meter in diameter) and are probably the result of spills or leaks. The area appeared dry and well-drained. Surrounding vegetation and nearby waters showed no signs of stress or contamination.

Site 1b is located along the western side of the runway (identified in Phase I as Landfill No. 2 of site 1) and was recently cleaned and covered over by the 5099th. The landfill appears dry, with no obvious inflows or effluents. No signs of contamination were noted. A small stream flows along the eastern margin of the landfill and empties into Kuskokwim Bay a few hundred meters downstream from the site. The vegetation in the streambed was healthy, the water appeared clean and free of contamination. (Some rusted scrap was found in the stream channel.)

The Upper Camp Dump Area (site 2) is located on a steep slope beneath the Radome. Debris and wastes were deposited here in the past, although its use was discontinued in the 1970s. This area is subject to high winds and severe weather. There was no evidence of any debris or wastes other than two or three large heavy metal structural pieces. No signs of contamination were apparent.

As stated above, no evidence of contaminants from road oiling (site 3) were visible during the site visit.

The waste accumulation area (site 4) at the Lower Camp has been graded and leveled. No signs of contamination were apparent and any evidence which existed during the Phase I investigation has been buried. The actual boundaries of the site are no longer visible.

Site 5, the old landfill, also has been graded and buried. The appearance of the site during the site visit was similar to that of site 4.

The White Alice Site (site 6) was demolished and covered over by the 5099th in 1987. There is no evidence of any structures, wastes, or debris visible on the surface. The Phase I report noted that transformers were seen stored on the site (not mentioned whether inside or outside of building). It is not known if the transformers have been deposited and buried here. The site has been filled and graded. There are no visible signs of contamination.

2.2.3 Findings from the Literature Search

The Phase I report (Eng. Sci. 1985) provides most of the site specific information. The Cape Newenham AFS is reported to be underlain by isolated masses of permafrost which are usually restricted to predominately fine-grained sediments (Ferrians 1965).

The local topography is steep and rugged. The southern border is very steep with 600 meter cliffs dropping directly to sea level. The Upper Camp is located in this terrain. The cape slopes more gradually to the north over 3 km to Kuskokwim Bay. The Lower Camp is at about 200 meters above mean sea level (MSL). Most drainages at the AFS flow into an unnamed creek which flows predictably north into Kuskokwim Bay (Eng. Sci. 1985).

The hydrology of the Upper Camp at the AFS consists of poorly-sorted coarse talus on steep slopes over bedrock. Groundwater may occur in these sediments seasonally as perched water, but discharge of runoff into bedrock or downslope is more likely. The Lower Camp hydrology is

dominated by thick talus and alluvium (27 meters). These unconsolidated, highly permeable sediments generally contain ground water at shallow depths (1 to 2 meters). The talus/alluvial material receives recharge from upslope and discharges downslope. It is reported that ground water in bedrock flows under artesian conditions at the Lower Camp area (Eng. Sci. 1985). Bedrock is about 27 meters below the surface. Two drinking water wells have been installed in bedrock since 1975. The first one silted up and the second was abandoned. The present drinking water source is a gallery, about 6 meters deep, which serves as a "collecting pan" for shallow water percolation. The water is then pumped out and into holding tanks. The gallery is currently the only fresh drinking water source at the AFS. The gallery is located just south of the road leading to the White Alice site, and east of the small creek. It has been in operation since before 1965 (USGS Water Resources Div. 1966).

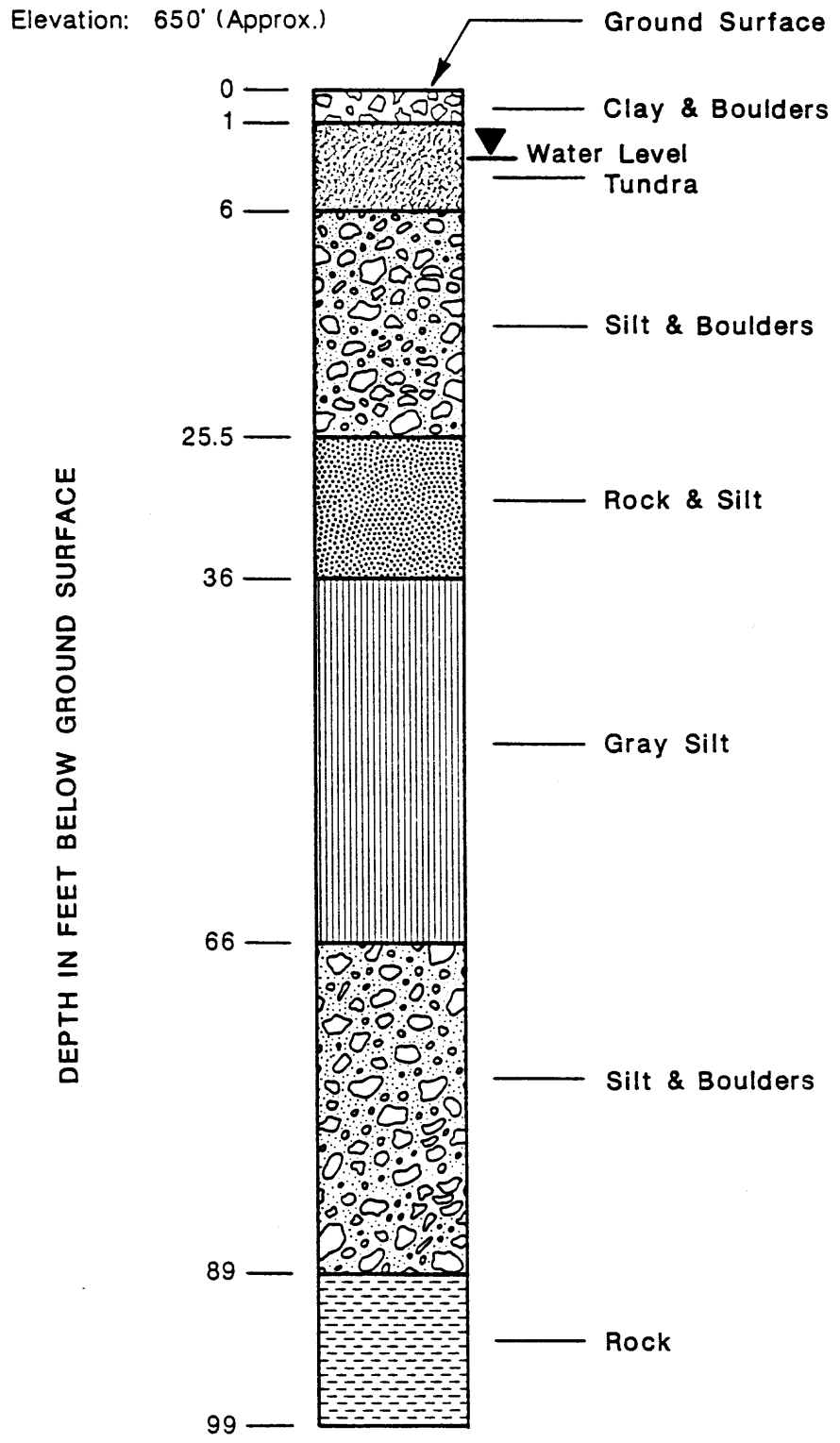
The geology is primarily a fractured volcanic greenstone as bedrock with varying thicknesses of accumulated talus and alluvium overlying. The accumulated residuum is thin at higher elevations but increases in depth at lower elevations. A well log taken near the Lower Camp shows depth to bedrock as 89 feet (27 meters). The log shows the constituents of the poorly sorted talus/alluvium (Figure 6). Permafrost may occur as isolated lenses in the fine silts.

The mean annual precipitation at Cape Newenham is 102.3 cm (Alaska Weather Service).

2.2.4 Consistency with Environmental Laws

2.2.4.1 Resource Conservation and Recovery Act (RCRA)

Subtitle C-Hazardous Waste Management. Defines hazardous wastes and prohibits disposal except in permitted facilities. Cape Newenham AFS is in compliance with Subtitle C.



Note: Water Level Measured June 17, 1975 in Lower Camp Area

Source: Modified from U.S. Geological Survey Water Resources Division File Data, undated.

CAPE NEWENHAM AFS
WELL LOG

Woodward-Clyde Consultants

Figure 6

Subtitle D-State or Regional Solid Waste Plans. State or regional permits are required for non-hazardous waste disposal facilities. The current landfill (site 1b) is permitted until April 1, 1988 by the Alaska Department of Environmental Conservation at which time it must be renewed. The disposal of hazardous substances in the landfill is prohibited by the permit.

