KM-6120

ROOSEVELT ROAD TRANSMITTER SITE
SITE INVESTIGATION PROJECT REPORT
FORT RICHARDSON, ALASKA

Contract No.: DACA85-88-D-0014
Delivery Order No. 12

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Prepared By:

ECOLOGY AND ENVIRONMENT, INC.

Submitted To:

CORPS OF ENGINEERS, ALASKA DIVISION
David Williams, P.E., Project Manager
Engineering Project Management
U.S. Army Engineer District
P.O. Box 898
Anchorage, Alaska 99506-0898

ecology and environment, inc.
1057 WEST FIREWEED LANE, ANCHORAGE, ALASKA 99503, TEL. (907) 257-5000
International Specialists in the Environment

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EXECUTIVE SUMMARY

This Site Investigation Project Report was prepared to satisfy requirements of United States Corps of Engineers (COE), Alaska District, Contract Number DACA85-88-D-0014 and Delivery Order Number 12, under which Ecology and Environment, Inc. (E & E) was tasked to develop construction plans and specifications for remediation of PCB contamination in accordance with Federal and State environmental protection regulations at the Roosevelt Road Transmitter Annex Site. COE is implementing this project for the Directorate of Engineering and Housing (DEH) of the 6th Infantry Division (Light) at Fort Richardson, Alaska, under the Installation Restoration Program (IRP) of the United States Department of Defense (DOD).

The purpose of the IRP is to ensure DOD compliance with hazardous waste regulations. DOD policy is to identify and fully evaluate suspected problems associated with hazardous waste contamination, and to implement remedial actions that will minimize hazards to health and welfare resulting from past operations. The IRP is the basis for response actions under the provisions of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, clarified by Executive Order 12316.

This project, termed a Site Investigation Follow-Up by COE, consists of two parts, the field investigation and the remedial design. The Site Investigation Project Report contains descriptions of the site background, the summary and results of the field investigation, an evaluation of potential contaminant exposure routes, and the remedial alternatives.

The Roosevelt Road Transmitter Site, approximately 50 acres, is located within the boundaries of Fort Richardson, near Anchorage, Alaska. It is situated on generally level ground on a smooth ridge overlooking the Eagle River drainage, more than 1 mile north of the main installation facility. Major site features consist of a 5,000-square-foot bombproof underground bunker with two aboveground entrances, two large concrete foundations, four smaller concrete foundations, and numerous abandoned underground utilities (sewer/septic system, electrical cables, utility ducts, and waterlines). The bunker and related support facilities were constructed in the 1940s and were used as a high frequency transmitter communication center from World War II through the Korean War. The final date of operations at the bunker is not known; however, the complex was decommissioned during the late 1960s.

After the removal of the transmitter, the bunker and transmitter annex building were used periodically for maneuvers, training, and assorted staging activities. At some point, several transformers located in both the bunker and the transmitter annex building were apparently vandalized for the copper, resulting in release of the polychlorinated biphenyl (PCB)-containing dielectric fluids. Presently, most of the equipment and buildings at the site have been removed, leaving only concrete foundations and the underground bunker itself.

In 1978, a cleanup supervised by the United States Environmental Protection Agency (EPA) was performed by Crowley Environmental. The transformers were removed from the underground bunker and from the adjacent transmitter annex building. Oil residues were removed from the transmitter annex floor and the concrete was triple washed with diesel fuel. Contaminated materials were drummed and shipped to Chem-Nuclear in Arlington, Oregon. PCB-contaminated debris in the underground bunker, including 126 gallons of oil from the transformers which were spilled on the bunker floor, were not cleaned up. The bunker entrances were sealed and the transmitter annex building was sold and removed from the site.

In April 1988, COE conducted a surface and subsurface investigation on and around the concrete transmitter annex platform after discovering residual PCB contamination from the 1978 cleanup activities. Analytical results revealed levels of PCBs as high as 76,900 mg/kg (ppm) at the east entrance to the underground bunker. An Expedited Response Action, undertaken in October 1988, included the removal of 150 tons of

PCB-contaminated soil and debris and the cleaning and encapsulating of the transmitter annex foundation pad and cable trenches. Confirmation samples collected after removal of the soils reported values of PCB contamination greater than the 10 ppm action level at depths of 16 feet.

In 1989, COE reopened and collected samples in the underground bunker. These samples indicated PCB levels up to 655,300 mg/kg in residual oils present in the bunker.

In April 1990, E & E prepared a work plan for the Site Investigation Follow-Up field activities at the site. The objectives of the work plan were:

- o Characterize residual transformer oils, asbestos, and petroleum, oil, and lubricants (POL) in the underground bunker;
- o Determine the presence and extent of contamination at known and suspected electrical equipment locations within the site;
- o Determine if areas have been contaminated by past hazardous and toxic waste (HTW) disposal practices (cesspools, roads, etc.); and
- o Evaluate revegetation requirements.

COE and E & E conducted drilling and sampling activities at the site during May and June 1990. Drilling, sampling, and health and safety monitoring were conducted by COE personnel and monitored by E & E. Samples collected were analyzed for volatile organic compounds, base, neutral, and acid extractables, PCBs, asbestos, dioxin, total petroleum hydrocarbons, metals, and revegetation parameters.