2.2.4.2 Clean Water Act

Section 303-Water Quality Standards and Implementation Plans. This requires water quality standards for all surface waters to be implemented by the states. In Alaska these have been promulgated by ADEC. There is no evidence State water quality standards are being violated at Cape Newenham AFS.

Section 311-Oil and Hazardous Substance Liability. Accidental or intentional discharges of oil and hazardous substances are regulated. No evidence of contamination by previous road oiling exists.

Section 404-Permits for Dredged or Fill Material. Modifications to the wetlands require a Discharge of Dredged or Fill Material Permit from the Army Corps of Engineers. A permit was issued on March 12, 1987 for the current landfill (site 1b).

2.2.4.3 Safe Drinking Water Act

Section 1412-National Drinking Water Regulations. It is unlikely that drinking water standards as promulgated by the Safe Drinking Water Act (SDWA) will be exceeded by potential contamination at Cape Newenham AFS.

Section 1413-State Primacy Enforcement Responsibility. The State of Alaska has assumed primacy for enforcement of the SDWA. The water supply at Cape Newenham is classified as class C (serving 25 persons or less). A permit is not required nor is monitoring.

However, the installation routinely monitors for State primary contaminants and submits results to ADEC. The water supply is Public Water Supply No. 260480.

2.2.4.4 Coastal Zone Management Act

Consistency with the Alaska Coastal Management Program must be demonstrated for all construction initiated after October 1983 within coastal areas in Alaska. Certificates of consistency for construction and operation of the Cape Newenham Installation were not required at any of the potential contamination sites at Cape Newenham because of this time limitation.

2.3 POTENTIAL CONTAMINANTS

Hazardous substances which have the potential to exist in the environment at Cape Newenham AFS include many substances commonly used at LRRS installations. The most important of these are fuels, solvents, PCBs, battery contents, lubricants and oils, and antifreeze. All six sites identified in the Phase I report exhibited historical evidence of contamination. However, contamination was visible only at Site 1a during the 1987 site visit. This amounted to only a few small soil stains. Each site is discussed below.

2.3.1 Waste Accumulation Areas 1 and 2 (Site 1a)

The waste accumulation area is located upslope from the landfill. No wastes are currently stored there. Historically, waste substances were stored in 55-gal drums at the site. Some residual contamination was evident as small (less than 1 m diameter), dark stains apparently caused by spillage. The stains appear non-soluble and may be residual heavy petroleum products (e.g., diesel fuel or lube oil). There is no evidence of major spillage, although the amounts and types of contaminants remain undetermined. The area appears to be dry and well drained. The surrounding vegetation shows no sign of stress.

2.3.2 Active Landfill (Site 1b)

The landfill is currently permitted by the Alaska Department of Environmental Conservation (ADEC). That permit was issued March 23, 1983 and expires April 1, 1988. It prohibits the disposal of combustible material, hazardous material, liquid wastes, solvents, sewage, oil and greases, and toxic substances. There was no evidence of contamination during the 1987 site visit. The landfill had been recently cleaned and graded. The area was dry with no visible leachate or vegetation stress. Some debris, mostly scrap metal, was found in the toe of the fill and in the adjacent stream, but odors, discoloration, or oil sheens were not present in the water. Historically, there has been no reported hazardous material disposed in the landfill.

2.3.3 Upper Camp Dump Area (Site 2)

It is reported in Phase I (Eng. Sci. 1985) that ethylene glycol, wastewater from the radar facility, containers with waste oils, scrap metal, wood, 55-gallon drums and other debris were disposed of at this site in the 1950's and 1960's. The Upper Camp Dump Area has not been used as a dumping area since that time.

2.3.3.1 Ethylene Glycol

An unknown volume of ethylene glycol (anti-freeze) was apparently disposed at this site. Ethylene glycol is a two-carbon molecule with two hydroxyl groups which gives the compound infinite solubility in water. Because ethylene glycol has a high boiling point (197.5° C) and very low volatility, it is most commonly used as radiator antifreeze (freezing point -13° C).

Toxicity data for ethylene glycol is:

Threshold Limit Value (TLV) (Air): 100 ppm
Lethal Dose Low (LDL): 710 mg/kg (oral-human)

Toxic Concentration Low (TCL): 1000 mg/m^3 (inhalation-human)
Receptors: Major species threatened - lethal to fish at 2000-3000 ppm; lethal to biota using water supply

2.3.3.2 Wastewater

The type of materials likely to be present in wastewater from the Upper Camp is very limited because the Upper Camp was relatively remote from the lower, main camp. The wastewater would have contained sanitary wastes and small amounts of soaps and other cleaning compounds. These cleaning compounds are non-hazardous materials and are readily biodegradable.

2.3.3.3 Waste Oils

The Upper Camp Dump Area is expected to have been utilized for disposing minor amounts of lube oils. These lube oils were used to keep the radar equipment working smoothly. Typically, a drum of lube oil would have a pump type dispenser for filling small containers.

Lube oils are essentially non-volatile petroleum hydrocarbons and do not evaporate because of their high boiling point. They are insoluble in water and are less dense than water. Lube oils frequently contain trace amounts of metals such as chromium to improve wear stability under high temperatures and pressure. Various formulations of lube oils may include trace amounts of anti-oxidants to extend the useful lifetimes of the oil, but these materials are usually non-hazardous and biodegradable. The lube oil itself is not a hazardous material and is essentially non-toxic unless ingested in large quantities.

2.3.3.4 Scrap Metal, Wood, Drums and Cultural Debris

The Upper Camp dump was used for periodic disposal of scrap metal, wood, empty and crushed drums, and other cultural debris. Empty crushed drums were brought from the lower camp and disposed. These

drums originally contained aviation gasoline, lube oils, and other bulk materials. The aviation gas and related petroleum products were used for fueling vehicles, and heat and electric generation. Minor spills of these materials can be expected from routine transfer and handling, but the amounts of these materials spilled in the Upper Camp area is likely to be minimal.

Aviation gas is a low molecular weight, volatile, petroleum hydrocarbon which will rapidly evaporate. Aviation gas is virtually insoluble in water and is less dense (dens. = 0.71 at 15° C) than water. Therefore, it will float on top of either water or ice and will be rapidly dispersed and biodegraded in the environment. The short term inhalation limit for humans is 500 ppm for 30 mins. The ingestion toxicity (LD50) to humans is 0.5-5.0 g/Kg. Aquatic toxicity was found to be 91 ppm/24 hr/juvenile American shad/salt water (Sax 1984).

Gasoline, kerosene, diesel, and fuel oils in general are given a toxicity rating of 3. This corresponds to a moderately toxic rating, with a probable oral lethal dose to humans of 0.5-15.0 gm/Kg. The toxicity level of any given fuel is usually based on the content of benzene and other aromatic hydrocarbons, so these parameters must be known in order to adequately classify their toxicity levels. Threshold limit values have been established for gasoline and are given below:

Time-Weighted Average (TWA)		Short Term Exposure Limit (STEL)	
ppm	mg/m^3	ppm	mg/m^3
300	900	500	1,500

It is also reported by Engineering Science (1985) that minor amounts of solvent were disposed. The only solvents reported were ether, alcohol and paint thinner. All of these materials are extremely volatile and rapidly evaporate even under arctic conditions. These

solvents would have been used for small degreasing jobs (tools, etc.) or as paint thinners and as such may have been subject to small spills in transfer or handling operations. Trace amounts of these solvents were likely discharged in the wastewater.

During the 1987 site visit, no evidence of hazardous waste was observed at the site. However, two or three large heavy metal structural pieces were visible. There was no sign of any other remaining contamination.

2.3.4 Road Oiling - Lower Camp (Site 3)

Road oiling took place at the Lower Camp during the 1950's to the 1970's. Waste oils and hydraulic fluid were applied to the roads as a dust palliative and disposal method (Eng. Sci. 1985).

2.3.4.1 Waste Oils/Hydraulic Fluid

Until recently, the practice of road oiling to control dust was an accepted practice throughout the United States. Oils used in this manner do not release hazardous materials into the environment because neither waste oils nor hydraulic fluid contain more than trace amounts of hazardous materials. Surface disposal of oil brings the oil into contact with organisms which readily biodegrade most petroleum hydrocarbons leaving small amounts of weathered insoluble and immobile polynuclear aromatic hydrocarbons.

There was no evidence of contamination found on or along the roads during the 1987 visit. The vegetation along the roads appeared to be healthy and stress-free. No dark or insoluble staining was apparent on or along the roads.

2.3.5 Waste Accumulation Area 3 - Lower Camp (Site 4)

This waste accumulation area was used to store drummed wastes in the 1950s, 1960s and 1970s. These drummed wastes were not buried, and

have since been removed. During Phase I some evidence of minor spills and leaks from stored waste oils and thinners was noted (Eng. Sci. 1985).

2.3.5.1 Waste Oils/Thinners

Some accumulated waste oils and thinners in Lower Camp may have been spilled in routine handling and transferring operations. Such surface spillage does not represent a continuing potential contamination source. Waste oils and thinners readily biodegrade or evaporate; therefore, no further cleanup action is necessary.

The waste accumulation area was visited in 1987 but the boundaries of the site were unclear. Since the area had been cleaned and graded, there were no visible signs of contamination in the vicinity. The area was dry and well drained and the vegetation appeared to be healthy with no sign of stress.

2.3.6 Landfill - Lower Camp (Site 5)

This landfill, located at the Lower Camp, was used in the 1950s. It encompassed less than 50 m^2 and was reportedly used to dispose of refuse and shop wastes (e.g., oils and lubricants). The landfill has been covered with 2 to 3 m of fill (Eng. Sci. 1985).

2.3.6.1 Shop Wastes (Oils and Lubricants)

Lube oils are non-volatile petroleum hydrocarbons that do not evaporate, are insoluble in water, and are less dense than water. See section 2.3.3.3 for detailed discussion of lube oils.

2.3.6.2 Solvents

As discussed in Section 2.3.3.4, solvents containing ether, alcohol, or paint thinner are extremely volatile and rapidly evaporate when exposed to the atmosphere. Therefore, there can be no lasting effects

do not readily desorb. The implication is that PCBs will not leach or diffuse in soils; transport into the hydrosphere from contaminated soils will be through erosion of soil particles or sediment, not by desorption or dissolution. PCBs undergo some degradation by microorganisms and photochemical reactions, but these reactions are believed to be relatively slow and insignificant.

The potential receptors for PCBs include fish, waterfowl and reproducing phytoplankton. Because they are lipophilic and very stable, bioaccumulation of PCBs in exposed organisms is likely. If the risk of exposure to organisms by any potentially contaminated soils is effectively removed, then the environmental exposure risk is substantially reduced.

2.3.7.2 Liquid Wastes

These may include solvents, lube oils, gasoline, and anti-freeze. All of these components are discussed in Section 2.3.3.

3.2.7.3 Chlorinated Solvents

Chlorinated solvents such as trichloroethylene (TCE) and dichloroethane isomers (DCE) are used almost exclusively for degreasing machinery and metal parts. Typical solvent usage would include pouring solvent on a rag and using the rag to degrease equipment. Small amounts of solvents may be spilled during usage. Because the chlorinated solvents are highly volatile and rapidly evaporate in air and water, spills on surfaces are usually of no concern. However, disposal of significant quantities of chlorinated solvents such as TCE and DCE can produce long term groundwater contamination. Chlorinated solvents are not readily degraded by microorganisms; however, over time (1+ months) they are eventually transformed by biotic and abiotic mechanisms into other degradation products, including carbon dioxide and hydrochloric acid.

from routine spillage of these solvents during transfer and handling operations.

The landfill was unrecognizable at the time of the 1987 site visit and the landfill boundaries could not be delineated. There were no visible signs of contamination in the general area. The vegetation was healthy and free from signs of stress and the site appeared to be dry and well drained.

2.3.7 White Alice Site (Site 6)

The White Alice site at Cape Newenham AFS was in operation from the 1950s to the 1970s. During its operation, the facility generated wastes such as ethylene glycol (418 L per year), motor oil (840 L per year), waste batteries, and electrical generation debris such as transformers, capacitors, etc. After the 1970s, the site was used to store liquid wastes, which spilled and leaked on the ground. In 1984, thirteen transformers and 1200 L of PCB oil from the White Alice site were shipped from the installation; no contaminated soil was shipped (Eng. Sci. 1985).

2.3.7.1 PCBs

In the event that PCB contamination occurred during the operation of the site, toxicity data for PCBs has been included. PCBs have been established as suspected human carcinogens by the IARC (International Agency on Research on Cancer). The Time-Weighted Average for PCBs is 1.0 mg/m^3 for skin contact, 10 mg/m^3 for inhalation (human). There is a moderate to high acute danger for ingesting PCBs orally, by inhalation, or through skin contact, especially when exposed simultaneously to carbon tetrachloride. The higher the chloride content, the greater the toxicity level. Oxides of PCBs are more toxic than their unoxidized counterparts.

PCBs are very persistent in the environment. Their adsorption in soils depends on the presence of organic matter. Once adsorbed, PCBs

Toxicity data for TCE and DCE are given below:

TCE: LDL (oral-human): 7 g/Kg
TCL (inhalation-human): 6900 mg/m^3
TWA: 350 ppm, 1900 mg/m^3
STEL: 450 ppm, 2450 mg/m^3
Irritant to skin/eye (human): 5 ppm

Aquatic toxicity: 100-1000 ppm; positive animal carcinogenic determination.

DCE: TCL (inhalation-human): 25 ppm
TWA: 200 ppm, 810 mg/m^3
STEL: 250 ppm, 1010 mg/m^3

2.3.7.4 Batteries and Electrical Generation Equipment

Batteries, capacitors, transformers, and related used or broken equipment has been removed from the site. Some potential contamination of buried soils resulting from spills or leaks of fluids may remain on site. Although battery acid is a hazardous material, the acid will be rapidly neutralized by soils. Trace amounts of lead may remain, but the mobility of lead particulates is negligible.

Oils from electrical generation equipment may have leaked to the soils before removal. The oil in transformers and capacitors probably contained PCBs (see Section 2.3.7).

2.4 CONTAMINANT MOVEMENT/TRANSPORT MECHANISMS

2.4.1 Waste Accumulation Areas 1 and 2 (Site 1a)

These waste accumulation areas (site 1a) are no longer used. Some evidence of past hazardous substance spillage exists, but no obvious potential migratory paths exist. The area consists of an unvegetated region less than 1,525 m^2. The rest of the site has been reclaimed

with apparently healthy vegetation. The area is dry and well drained with no obvious effluents. Very little potential exists for contaminant migration from the site; therefore, further action is not warranted for the site.

2.4.2 Upper Camp Dump Area (Site 2)

The dump area at the Upper Camp (site 2) is located on the northwest slope of a steep mountain. Although no contaminants were disposed here after the 1970's, compounds such as antifreeze, waste oils, and petroleum products were dumped in the 1950s and 1960s. Almost all of the contaminants have been washed down the slope by precipitation. The area receives about 0.75 m of precipitation annually. Any remaining contamination is negligible. Of the contaminants known to be present during the dump's operation, the fate of some of these in the environment is presented below.

2.4.2.1 Ethylene Glycol

Because ethylene glycol is infinitely soluble in water, as well as biodegradable, it poses no long-term contamination threat. The solubility factor implies that any ethylene glycol spilled at the site will have been washed away by precipitation. Additionally, biodegradation is an important fate process since many strains of bacteria use ethylene glycol as their sole carbon source. In laboratory biodegradation rate tests, a 10 mg/L concentration of ethylene glycol was completely degraded within 3 days at 20° C. At 8° C, it took 14 days for complete biodegradation (EPA 1979). Therefore, it is highly unlikely that any lasting or continuing detrimental effects have resulted from spillage of ethylene glycol.

2.4.2.2 Waste Lube Oils

Lube oils are non-volatile, straight-chain petroleum hydrocarbons that are less dense than water and insoluble in water. Therefore, they are most likely to float on water and be washed downslope with

precipitation. Because lube oils are hydrophobic, migration in soil by groundwater pathways is generally insignificant. The small amounts of lube oils potentially remaining at the site would pose little threat to the virtually non-existent and/or seasonal water table.

2.4.2.3 Gasoline/Kerosene/Aviation Gas

These petroleum products undergo alterations from physical, biological, or chemical processes occurring over time frames ranging from days to years. The magnitude of transformation increases with time. Although the biodegradation and physical processes proceed at slower rates in the arctic than in warmer climates, a substantial change in composition of materials is likely to have occurred during the last 10 to 15 years. Evaporation and dissolution are important physical processes. In addition, photochemical and microbial oxidations are possible. Weathered petroleum products generally exhibit the following characteristics:

- Loss of low boiling hydrocarbons from evaporation.
- Loss of low boiling hydrocarbons from dissolution.
- Increase in relative proportions of naphthenic compounds.
- Increase in relative proportions of highly branched alkylated compounds from biodegradation relative to straight chain compounds.
- Increase in relative proportions of polycyclic compounds relative to saturated compounds.