Analytical results at the bunker included:

- o Chrysotile asbestos at levels ranging from less than 1% to 60% by volume in the pipe wrapping;
- o Pentachloro dibenzodioxin (PCDD) and pentachloro dibenzofuran (PCDF) dioxin/furan isomers in ash samples; and
- o Aroclor 1260 in levels ranging from 4,000 ppb to 1,000,000,000 ppb (100%).

Analytical results for surface soils included:

- o Aroclor 1260 in levels ranging from 88.7 ppb to 3,300,000 ppb at the transmitter annex;
- o Aroclor 1254 at 985 ppb and 2,500 ppb at the transmitter annex; and
- o Coal tar products at levels ranging from 95 ppb to 9,900 ppb from visibly stained areas south of the bunker.

Analytical results from samples collected from cesspool areas included:

- o The regulated volatile organic compounds 4-methylphenol, trichloroethene, tetrachloroethene, and 1,2-dichloroethene all of which are Resource Conservation and Recovery Act (RCRA) Toxic Characteristic constituents;
- o The metals barium (2,700 ppm), lead (1,200 ppm), mercury (110 ppm), and zinc (2,000 ppm); and
- o Aroclor 1260 at levels ranging from 4,183 ppb to 5,600 ppb.

Analytical results from borehole samples included:

- o Aroclor 1260 at levels ranging from 83 ppb to 1,900,000 ppb at the transmitter annex;
- o Aroclor 1260 at 120,000 ppb at a depth of 29 to 30 feet near the transmitter annex; and
- o Aroclor 1254 at levels ranging from 1,900 ppb to 3,600 ppb at the transmitter annex.

The baseline risk assessment performed for the report included fate and transport mechanisms and environmental risks. In summary, contaminants are present in two general locations at the site, the underground bunker and the on-site soils. The surface soil contamination at the bunker entrance and the transmitter annex foundation is a result of transformer oil disposal and cleanup activities that may have been extended from either foot or vehicle traffic. Contaminant release to subsurface soils has occurred by leaching and was enhanced by the diesel fuel washing activities that once occurred.

Groundwater exists at 95 feet below ground surface and an on-site well, Well B, is sampled biannually as part of the basewide groundwater sampling activities. No targeted compounds have been reported in any water sample collected from this well.

No defined surface water drainages or water courses are near the site; hence, transport to surface water appears unlikely.

The contamination within the bunker is isolated from the environment and is not subject to the fate and transport mechanisms as is the soil. Given the construction materials and thickness, contaminant migration from the bunker is considered negligible.

The overall objectives of the remedial plan for the Roosevelt Road Transmitter Site are:

- o Prevent PCB contaminant migration from the site by air and surface erosion and prevent direct contact with human and animal populations;
- o Achieve soil concentrations of PCBs that satisfy both EPA and Alaska Department of Environmental Conservation (ADEC) cleanup requirements.

Six remedial alternatives were considered and evaluated for their ability to meet the goals stated above. Cleanup alternatives address both site soils and PCB-contaminated concrete and debris in the bunker. volatile organic compound (VOC) contamination discovered in the cesspool soil and sludge is not addressed in these alternatives due to the fact that the source and extent of contamination that exists is unknown at this time. The remedial alternatives considered were:

- o **Alternative 1: No Action.**
- o **Alternative 2: Off-Site Landfilling.** Contaminated soils and materials would be excavated, shipped, and disposed of at a permitted hazardous waste landfill.
- o **Alternative 3: Off-Site Incineration.** Contaminated soils and materials would be excavated, shipped, and incinerated at a permitted PCB incinerator.
- o **Alternative 4: On-Site Incineration.** On-site incineration involves the mobilization of a thermal destruction unit (TDU) to the site.
- o **Alternative 5: On-Site Soil Washing.** This alternative uses a solvent to separate the PCB contaminants from the soil matrix. The soil is excavated and treated on site.
- o **Alternative 6: On-Site Landfilling.** PCB-contaminated soils would be excavated and placed inside the underground bunker. A RCRA storage facility permit and periodic monitoring of the groundwater would be required.

- **Alternative 7: Bioremediation.** PCB-contaminated soils on site would be excavated and staged in a central location and then transferred to treatment areas. Conventional soil management practices would be used to enhance the microbial degradation of PCBs. After acceptable PCB concentration levels are achieved, the soil would be backfilled into the excavation.

- **Alternative 8: Chemical Treatment (Quicklime).** PCB-contaminated soil on site would be excavated and staged in a central location and then transferred to treatment areas. The soils would be mixed with quicklime and other additives and allowed to react until PCB concentrations reached cleanup goals. The treated soils would then be backfilled into the excavation.

On-site soil washing and on-site landfilling were determined to be unfeasible and were screened from consideration due to the following:

- **On-Site Soil Washing.** Requires an extensive pilot scale study prior to effective implementation. Due to the limited amount of contaminated material, the high mobilization costs, and the inability to determine the effectiveness, it was screened from consideration.

- **On-Site Landfilling.** Screened from consideration due to the associated long-term liability.