As petroleum hydrocarbons age or weather, the most persistent compounds, polycyclic aromatic hydrocarbons, remain the longest. These compounds may slowly be removed by biodegradation, biotransformation, photolytic, or oxidative processes.

The rate of biodegradation of the weathered petroleum hydrocarbons slows substantially as the molecular weight increases. For instance, naphthalene has a half-life of 5 hours under controlled microbial transformation experiments. Under the same conditions, benzo[a]pyrene will require 21,000 hours to degrade by one half. The relative mobilities of these two materials show a similar relationship. Naphthalene is much more mobile than the more complex ring system of benzo[a]pyrene.

With the possible exception of Bunker C, petroleum hydrocarbon materials are generally less dense than water and will float on top of the water surface. Trace amounts of petroleum constituents will dissolve in water (principally benzene, toluene, and xylene), but for the most part petroleum hydrocarbons are virtually insoluble in water.

2.4.2.4 Diesel

Diesel fuel is relatively insoluble in water. Furthermore, adsorption of diesel fuel constituents on organic soils can be significant. Thus, once fuel is spilled, especially on soil with high humic content such as the peats in Alaskan tundra, migration is unlikely except where hydraulic gradients are sufficiently steep. Once infiltration has taken place, lateral migration is virtually negligible because of the hydrophobic characteristics of petroleum compounds typical in diesel, and the adsorptive capacity of humic soils.

Because of the low volatility of diesel fuel, particularly after many years of weathering, air transport of hazardous substances from a spill is not a significant concern. Because diesel fuel is a complex mixture of hydrocarbons, it is speculative to discuss the processes contributing to its fate over time. Biodegradation and chemical transformations, as well as physical processes such as volatilization and differential adsorption on soils, will occur in fuel spills. The possible exposure to environmental receptors is essentially negligible and human exposure to hazardous levels would be possible only through direct ingestion of contaminated soils.

2.4.2.5 Chlorinated Solvents

1,1,1-trichloroethane (TCE):

Due to the high vapor pressure of TCE, volatilization to the atmosphere is rapid. Consequently, this is the most significant process for removal of TCE from both air and water. Based on laboratory studies, the half-life of TCE has been calculated at between 20 and 90 min. in shallow surface water. However, any quantity of non-volatilized TCE that migrates to groundwater can present long-term contamination, since competing degradation mechanisms are not significant.

1,1-dichloroethane (DCE):

Like TCE, the major transport mechanism for DCE to the environment is volatilization. The tropospheric lifetime of DCE, estimated by extrapolating from the reported lifetime of TCE, is less than one day (Callahan 1979). Photolysis, biotransformation/biodegradation, and bioaccumulation are all considered insignificant degradative processes. Hydrolysis of DCE occurs too slowly (half-life estimated at 1+ years) to be considered a significant fate process. As in the case of TCE, any quantity of DCE not immediately volatilized may persist in the environment. However, in the case of DCE, the probable maximum lifetime is several years. In the arctic environment, this lifetime is probably extended.

2.4.3 Road Oiling - Lower Camp (Site 3)

Road oiling was concluded in the 1970's. It is possible that waste oils from the road oiling actions migrated or were directly sprayed into the drainage. Since the 1970's any contaminants that did migrate into the streams and drainages have since been transported off site or have been sufficiently degraded. Contaminants may have migrated in airborne dust particles from the roads. However, since the surface disposal of oil brings the oil into contact with organisms which readily biodegrade most petroleum hydrocarbons, only the insoluble and immobile polynuclear aromatic hydrocarbon (PAH) portion remains. PAHs

are readily adsorbed onto humic, carbon-rich soils. These hazardous materials are slowly degraded by photolytic, oxidative and biological processes. In some circumstances, lower molecular species such as naphthalene will sublime (a form of evaporation) and be removed from the surface environment. The 1987 site visit found no evidence of residual contamination. Further consideration of migration pathways is not provided since the tendency for current levels of contaminants to migrate are inconsequential. For these reasons, no additional action is recommended at site 3.

2.4.4 Waste Accumulation Area 3 (Site 4)

Site 4, the Lower Camp waste accumulation area, was in service prior to the 1970's. It has since been cleared and graded. Although there are reports of past waste oil and paint thinner spills and leaks at this site, no evidence of contamination could be found during the 1987 site visit. The area was dry and well drained. The specific historical waste area boundaries could not be detected. Although there may be small amounts of residual contaminants, there are no existing migration paths. Therefore, the potential for harm is negligible, and no further action is warranted for site 4.

2.4.4.1 Paint Thinners

Since the compounds in paint thinners are extremely volatile and quickly evaporate when exposed to the atmosphere, any spills having occurred at this site are insignificant in terms of long-term contamination effects.

2.4.4.2 Waste Lube Oils

See discussion, Section 2.4.2.2 for fate of waste lube oils in the environment.

2.4.5 Landfill - Lower Camp (Site 5)

The landfill at the Lower Camp (site 5) is located near site 4. It has not been used since the 1970's. The site has been cleared and filled. Shop wastes (e.g., waste oils and lubricants) may have been disposed at the landfill, but during the 1987 site visit no signs of residual contamination were observed. The historical landfill boundaries were not obvious and the area contained healthy vegetation and dry soils. No Potential migration paths were apparent. Any residual contamination is well contained with negligible threat of movement. Therefore, further action is not warranted at site 5.

2.4.5.1 Waste Oils/Lubricants

See discussion, Section 2.4.2.2 for fate of waste lube oils in the environment.

2.4.6 White Alice Site (Site 6)

In 1986 the White Alice Site (site 6) was cleared and graded. Previous to clearing, liquid wastes were reportedly stored at site 6. These wastes included electrical and communication generation equipment which possibly contained PCBs. Minor spills and leaks of these materials reportedly occurred. PCBs, waste oils, lubricants and solvents may have been buried at the White Alice Site, but the potential for migration of the chemicals is minimal. The site is located on a ridge with no obvious drainages running through the area. At the time of the 1987 visit, the site had been cleared and graded, and no evidence of any structures, wastes or debris were visible. The potential for contaminant migration from any unknown residual contamination is unknown or minimal since the site is now covered with six feet of clean fill and the exact location of this is unknown.

2.4.6.1 PCBs

PCB compounds vary widely in composition and their persistence in the environment is dependent on the number and position of chlorine atoms per molecule. The primary fate processes of PCBs with four or fewer chlorine atoms is biodegradation. Those with more than four are extremely resistant to this process. The rate of biodegradation depends on the concentration of PCBs, composition and distribution of biota, and other physical factors. Based on laboratory experiments of biodegradation of mono-chloro PCBs, the half-life was estimated at between 100 and 175 hrs. Di-chloro PCBs were significantly degraded after 33 days, but tetra- and penta-chloro species remain virtually unchanged over long periods of time (Callahan 1979).

The heavier PCBs (5+ chlorine atoms) have been shown to degrade in the laboratory by irridation with short-wave UV light. From laboratory experiments aimed at simulating PCB photolysis under environmental conditions, it was estimated that approximately one chlorine atom may be lost from each highly chlorinated molecule annually (Callahan 1979). The resulting lighter compounds are subsequently degraded by biodegradation. Although this fate process is slow, it is considered significant since no other process is known to degrade the heavier PCBs. It should be emphasized that it is unknown if this process is actually at work in the environment, since these results are based on experimental laboratory conditions only. Additionally, this process is significant to potential contaminant spills at the White Alice Site only if a PCB contamination spill occurred and persisted in the photic zone.

Other processes attributable to non-destructive distribution and transport of PCBs in the environment are adsorption, bioaccumulation, and volatilization. PCB compounds have a high affinity to sediments or soils in soil-water systems. The tendency for adsorption increases with the degree of chlorination and the organic content of the absorbent. If contamination is known to be significantly high, sediments in soil-water systems can serve as reservoirs for future

slow release of PCBs. However, high concentrations of PCBs have not been detected at Cape Newenham, and the potential for long-term pollution is expected to be minimal.

The extent to which PCBs are bioaccumulated in aquatic and terrestrial organisms is directly related to the number of chlorine atoms per molecule. Because the heavier species are more resistant to biodegradation, these compounds bioaccumulate and are passed along food chains.

Finally, volatilization accounts for the widespread distribution of PCBs via atmospheric transport and subsequent fallout with dust or rain. Volatilization of PCBs from soils high in organic content is greatly reduced due to adsorption by organic materials. Although a slow process, volatilization is an important fate process because PCBs are not degraded but remain persistent in the environment.

2.4.6.2 Chlorinated Solvents

For detailed discussion of TCE and DCE movement, see Section 2.4.2.

2.4.6.3 Batteries/Electrical Generation Equipment

PCBs:
See discussion in Section 2.4.6 for fate of PCBs in the environment.

Lead:
The primary fate processes for lead in the environment is adsorption to inorganic solids and organic materials which severely limits its mobility. Volatilization, biotransformation, and photolysis are other fate processes which apply to lead degradation, but these are dependent upon the presence of lead complexes. In the aquatic environment lead is bioaccumulated by organisms, but not generally biomagnified.

2.5 QUALITATIVE RISK SCREENING

2.5.1 General Approach

This is a qualitative risk screening of contamination at Cape Newenham AFS. The screening is qualitative because it relies on field observations and indirect data evaluations rather than direct and quantitated field or laboratory measurements. Many quantitative methodologies for risk screening are available ranging from statistical probability evaluations to numerical rating systems. However, an initial qualitative screening is necessary to justify the expense and effort necessary to satisfy the data requirements of more rigorous quantitative approaches. The purpose of this section is to provide the initial screening.

2.5.2 Definition of Risk

Risk is "the probability that a consequence of defined magnitude will occur." The three key concepts of this definition are probability, consequence and defined magnitude. Each is discussed below:

- Probability - According to the above definition of risk, the mere presence of a hazardous substance at a site does not constitute significant risk; risk is the probability of adverse effects to humans or other receptors exposed to the hazardous substance. When that probability is negligible, risk will be considered to be negligible. Conversely, when that probability is not negligible, identifiable risks will be assumed to be present. Thus, probability is evaluated qualitatively rather than quantitatively in this document.

- Consequence - A consequence is an adverse effect on a receptor(s) caused by exposure to oil or hazardous substances. Receptors can be human or environmental resources. Environmental receptors include surface water, ground water, air, soils, vegetation or wildlife. For a

receptor to be adversely affected by a contaminant, three general conditions must be met. First, contamination must be present in the environment. Second, the receptor must be exposed to that contaminant. Exposure is a function of contaminant release mechanisms, paths of migration, and chemical fate processes. Third, adverse effects are possible only if receptors are exposed to sufficient quantities of contaminant and for sufficient intervals of time. This third condition introduces the concept of effect threshold, or the level of exposure necessary to cause an effect. For thresholds to be exceeded, toxicity of contaminants must be sufficiently high, their quantities or concentrations sufficiently large, and their durations/ frequencies of contact with receptors sufficiently long to cause adverse impacts. The screening procedure used here estimates the qualitative probability of these three conditions being present at a site.

- Defined Magnitude - What constitutes an adverse effect must be established. That is, the magnitude of effect necessary to qualify as adverse or as a consequence must be defined. In general, for an effect to be considered adverse, it must be of sufficient magnitude to create health hazards, cause exceedences of environmental and health standards or regulations, or lead to significant environmental perturbations.

2.5.3 Specific Approach

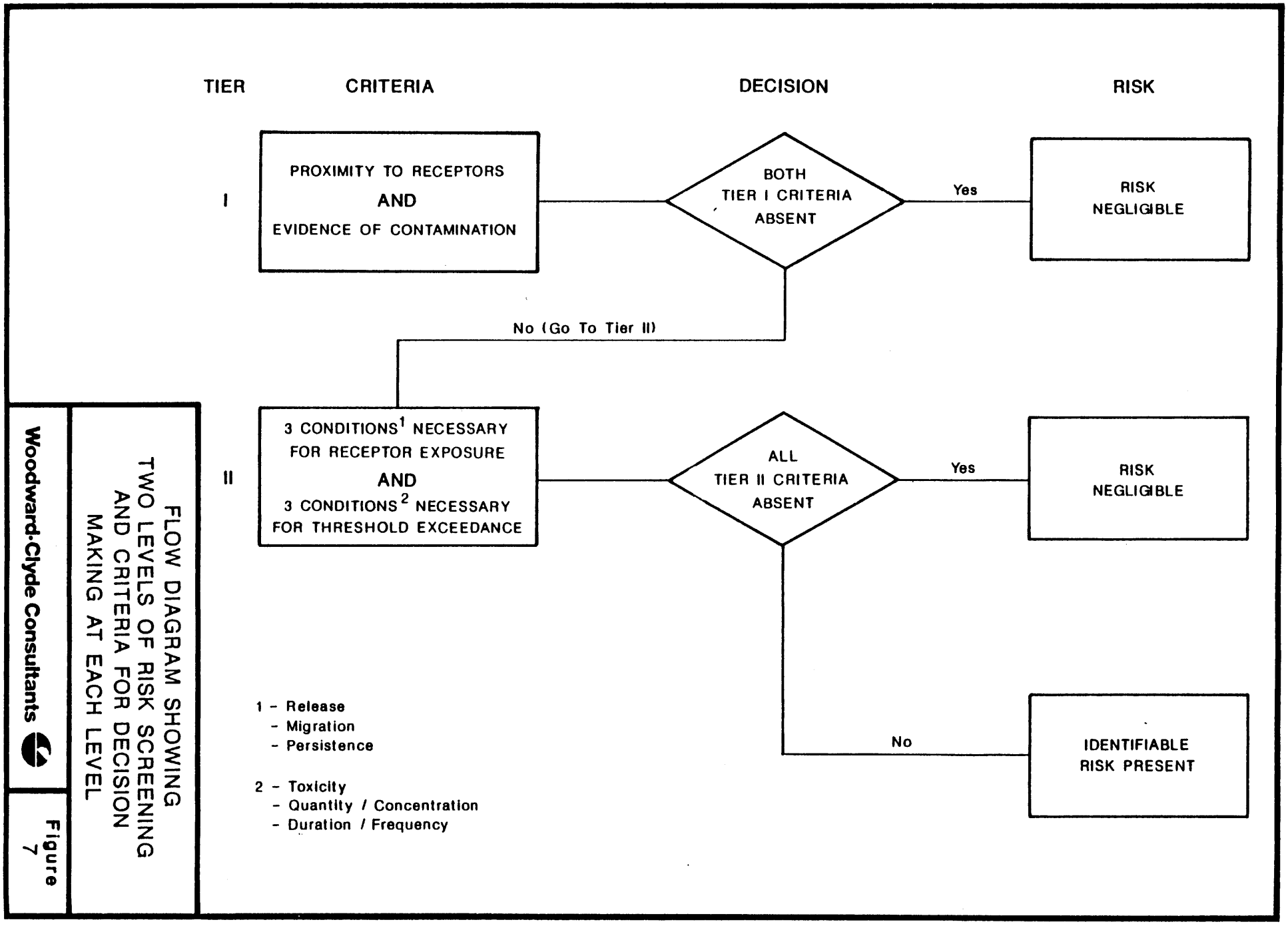
Risk can be either negligible, or present. For those sites assigned a negligible risk, no further action will be recommended. For sites where risks are present a preferred remedy will be selected from two or more alternatives. On of these alternatives may be "No Further Action." For no further action to be recommended at a site that has identifiable risks, one of the following conditions must be met:

- o the hazards created by remedial action or further study outweigh those presently existing at the site or,

- o the cost of remedial action or further study is excessive relative to the derived benefit.

For the purposes of assigning risk levels to a site, a two-tiered hierarchical decision scheme is employed (see Figure 7). At tier I, an initial assessment of the presence of contaminants and the proximity of sensitive receptors is made. This determination is made by reviewing historical records, observations from the site visit, or other evidence. If the available evidence does not indicate that contaminants have been released at the site, and if the site is not close to sensitive receptors, then the probability of risk is considered negligible. In this case no further action will be recommended.

However, if it is concluded that the site is, or possibly has been, contaminated with hazardous or toxic substances, or if the site is in close proximity to sensitive receptors, the screening proceeds to tier II. The approach to tier II is deductive. First, receptors and the conditions necessary for exposure must be identified. Second, the conditions necessary for exceedences of thresholds must be established. Then the actual conditions at the site are compared to the specified conditions. In actuality, all the specified conditions must be present for significant risk to exist. However, the risk screening procedure used here is conservative in that it assumes a negligible risk only if all the conditions are absent. Thus, if all the necessary conditions are absent, then a negligible risk is deduced. Likewise, if the status of a specified condition cannot be determined at a site but there is no reason to suspect that it exists, and all other conditions are absent, the site will be assumed to have negligible risk. If not all of the conditions are absent or not suspected, then the site represents some identifiable level of risk.