Remedial action alternatives presented in the report are:

2. **Off-Site Landfilling.** Off-site landfilling is the least expensive of the remedial alternatives considered feasible. Standard construction techniques can be employed to implement the remediation. A primary disadvantage associated with this alternative is that the hazardous waste must be transported a considerable distance to the nearest permitted landfill which is located in Arlington, Oregon.

   Off-Site Landfilling Cost: $1,838,896

3. **Off-Site Incineration.** The advantages of this alternative are that the contaminants are permanently destroyed and future liabilities are eliminated. The primary disadvantages are the high costs of transportation and thermal destruction.

   Off-Site Incineration Cost: $5,322,896

4. **On-Site Incineration.** The advantages of this alternative are that no shipping of the hazardous waste is required and thus the associated liability is eliminated. Extensive time and labor is anticipated for acquiring the necessary permits to operate the thermal destruction unit. The exceptionally high mobilization costs for the thermal destruction unit combined with the limited volume of contaminated soil make the selection of this alternative costly.

   On-Site Incineration Cost: $5,232,913

For the three alternatives listed above, remediation of the bunker involves demolition, removal, and disposal of debris (including asbestos), removal and disposal of PCB sludge, and scarification and disposal of PCB-contaminated concrete. Costs for this remediation are included in the totals above.

The recommended remedial alternative is Alternative 2: Off-Site Landfilling.

1. INTRODUCTION

This report presents the results of a site investigation at the Roosevelt Road Transmitter Site, Fort Richardson in Anchorage, Alaska. Pursuant to United States Corps of Engineers (COE), Alaska District, Contract Number DACA85-88-D-0014 and Delivery Order Number 12, Ecology and Environment, Inc. (E & E) has been tasked to develop construction plans and specifications for remediation and final closure of the site in accordance with appropriate requirements as provided by federal and state environmental agencies. COE is implementing this project for the Directorate of Engineering and Housing (DEH) of the 6th Infantry Division (Light) at Fort Richardson, under the Installation Restoration Program (IRP) of the United States Department of Defense (DOD).

This project, termed a Site Investigation Follow-Up by COE, consists of two parts, the field investigation and the remedial design. The objectives of the field investigation were to determine the extent of contamination at the site and to recommend remedial measures. The information obtained during the field investigation is described in this project report which will be used to select a preferred scenario for remediation and closure of the site consistent with federal and state environmental resource agencies. The field investigation was performed as specified in the work plans. These plans, dated April 1990, included the Sampling and Analysis Plan, Quality Control/Quality Assurance Plan, the Subsurface Exploration Plan, and the Site Health and Safety Plan for the field investigation phase.

The work plans were implemented under the direction of COE Engineering Project Management (CENPA-EN-PM-C); drilling was performed by COE's Geotechnical Branch, and the analytical work was done under the supervision of the North Pacific Division's QA-laboratory (CENPD-EN-G-L) at Troutdale, Oregon. E & E monitored the field work and received the resultant data packages.

The present report includes descriptions of the site history, the environmental setting, the field activities conducted, the results and interpretation of the analytical work, the evaluation of the potential contaminant exposure routes, and an evaluation of potential remediation methods. The next phase of the project will consist of the development of construction plans and specifications for remediation and final closure of the site.

The purpose of the IRP is to ensure compliance with hazardous waste regulations. The current DOD IRP policy is contained in Defense Environmental Quality Program Policy Memorandum (DEQPPM) 81-5, dated 11 December 1981. DEQPPM 81-5 reissued and amplified all previous directives and memoranda on the IRP. DOD policy is to identify and fully evaluate suspected problems associated with hazardous waste contamination, and to implement remedial actions which will minimize hazards to health and welfare that resulted from these past operations. The IRP is the basis for response actions under the provisions of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, clarified by Executive Order 12316.

Any requirements for public involvement, permits, and the participation of local, state and federal agencies will be coordinated between COE and the Directorate of Engineering and Housing (DEH) AFVR-DE, 6th Infantry (Light) at Fort Richardson.

2. SITE BACKGROUND

2.1 SITE LOCATION

The Roosevelt Road Transmitter Site is located on the northwest quarter of Section 20, Township 14 North and Range 2 West of the Seward Meridian at an elevation of 256 feet above mean sea level (MSL) within the installation boundaries of Fort Richardson (see Figures 2-1 and 2-2).

Fort Richardson is bounded by the Municipality of Anchorage and Elmendorf Air Force Base (EAFB) to the west, by Eagle Bay and Knik Arm to the north, and by the Chugach Mountains and State Park along the eastern boundary. The Glenn Highway bisects Fort Richardson.

2.2 PHYSICAL DESCRIPTION OF THE SITE

The Roosevelt Road Transmitter Site is located more than 1 mile north of the main installation facility and approximately 1,000 feet north of the intersection where Roosevelt Road turns west toward Otter Lake. The site lies at the end of the dirt road, which continues north at this intersection. It is situated just south of a bluff overlooking the Eagle River drainage and approximately 1,000 feet south of an existing railroad line. The site is located on generally level ground on a smooth ridge. The natural vegetation in the general area consists of spruce and birch forest with grass and shrubs. No surface water ponds or streams are present on the site.