FLOW DIAGRAM SHOWING
TWO LEVELS OF RISK SCREENING
AND CRITERIA FOR DECISION
MAKING AT EACH LEVEL

Figure 7

Woodward-Clyde Consultants

2.5.4 Logic Supporting the Screening

Previous studies identified six sites at Cape Newenham AFS as having the potential to be contaminated with oil or hazardous waste. However, during the 1987 field inspection, site 1 was redefined as two separate sites - site 1a, the waste accumulation areas, and site 1b, the active landfill. Site 1b is currently permitted by ADEC and, therefore, was not included in this risk screening. Of the remaining sites, only the Lower Camp landfill (site 5) had no evidence of contamination and was not in close proximity to sensitive receptors. Thus, site 5 was assigned a negligible risk at Tier I in the risk screening (Table 4). At the remaining five sites, contamination was either observed or suspected, or sensitive receptors were nearby. These sites were, therefore, assessed at tier II.

For sites 1a, 2, 3, 4, and 6, the potential hazards and conditions necessary to produce them were identified. The conditions necessary to allow exposure of receptors to threshold levels of contaminants are listed in Table 4. Finally, conditions at the site were compared with hypothetical "necessary conditions." Table 4 summarizes the conclusions of the risk screening. The rationale for the probability screenings is discussed in detail below.

2.5.4.1 Waste Accumulation Areas 1 and 2 (Site 1a)

This is the site of possible spillage of liquid wastes. However, historical evidence of spillage exists and the site was, therefore, subject to a tier II screening. Those wastes have not been identified nor has spillage been confirmed. Possible receptors include humans and water resources. Potential health hazards are possible through direct human contact with chemical contaminants. Furthermore, health and environmental hazards exist should ground and surface waters become contaminated and state water quality standards could be violated. Critical or unique wildlife habitat and protected species of plants and animals are not known to exist in the immediate vicinity and, therefore, are not identified as receptors. The following

TABLE 4

RISK SCREENING FOR CAPE NEWENHAM SITES
TIER I SCREENING - EVIDENCE OF CONTAMINATION AND RECEPTORS

	Site					
	1a	2	3	4	5	6
TIER 1 CRITERIA Is Site in Close Proximity to Sensitive Receptors?	NO	NO	NO	NO	NO	NO
Is Evidence of Contamination Present at Site?	YES	YES	YES	YES	NO	YES
Both Criteria Absent?	NO	NO	NO	NO	YES	NO
Risk	Go to Tier II	Go to Tier II	Go to Tier II	Go to Tier II	NEGLIGIBLE	Go to Tier II

[redacted]ABL[redacted](Co[redacted]ued[redacted]

RISK SCREENING FOR CAPE NEWENHAM SITES
TIER II SCREENING - EVIDENCE OF CONDITIONS NECESSARY FOR A CONSEQUENCE OF DEFINED MAGNITUDE

Site

TIER II CRITERIA	1a	2	3	4	6
3 Conditions Necessary for Receptor Exposure:					
Significant Release Mechanisms	ABSENT	ABSENT	ABSENT	ABSENT	ABSENT
Significant Migration Pathways	PRESENT	PRESENT	ABSENT	ABSENT	ABSENT
High Persistence	ABSENT	ABSENT	ABSENT	ABSENT	PRESENT
3 Conditions Necessary for Threshold Exceedances:					
Moderate to High Toxicity Relative to Receptors and Likely Routes of Exposure	UNKNOWN	ABSENT	ABSENT	ABSENT	PRESENT
Quantity/Concentration Sufficient to Exceed Env., Health, Toxicity Standards	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN
Duration and Frequency of Exposure Sufficient to Cause Adverse Health/Env. Effects	ABSENT	ABSENT	ABSENT	ABSENT	ABSENT
All Criteria Absent or Unknown?	NO	NO	YES	YES	NO
RISK	YES	YES	NEGLIGIBLE	NEGLIGIBLE	YES

assessment of conditions necessary for adverse effects is an evaluation of the potential for those receptors listed above to be significantly exposed to contaminants.

- Release Mechanisms - Contaminants, if present, could be released from the site by volatilization, by mobilization with solvents or water, or by mechanical transport of affected soils. Because of the age of possible contaminants at the site and the relatively small volumes which would have been spilled, most volatilization of the lower molecular weight compounds would have occurred by now. A large solvent or fuel spill would be required to solubilize non-polar hydrocarbons and to transport them into surface or ground waters. This is an unlikely event. Due to the large amount of precipitation in the area, and water soluble compounds that were originally present, have been previously leached from the soil. Other compounds with higher adsorption coefficients would tend to remain in the soil. The intentional movement of contaminated soil is unlikely because of the remoteness of the site. Movement from erosive processes is improbable because of relatively flat terrain and the stability of soils.

- Migration Pathways - Ingestion of contaminated soil by humans is unlikely. Volatile fractions of the contaminants would have volatilized from the surface by this time and accumulations of threshold air concentrations are unlikely. Other potential pathways to human and environmental receptors include surface or subsurface migration into surface and ground waters. The drinking water supply for the installation is located up-gradient from the spill and cannot be affected. The surface gradient at site 1a is relatively flat, but the site is close (50 m) to a stream and is underlain by permeable soils. Therefore, vertical or horizontal migration could be expected if large quantities of contaminants were present. However, the amount of

contaminants could not be confirmed either through review of historical records or by visual observations during the site visit.

- o Persistence - The age of the spillage at site 1a is such that significant weathering, volatilization, chemical transformation, and biodegradation may have already occurred. No evidence of highly persistent compounds was found.

- o Toxicity - Conclusive evidence that toxic or hazardous substances were spilled at the site does not exist. The toxicity of components present in the small soil stains is unknown.

- o Quantity/Concentration - There is no evidence of the amount of liquid wastes that were spilled at site 1a. The number and size of soil stains present and the vigor of vegetation at the site indicate that any previous spillage was minimal.

- o Duration and Frequency of Exposure - Ground water and surface waters could be exposed to contaminants from spillage. However, the water gallery is located up-gradient from site 1a. Due to the water supply location, the distance from the living quarters, and the overall remoteness of the site, it is improbable that humans could be exposed to toxic concentrations of contaminants either orally, dermally or through respiratory routes. If exposure were to occur it would be very infrequent and of short duration.

It is concluded that there is an identifiable risk of receptor exposure to possible contaminants at site 1a. However, this risk exists only because of the presence of significant migration pathways (ground water and surface water). Evidence does not exist which indicates that hazardous substances are present in high enough

concentrations to pose a significant risk. Release mechanisms are not available. Therefore No Further Action is recommended.

2.5.4.2 Upper Camp Dump Area (Site 2)

The Phase I document (Eng. Sci. 1985) reported that waste oils and ethylene glycol were dumped over the side of steep talus slopes at the Upper Camp. Therefore, a tier II screening was performed. Quantities of contaminants are unknown and the site has been cleaned. No evidence of contamination was observed during the site visit.

Health effects through direct human contact with hazardous substances are improbable due to the remoteness of the site and its steep, inaccessible terrain. It is unlikely that important ground water or surface water resources would be affected, but contaminants which are mobilized from site 2 could ultimately enter Bristol Bay. Critical or unique wildlife habitats and protected species of plants and animals are not known to exist in the immediate vicinity of the site and, therefore, are not identified as receptors. The following assessment is an evaluation of the potential for receptors to be significantly exposed to contaminants.

- Release Mechanisms - For contaminants to be released from site 2 a large solvent spill would be necessary to mobilize non-polar compounds. This is unlikely. Volatilization is not a significant release mechanism because of the age of the dump and the lack of adsorptive humic soils; any lower molecular weight compounds originally present would have volatilized. Due to the high precipitation rates and the extreme gradient at the site, water-soluble compounds such as ethylene glycol would have previously migrated off-site.

- Migration Pathways - The extremely high gradient provides a surface pathway from the site into Bristol Bay.

- Persistence - The age and location of the possible spillage at site 2 is such that significant weathering, mobilization, or chemical transformation may have already occurred. No evidence exists that highly persistent compounds were disposed of at the site.

- Toxicity - Conclusive evidence that toxic or hazardous substances were spilled at site 2 does not exist. Substances reportedly dumped include lube oils, wastewater and ethylene glycol. Ethylene glycol is the most toxic of these but its toxicity is relatively low (see Section 2.3.3.1).

- Quantity/Concentration - There is no evidence of the amount of liquid wastes spilled at site 2. However, the total volume was probably minimal because of the remoteness of the site.

- Duration and Frequency of Exposure - Because of the inaccessibility of the site, the steepness of the slope, and the distance to Bristol Bay and other significant water resources, it is improbable that human or other biotic receptors would be exposed to toxic concentrations of potential contaminants.

It is concluded that there is an identifiable risk of receptor exposure to presumed contaminants at site 2. However, this risk exists only because of the existence of migration pathways. Potential contaminants are relatively non-toxic or would have previously migrated from the site. No visual evidence of contamination exists. Therefore, the recommended action is No Further Action.

2.5.4.3 Road Oiling (Site 3)

Visual evidence of contamination from road oiling was not observed during the site visit, but a tier II screening was performed because

of historical evidence. Potential health hazards are possible only through accidental ingestion of contaminated soils. Critical or unique wildlife habitat and protected species of plants and animals are not known to exist in the immediate vicinity and, therefore, are not identified as receptors. The following assessment of conditions necessary for adverse effects is an evaluation of the potential for receptors to be significantly exposed to contaminants.

- Release Mechanisms - Road oils, if present, could be released by mobilization with solvents or by mechanical transport of affected soils. A large solvent or fuel spill would be required to solubilize non-polar hydrocarbons and to transport them into surface or ground waters. This is improbable. Because of the large amount of precipitation, any water soluble compounds are likely to have been leached from the soil. Others with higher adsorption coefficients would tend to remain in the soil. Intentional or erosive movement of soil is unlikely.

- Migration Pathways - Ingestion of contaminated soil by humans is unlikely. Due to the age of possible contamination, mobilization would be improbable and the existence of migration pathways extremely limited.

- Persistence - Oil is not persistent in the environment. It is subject to weathering, chemical transformation and biodegradation.

- Toxicity - Lube oil is not toxic unless ingested in large quantities.

- Quantity/Concentration - There is no evidence of the volume of oil used as a dust suppressant. The lack of visual evidence of contamination indicates that minimal quantities were applied to the road system.

- o Duration and Frequency of Exposure - Humans, through accidental ingestion of contaminated soil, are the only possible receptors. Ingestion is unlikely.

All conditions necessary for receptor exposure or threshold exceedence are absent or unknown. Therefore, site 3 presents a negligible risk.

2.5.4.4 Waste Accumulation Area No. 3 (Site 4)

Evidence of contamination at site 4 was noted in historical records. Therefore, a tier II screening was made.

Quantities of contaminants are unknown. However, the site has been cleaned and no evidence of contamination was observed during the site visit. Critical or unique wildlife habitat and potential species of plants and animals are not known to exist in the immediate vicinity and, therefore, are not identified as receptors. Surface waters will not be affected. The only possible critical receptor is ground water.

- o Release Mechanisms - A large solvent or fuel spill would be necessary to mobilize spilled oil. This is unlikely. Other possible contaminants are volatile or water soluble and would have dissipated by now.

- o Migration Pathways. The only potential migration pathways are vertical movement into the ground water in the event of a solvent or fuel spill and the physical removal of contaminated soil. Both are unlikely.

- o Resistance - The age of spillage is such that significant weathering, volatilization, chemical transformation, and biodegradation may have already occurred. No evidence of highly persistent compounds was found.

- o Toxicity - Conclusive evidence that toxic or hazardous substances were spilled at the site does not exist. The

toxicity of compounds in the stains observed during Phase I is unknown.

- o Quantity/Concentration - There is no evidence of the volume of liquid waste spilled at site 4. The size of soil stains as described in the Phase I report indicate that spillage was minimal.

- o Duration and Frequency of Exposure - It is unlikely that human or environmental receptors would be exposed to possible contaminants for sufficient duration to present a hazard.

It is concluded that there is a negligible risk of receptor exposure to potential contaminants at site 4.

2.5.4.5 Landfill - Lower Camp (Site 5)

Site 5 is not located near sensitive receptors nor was evidence found that contaminants are present in the landfill. The site has been cleaned and graded and presently lies under several inches of gravel fill. It was assigned a negligible risk at tier I and recommended for No Further Action.

2.5.4.6 White Alice Site (Site 6)

The White Alice Site has been dismantled, cleaned, and buried. The area where the facility was located was filled and graded in 1987. There was no visual evidence of contamination found during the site visit and there are no known receptors in close proximity to the site. Ground water is the only potential receptor. Information of hydrogeology in the area is lacking but because of the elevation and remoteness of the site it is doubtful that important groundwater resources could be affected. However, the Phase I report indicates that transformers were used at the White Alice Site and stored. Due to the possible existence of transformers, the potential for PCB

contamination must be considered even though confirmatory evidence does not exist. Therefore, site 6 was evaluated at tier II in the risk screening. The following discussion analyzes whether the conditions necessary for non-negligible risk are present at site 6.

- Release Mechanisms - PCBs are insoluble in water. If they are present at the site, a large solvent or fuel spill would be necessary to mobilize them. This is unlikely because of the remoteness of the site from normal operating activities at the installation. The only other potential release mechanism is mechanical removal of contaminated soil. This is unlikely because the site has already been filled and leveled.

- Migration Pathways - The only migration pathway is vertical movement through soil into ground water. This is unlikely because of the insoluble properties of PCBs and their relatively high adsorptivities to organic soil particles.

- High Persistence - PCBs are extremely persistent in the environment. They are very stable compounds that do not undergo significant chemical transformation or biodegradation. Therefore, persistence, one condition necessary for receptor exposure, may be present at site 6. This depends upon whether PCBs are in fact present in significant quantities at the site.

- Toxicity - PCBs are very toxic and are suspected carcinogens (see Section 2.3.7.1). Routes of exposure include ingestion, skin contact and inhalation. They have relatively high bioconcentration factors.

- Quantity/Concentration - PCBs are not known to be present at site 6. Their presence is only suspected. Therefore, quantities are unknown.

- Duration and Frequency of Exposure - It is improbable that humans would be exposed to toxic concentrations of PCBs either orally, dermally or through respiratory routes.

In conclusion a risk of PCB contamination is present at site 6. This risk exists only because of the potential for PCB contamination and their high persistence and toxicity. However, conclusive evidence that contamination actually exists at the site cannot be found. Because of this and the remoteness of the site, the distance from the living quarters, the location of the water supply relative to the site, the insolubility of PCBs, and the containment of potential PCB contamination under fill and gravel, the risk associated with potential PCBs at site 6 is very low.

2.6 ALTERNATIVES ANALYSIS

2.6.1 Purpose

Based on previous studies, a site visit and literature search, five sites of potential concern were identified at Cape Newenham AFS and evaluated at tier II in the risk assessment. These sites are:

- Site 1a: Waste Accumulation Area 1 & 2
- Site 2: Upper Camp Dump
- Site 3: Road Oiling
- Site 4: Waste Accumulation Area 3
- Site 6: White Alice Site

A qualitative risk screening (see Table 4) concluded that sites 3 and 4 do not present a significant risk to human health or to the environment. A potential risk was judged to be present at sites 1a, 2, and 6 because of the presence of significant migration pathways at sites 1a and 2, the presence of exposive routes at site 6, and the fact that the presence of toxic substances has not been ruled out at any of these three sites. However, at each of the sites delineated above, some small amounts of residual contaminants are known to exist

or might be found to exist if further studies are completed. Results of the risk screening suggest that the known or probable levels of contamination are so slight or of so little concern relative to health or environmental impact that no further action should be taken at these sites. This section examines feasible alternatives to "no further action" to determine if any other course of action regarding these sites would result in a lesser risk to human health or the environment.

The Comprehensive Environmental Response and Compensation Liability Act (CERCLA, as amended by the Superfund Amendments and Reauthorization Act--SARA) govern federal agency response to contamination of federal facilities by oil or hazardous substances. The National Contingency Plan calls for cost-effective remedies to be implemented for sites where a significant risk to human health or the environment is shown to exist; such sites are enrolled on the "National Priority List" (called NPL). Guidance for selecting cost-effective remedies for NPL sites is available in EPA document EPA/540/G-85/003, "Guidance for Feasibility Studies Under CERCLA." No specific guidance exists for selecting cost-effective remedies for non-NPL sites such as those at Cape Newenham AFS. The alternatives analysis presented in the following paragraphs is modeled after the above-referenced EPA guidance, and is generally in compliance with the requirements of the National Contingency Plan (40 CFR 300).