Major site features consist of a gravel entrance road, an underground bunker with two aboveground entrances, two large concrete transmitter annex foundations, four smaller concrete foundations, and numerous abandoned underground utilities (sewer/septic system, electrical cables, utility ducts, and waterlines). The tunnels are reportedly of concrete construction on the sides and bottom, and of timber construction on the top. The tunnels were built to permit underground passage of personnel between facilities. The estimated dimensions of the tunnels are 6 feet high by 4 feet wide. The timber roofs of the tunnels are unstable, and instances of cave-ins were noted during the follow-up site inspection.

The original transmitter annex was located at a large concrete foundation approximately 200 feet south of the bunker. Later, another large concrete foundation was constructed adjacent to the east entrance of the bunker and the transmitter annex was relocated to this location.

2.3 SITE HISTORY

2.3.1 History of Fort Richardson

Fort Richardson was established east of Anchorage, Alaska in 1940, under the command of the Alaskan Defense Force (ADF). In 1941, ADF was redesignated as the Alaskan Defense Command (ADC), with approximately 7,800 stationed United States Army personnel. Fort Richardson was utilized as a staging area and supply point during World War II. During this period, troop size at Fort Richardson increased to over 15,500. In 1947, ADC was reorganized as United States Army, Alaska (USARAL) (ESE 1983).

In 1950, use of the Fort Richardson property was divided between the United States Army and the United States Air Force. The United States Army established a new cantonment area on the northern portion of the property, while the United States Air Force established EAFB on the southern portion of the property. In 1963, USARAL was reorganized into the 172nd Infantry Brigade. Since 1986, Fort Richardson has been under the Command of the 6th Infantry Division (Light) (DOEH 1990).

2.3.2 Roosevelt Road Transmitter Site History

The Roosevelt Road Transmitter Site consists of a bombproof bunker and the remnants of the attached support facilities which were constructed in the 1940s. The bunker was utilized as a high frequency transmitter communication center from World War II through the Korean War era. The final date of operations at the bunker is not known; however, the complex was decommissioned during the late 1960s. At that time, it was determined that only one high frequency transmitter was necessary for the region, and the Roosevelt Road transmitter was removed.

After the removal of the transmitter, the bunker and transmitter annex were used periodically for maneuvers, training, and assorted staging activities. At some point, several transformers located in both the bunker and the transmitter annex were apparently vandalized for the copper present inside them. Presently, most of the equipment and buildings at the site have been removed, leaving only concrete foundations and the underground bunker itself.

2.4 IDENTIFICATION OF POTENTIAL ON-SITE CONTAMINANTS

Previous sampling at the site confirmed the presence of PCB contamination in both surface and subsurface soils as well as in debris within the bunker. Additional potential contaminants include heavy metals, such as copper from the transformers; dioxins from the incomplete combustion of transformer oil containing PCBs; chlorobenzenes used in the dielectric fluid mixtures; and diesel components, since diesel was used as a solvent in one of the cleanup activities. Volatile organic compounds may be present in the sewer system from previous activities at the garage and various work areas when the site was operable. The underground bunker may contain asbestos in pipe wrapping and floor tiling. Other compounds potentially present include fuels and oils.

2.5 INVESTIGATIVE HISTORY

The history of releases at the site is poorly documented. A spill occurred when PCB-laden transformers were vandalized to recover copper. The date of the release is unknown. Following this, a 1978 cleanup supervised by the Environmental Protection Agency (EPA) was performed by Crowley Environmental. The transformers were removed from the underground bunker and from the adjacent transmitter annex building. The date of this activity is not documented. Oil residues were removed from the transmitter annex floor and the concrete was triple washed with diesel fuel. Contaminated materials were drummed and shipped to Chem-Nuclear in Arlington, Oregon. PCB-contaminated debris in the underground bunker, including 126 gallons of oil from the transformers which were spilled on the bunker floor, were not cleaned up. The bunker entrances were subsequently sealed, and the bunker abandoned. The transmitter annex building was eventually sold and removed from the site.

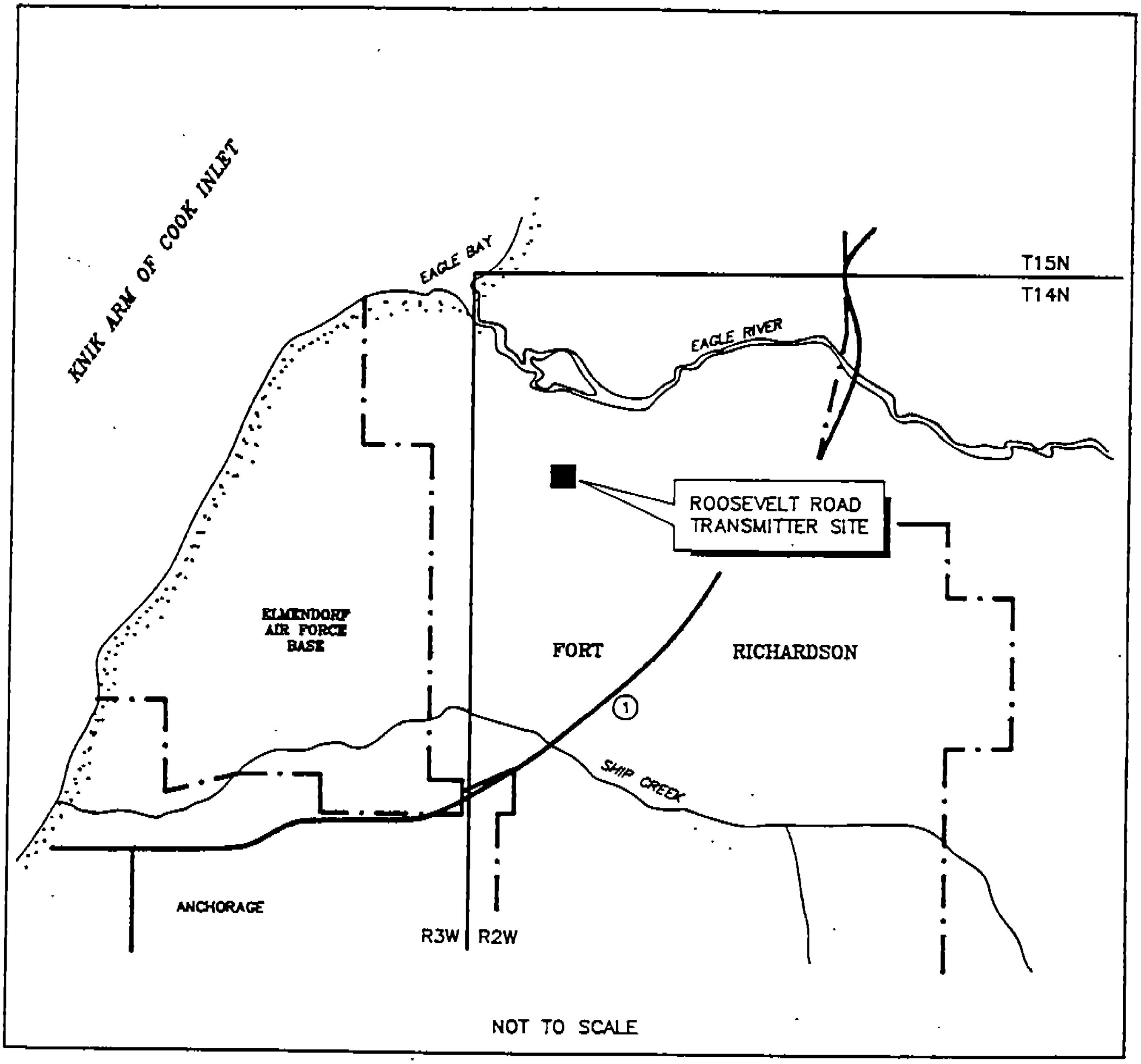
During the cleanup operation the diesel solvent washed off the edge of the transmitter annex concrete pad where the cleanup was performed, causing PCB contamination to migrate deeper into the soil. EPA no longer has records of this cleanup activity (Woodward-Clyde Consultants [WCC] 1989).

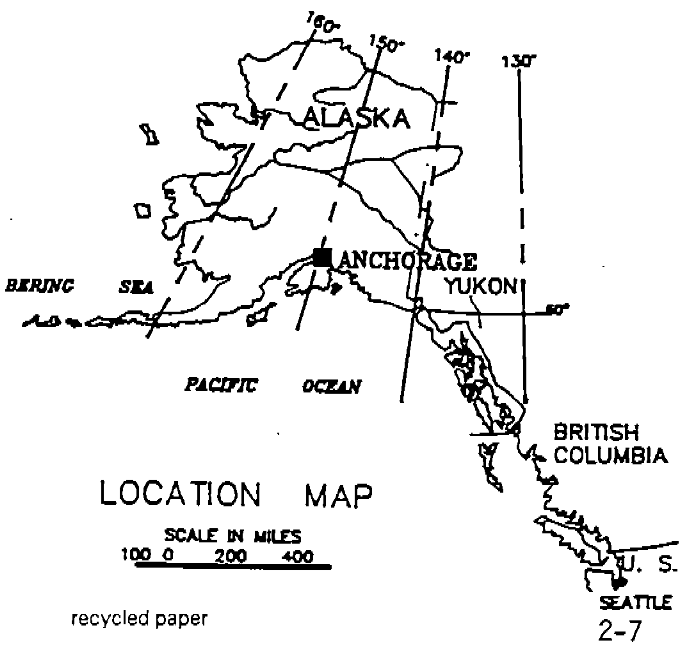
In April 1988, COE conducted a surface and subsurface investigation on and around the concrete transmitter annex platform after discovering residual PCB contamination from the 1978 cleanup and disposal activities. Analytical results revealed levels of PCBs as high as 76,900 parts per million (ppm) at the east entrance to the underground bunker. As a result of this investigation, an Expedited Response Action, which involved removal operations, was undertaken in October 1988 under the direction of Woodward-Clyde Consultants (WCC 1989). This activity was limited to the removal of 150 tons of PCB-contaminated material. Actual work consisted of the following: removing PCB-contaminated soil and debris from the site, sampling exposed surfaces, lining the excavations, backfilling the excavations, cleaning the concrete pad and the cable trenches, encapsulating the pad and trenches, and shipping all contaminated materials to the Defense Reutilization and Marketing Office (DRMO) on Elmendorf Air Force Base.