2.6.2 Evaluation Criteria and Method

EPA guidance ("Guidance for Feasibility Studies Under CERCLA) describes an evaluation method for alternative remedies that includes the following evaluation criteria:

- Performance level (how effective will the alternative be in abating the hazard, and in reducing risk)
- Useful life (how long will the alternative last)
- Risk of increased exposure (will the alternative create new opportunities for receptors to be exposed to contaminants)

- o Environmental impact (will the alternative cause disturbance or loss of environmental resources)
- o Cost (Rough, Order-of-Magnitude cost is used: is the economic cost of the alternative low, moderate or high).
- o Implementability (what infrastructural, administrative or logistic requirements does the alternative have).
- o Institutional impacts (does the alternative place a burden on local community institutions)
- o Socioeconomic impacts (does the alternative affect employment, housing, or other socioeconomic factors)
- o Safety (what is the health risk to site workers and surrounding residents of the alternative remedial measure)
- o Reliability (what are the maintenance, inspection and replacement requirements of the alternatives)

The last four evaluation factors are not considered in the evaluation that follows. Institutional factors are not relevant because no local community institutions or interactions are involved. Socioeconomic impacts are not relevant because the sites are remote and are not economically interactive with local communities; the remedial alternatives considered are relatively specialized and would not present employment or income opportunities to local communities. Safety impacts are not relevant because none of the known or potential contamination problems and none of the alternative actions present a significant risk to workers or residents of the sites. Reliability is not a relevant factor because none of the alternatives are active treatment systems or have any maintenance or replacement requirement.

The six evaluation factors (the first six in the list above) will be applied to each alternative at each site, using a tabular format with the following headings:

Alternative	Performance Level	Useful Life	Risk of Increased Exposure	Env. Impact	ROM* Cost	Implementability

*Rough Order-of-Magnitude

The alternatives will be ranked based on a qualitative scoring that considers performance level, useful life and risk of increased exposure to be relatively more important than environmental impact. Environmental impact will be considered to be relatively more important than ROM cost and implementability.

2.6.3 Alternatives to be Evaluated

Two or more alternative remedies were considered at each of the five sites evaluated at tier II in the risk screening. These alternatives are presented below for each of the sites.

2.6.3.1 Waste Accumulation Areas 1 and 2 (Site 1a)

- no further action
- excavation of contaminated soils beneath the storage area and aeration through spreading on dirt roads
- further investigation of the site, consisting of test borings in and around the site to determine the extent of contamination, and installation of groundwater monitoring wells to confirm local groundwater conditions and detect contamination in the ground water.

2.6.3.2 Upper Camp Dump Area (Site 2)

- no further action
- further investigation of the site, consisting of a geophysical survey to locate the extent of buried waste and test borings to detect contamination in the dump site.

2.6.3.3 Road Oiling (Site 3)

- no further action
- further investigation of the site consisting of test borings to determine the extent of contamination, if any, and

installation of monitoring wells to confirm groundwater conditions

- o no active remedial alternative is proposed due to the lack of confirmation of contamination

2.6.3.4 Waste Accumulation Area 3 (Site 4)

- o no further action
- o further investigation of the site consisting of test borings and monitoring well installation as for sites 1a and 3
- o no active remedial alternative is proposed

2.6.3.5 White Alice Site (Site 6)

- o no further action
- o further investigation consisting of test borings and monitoring well installation, some excavation of the recently applied fill material may be necessary to facilitate the investigation

2.6.4 Results

The following results are presented for each site evaluated in tier II screening in table format as described in section 2.6.2 of this report.

2.6.4.1 Waste Accumulation Areas 1 and 2 (Site 1a)

Alternative	Performance Level	Useful Life	Risk of Increased Exposure	Env. Impact	ROM Cost	Implementability
no action	mod	high	neg	neg	neg	good
excavation	mod	high	low	mod	high	very poor
investigation	low	low	low	mod	high	poor

Preferred alternative: no action

2.6.4.2 Upper Camp Dump (Site 2)

Alternative	Performance Level	Useful Life	Risk of Increased Exposure	Env. Impact	ROM Cost	Implementability
no action	high	high	very low	neg	neg	good
investigation	low	low	very low	high	high	fair

Preferred alternative: no action

2.6.4.3 Road Oiling (Site 3)

Alternative	Performance Level	Useful Life	Risk of Increased Exposure	Env. Impact	ROM Cost	Implementability
no action	high	high	very low	neg	neg	good
investigation	low	low	low	mod	very high	poor

Preferred alternative: no action

2.6.4.4 Waste Accumulation Area 3 (Site 4)

Alternative	Performance Level	Useful Life	Risk of Increased Exposure	Env. Impact	ROM Cost	Implementability
no action	high	high	very low	neg	neg	good
investigation	low	low	very low	high	high	fair

Preferred alternative: no action

2.6.4.5 White Alice Site (Site 6)

Alternative	Performance Level	Useful Life	Risk of Increased Exposure	Env. Impact	ROM Cost	Implementability
no action	high	high	very low	neg	neg	good
investigation	low	low	low	mod	very high	poor

Preferred alternative: no action

2.7 SUMMARY

At all of the sites considered in the risk screening, the no action alternative is the preferred alternative because it presents the lowest or same risk to human health as other alternatives, and a lower environmental and economic cost than any other alternative.

2.8 BIBLIOGRAPHY AND CONTACTS

Alderhold, W. 1987. Project Manager, Cape Newenham 1982 construction. Nealand Co., Inc. Homer, Alaska. Personnal Communication. (907) 235-8141.

American Conference of Governmental Industrial Hygienists, 1986-1987, Threshold of Limit Values and Biological Exposure Indices for 1986-1987.

Box, S.E. 1984. Geologic Setting of High Pressure Metamorphic Rocks of the Cape Newenham Area. USGS 1984 Circular, pgs. 37-42.

Bureau of Land Management. 1943. Land Ownership Plats, Pending Historic Site Claims. Dept. of Interior withdrawal.

Callahan, M., et al. 1979. Water-Related Environmental Fate of 129 Priority Pollutants, Volume I. EPA Doc. #440/4-79-029A.

Callahan, M., et al. 1979. Water-Related Environmental Fate of 129 Priority Pollutants, Volume II. EPA Doc. #440/4-79-029B.

Engineering Science. 1985. I.R.P. Phase I Report, Southern Region LRRS. Prepared for the USAF Engineering Service Center.

Feldman, M.H. 1973. Petroleum Weathering: Some Pathways, Fate, and Disposition on Marine Waters. EPA Doc. #660/3-73-013.

Gosselin, R.E., Smith, R.P., and H.C. Hodge. 1984. Clinical Toxicology of Commerical Products, 5th ed.

Gusey, W.F. 1979. The Fish and Wildlife Resources of the Southern Bering Sea Region. Prepared for Environmental Affairs, Shell Oil Company.

Hoare, J.M., and Coonrad, W.L. 1977. New Geologic Map of Goodnews - Hagemeister Island Quadrangles, Alaska. USGS 1977 Circular pgs. 50-55.

Humphrey, C. 1987. Civil Engineering Management, 11th Tactical Control Group, Alaska Air Command, U.S. Air Force, Elmendorf AFB, Alaska. Personal communication. (907) 552-3691.

Murie, O.J. 1959. Fauna of the Aleutian Islands and Alaska Peninsula.

Murray, D.F., Lipkin, R. 1987. Candidate Threatened and Endangered Plants of Alaska. University of Alaska Museum, Fairbanks.

Raassen, C.D., Amdur, M.D., and J. Doull, Eds. 1986. Casarett & Doull's Toxicology: The Basic Science of Poisons. 3rd Ed.

Sax, N. Irving. 1984. Dangerous Properties of Industrial Materials. 6th Ed.

Sax, N. Irving. 1985. Hazardous Chemical Information Annual #1.

U.S. Army Corps of Engineers. Latest update. Construction and AFS As Builts and Layouts. COE, Alaska District, Anchorage, Alaska.

U.S. Department of Interior. 1986. Togiak National Wildlife Refuge, Final Comprehensive Conservation Plan, Wilderness Review and Environmental Impact Statement. Prepared by U.S. Fish and Wildlife Service, Region 7, Anchorage, Alaska.

U.S. Department of Interior. 1974. Proposal for the Togiak National Wildlife Refuge. Prepared by Alaska Planning Group, U.S. Dept. of Interior.

U.S. EPA. 1980. Ambient Water Quality Criteria for Benzenes. EPA Doc. #440/5-80-018.

U.S. EPA. 1980. Ambient Water Quality Criteria for Polynuclear Aromatic Hydrocarbons. EPA Doc. #440/5-80-069.

USGS. 1947 revised 1971. Topographic Map, 1:630,000 Hagemeister Quadrangle.

USGS, Water Resource Division. No Date. Water Source Used by the USAF in Alaska, 1964-65, Cape Newenham. pgs. 52-55.

Weiss, G., Ed. 1980. Hazardous Chemical Data Book, Environmental Health Review #4.

Westlake, D.W.S., and F.D. Cook. 1980. Petroleum Biodegradation Potential of Northern Puget Sound and Strait of Juan de Fuca Environments. EPA Doc. #600/7-70-133.

Zenone, C. 1987. Hydrologist, USGS Water Resources Division, 4230 University Drive, Suite 201, Anchorage, Alaska. Personal communication. (907) 271-4138.