The bunker was reopened by COE in April 1989 to verify rumors of the storage of contaminated materials from prior cleanup activities within the bunker. While COE determined that no materials from the previous cleanup operations were stored in the bunker, dead rabbits were observed in one area of the bunker, as well as signs of vandalism and the remains of a small fire.

COE and E & E project managers visited the bunker in October 1989. Acting on a recommendation following the site visit, COE collected samples in the bunker. These samples indicated PCB levels up to 655,300 ppm in residual oils present in the bunker. The rabbit deaths were attributed to starvation and injuries resulting from falls through a roof vent.

E & E prepared a work plan for sampling activities in April 1990. The resultant field investigation is addressed in Section 4 of this report. COE and E & E conducted drilling and sampling activities at the site during May and June 1990. Drilling, sampling, and health and safety monitoring were conducted by COE personnel while E & E performed oversight.





ROOSEVELT ROAD TRANSMITTER SITE
Fort Richardson, Anchorage, Alaska
CONTRACT DACA85-88-D-0014

TITLE:

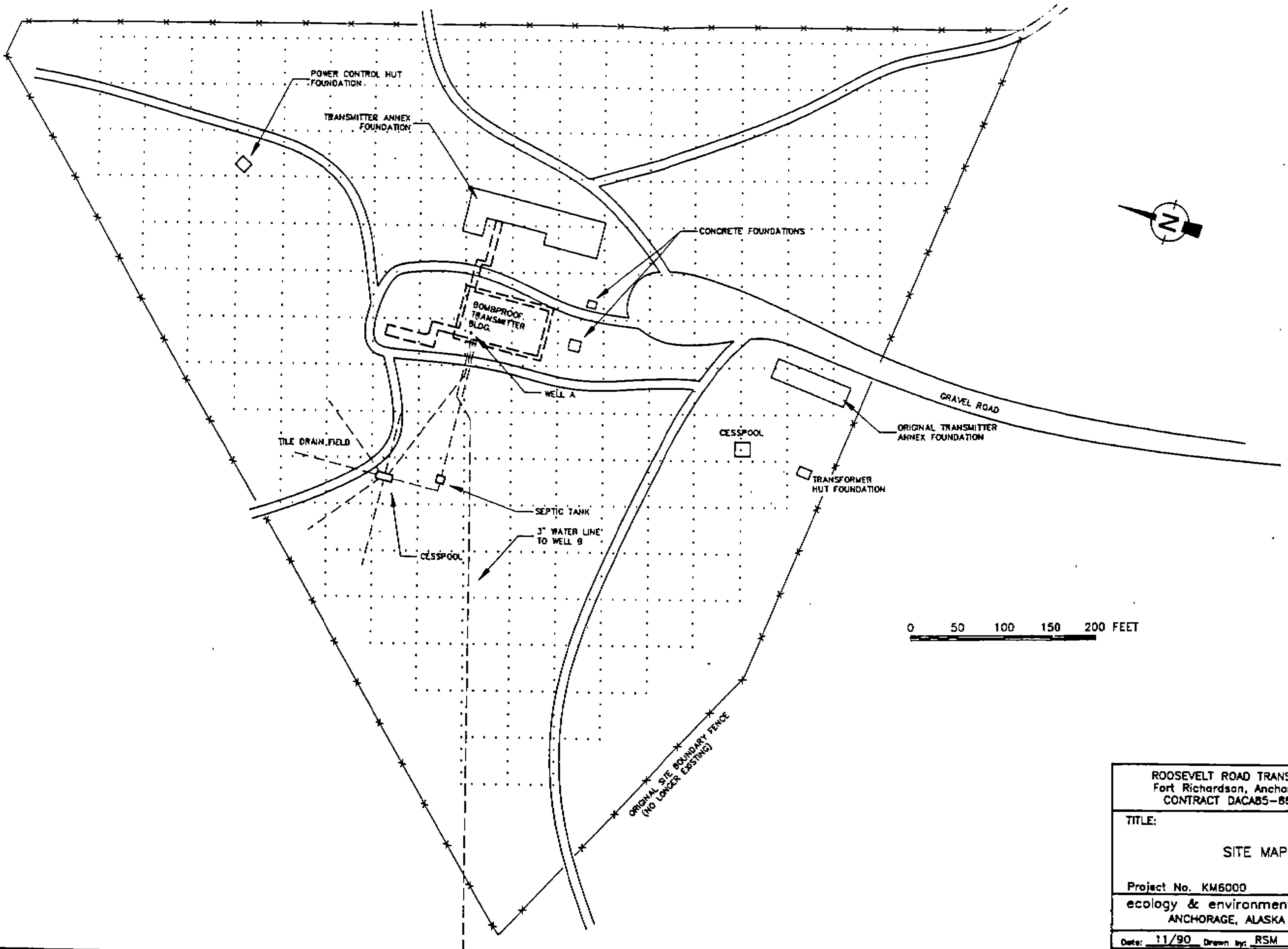
LOCATION AND VICINITY MAP

Project No. KM6000

ecology & environment, inc.
ANCHORAGE, ALASKA

FIG. 2-1

Date: 11/90 Drawn by: RSM Scale: NTS



ROOSEVELT ROAD TRANSMITTER SITE
Fort Richardson, Anchorage, Alaska
CONTRACT DACA85-88-D-0014

TITLE:

SITE MAP

Project No. KM6000

ecology & environment, inc.
ANCHORAGE, ALASKA

FIG. 2-2

Date: 11/90 Drawn by: RSM Scale: 1" = 100'

3. ENVIRONMENTAL SETTING

The information on the environment presented in this section is taken in part from the WCC (1989) and AEHA (1983) reports.

3.1 GEOGRAPHICAL SETTING

The Roosevelt Road Transmitter Site is located within the installation boundaries of Fort Richardson. Fort Richardson lies in two major physiographic provinces of Alaska; the Coastal Trough province and the Pacific Border Range province. The Cook Inlet-Susitna Lowland section is within the Coastal Trough province and encompasses the northern and eastern areas of Fort Richardson.

The site lies within the Cook Inlet-Susitna Lowland areas of Fort Richardson. This lowland area typically has elevations of less than 500 feet above mean sea level (MSL) with reliefs of 50 to 200 feet. The region is characterized by flat lowlands and gently rolling hills, open-low spruce forests, numerous streams, ponds, and treeless wetlands.

The main drainages of the installation are Eagle River and Ship Creek. These drainages traverse the installation from east to west and drain into Knik Arm of Cook Inlet. Eagle River forms Eagle River Flats and Eagle Bay at the mouth in the northern part of Fort Richardson. This tidal flat is the largest and ecologically most important tidal marsh of the area. The site lies within the Eagle River Drainage. Ship Creek is the drainage for the main cantonment area of Fort Richardson. It flows westward through Fort Richardson, Elmendorf Air Force Base and parts of the Municipality of Anchorage to Cook Inlet (WCC 1989).

The site is situated in the northern margin of the outwash plains of the Anchorage Plain Deposits. The broad flat plains of alluvial and glacio-alluvial deposition extend to Cook Inlet and underlie the main cantonment area of Fort Richardson.

3.2 POPULATION

Fort Richardson, headquarters of the 6th Infantry Division (Light) (Alaska), lies within the boundaries of the Municipality of Anchorage. Although entirely separate from nearby Elmendorf Air Force Base, Fort Richardson is generally regarded as the single military presence in the area. Estimates indicate that roughly one-third of the assigned military personnel live off base. The military population of Fort Richardson is 5,300, while civilian employees and military dependents total about 10,690 (DEH 1989). Anchorage, the largest city in the state, has a population of about 211,000; this accounts for approximately one-half of the state's 426,000 residents (Community and Regional Affairs 1988).

3.3 GEOLOGY

Surficial deposits comprise the unconsolidated soil material above bedrock at Fort Richardson. Drill logs at the Fort Richardson Landfill, approximately 1 mile south of the Roosevelt Road Transmitter Site, show that surficial deposits are more than 160 feet thick. Surficial Pleistocene deposits derived from glacial activity have accumulated in the upper Cook Inlet in the last 2 million years. Five glacial events have been recognized in the upper Cook Inlet area (Cederstrom et al. 1964). Most of the surficial deposits near Fort Richardson were formed during the Late Wisconsin glacial stade, about 25,000 to 10,000 years ago (Zenone et al. 1974). The surficial deposits were derived from the Knik, Matanuska, and Eagle River Valleys.

Zenone et al. (1974) state that earlier glaciers eroded some of the bedrock and much of the older unconsolidated materials in the area. The most recent glaciers have left till as glacial moraines and associated landforms. Examples of these landforms in the Fort Richardson area include kames, eskers, small alluvial fans, glacio-fluvial meltwater channels, and proglacial outwash (Schmoll and Dobrovolny 1972). Repeated glacial events produced complex sequences of glacial and related deposits. The Roosevelt Road Transmitter Site is located just north of the massive Elmendorf Moraine which represents the terminal margin of a glacier that once filled Cook Inlet.

3.4 HYDROGEOLOGY

3.4.1 Groundwater

Water bearing strata (aquifers) at Fort Richardson consist of a complex of buried sand and gravel layers interspersed and semi-confined by glacial till. Major aquifers for the Anchorage area extend from the Chugach Mountains across the Anchorage basin and north through most of Fort Richardson (Cederstrom et al. 1964). Groundwater reservoirs are replenished by direct infiltration of precipitation and percolation from surface waters. The availability of water is dependent upon the amount of local precipitation (Zenone and Anderson 1978). The water table at the Roosevelt Road Transmitter Site is 95 feet deep based on Well B data supplied by COE (Davies 1990).

Drinking water at Fort Richardson is provided mainly by the Fort Richardson Military Dam near the headwaters of Ship Creek. Several deep wells (depths of greater than 300 feet) near the hospital at Elmendorf Air Force Base provide water if needed during the spring. Water storage is provided by a permanent 2.5-million-gallon reservoir located on the base and by the Ship Creek Dam Impoundment. A water treatment plant located near the dam provides treatment for drinking water used at Fort Richardson and Elmendorf Air Force Base. The municipality of Anchorage obtains its drinking water from Ship Creek and Eklutna Lake.

The site is located near a natural water divide. The groundwater on the south side of the Elmendorf Moraine is anticipated to flow southwesterly to contribute to the Ship Creek aquifer system. The groundwater on the north side of the moraine, where the site is located, is anticipated to flow northwesterly into the Eagle River aquifer system. It has not been determined into which system groundwater from the immediate vicinity of the site flows (DOA 1990).

Groundwater quality in the Anchorage area is excellent (Cederstrom et al. 1964). Dissolved solids content is low, hardness is moderate, and the concentrations of other constituents are also low. Nearly all water samples in this area are classified as calcium and magnesium bicarbonate waters of moderate hardness (Cederstrom et al. 1964). Total hardness normally ranges from 8 to 130 ppm. Calcium concentrations normally range from 20 to 35 ppm and magnesium concentrations range from approximately 5 to 15 ppm. In harder waters, the calcium and magnesium concentrations can be as high as 138 and 23 ppm, respectively. Sodium and potassium concentrations generally range from 3 to 12 ppm. Sulfate concentrations are generally low (around 10 ppm) and chloride is similarly low. The groundwater pH in the area ranges from 7 to 8 standard units.

3.4.2 Surface Water

The primary surface drainage features in the area are Eagle River and Ship Creek. Both originate in the Chugach Mountains and flow west across Fort Richardson into the Knik Arm of the Cook Inlet. Several streams in the southern portion of Fort Richardson, including Ship Creek, flow through Anchorage prior to entering the Knik Arm of the Cook Inlet. Eagle River is fed by turbid glacial melt waters, and Ship Creek is sustained by snowmelt and rainwater runoff. The flows for Eagle River and Ship Creek are variable, with maximum runoffs occurring in August and June, respectively. Eagle River, the major surface water body nearest to the Roosevelt Road Transmitter Site, is located approximately 1 mile north of the site. Surface water from the site drains to the Eagle River.

3.5 CLIMATE

Fort Richardson is located in a climatic transition zone between the maritime climate of the coast and the continental climate of interior Alaska. The mean annual temperature is 1.7°C. Mean monthly temperatures range from a low of -11.2°C in January to 14.4°C in July.

The mean annual total precipitation is 37.4 centimeters (cm), with almost half of the precipitation occurring in July, August, and September. The total precipitation includes a mean annual snowfall of 177 cm. The driest period occurs from January through May.

The area is moderately to very cloudy throughout the year, with approximately 234 cloudy days and 65 partly cloudy days. Heavy fog occurs on approximately 22 days each year.

4. FIELD INVESTIGATION

4.1 SAMPLING RATIONALE

The rationale and technical approach for the field investigation are described in detail in the Roosevelt Road Transmitter Site Workplan (E & E 1990). A summary is presented in this section; departures from the work plan are described in this section as well.

The primary objective of sampling activities at the site was to characterize contaminated areas in sufficient detail to develop remedial plans and specifications. Sampling activities were designed taking into account past sampling activities, remedial design and engineering requirements, USDOT regulations (49 CFR 172), and EPA Hazardous and Toxic Waste regulations (40 CFR 1261-264 and 761). The sampling plan was designed to meet the following objectives:

- o Characterize residual transformer oils, asbestos, and petroleum, oil, and lubricants (POL) in the underground bunker;
- o Determine the presence and extent of contamination at known and suspected electrical equipment locations within the site;
- o Determine if areas have been contaminated by past hazardous and toxic waste (HTW) disposal practices (cesspools, roads, etc.); and
- o Evaluate revegetation requirements.

The analytical test parameters were selected to provide data to determine the handling and disposal requirements for the site wastes. Analysis was performed for volatile organic compounds; base, neutral, and acid extractables; PCBs; ; asbestos; dioxin; identification of total petroleum hydrocarbons; metals; and revegetation parameters. These parameters were chosen based upon the following rationale:

- o Existing analytical data showed Aroclor 1260 and trichlorobenzene contamination from the transformer oils. PCBs and base/neutral/acid extractables (BNAs) analyses were included for these parameters;
- o Waste oil regulations address metals, halogens, and ignitability;
- o Charred debris in the underground bunker indicated the possibility of dioxin contamination from incomplete combustion of PCB materials;
- o Pipe wrappings and floor tiles could contain asbestos;
- o Total petroleum hydrocarbon analysis by modified EPA Method 8015 was included to identify POL products; and
- o Cesspool contents needed to be screened for hazardous constituents.

No groundwater samples were collected in this investigation. Two wells exist at the site and one of these, Well B, is sampled regularly by COE personnel as part of the basewide groundwater investigation.

4.2 DATA QUALITY OBJECTIVES

Quality control (QC) samples were collected to assess potential errors introduced during sample collection, handling, and analysis. As part of the field Quality Assurance/Quality Control (QA/QC) program, field duplicate samples, aqueous trip blanks, and equipment rinsate blanks were collected (see Section 4.4.8).

Sample integrity was maintained by COE field personnel. All samples were handled in accordance with United States Army Corps of Engineers Sample Handling Protocol for Low, Medium, and High Concentration Samples of Hazardous Waste (1986).

The sample containers were in compliance with EPA guidance (Specifications and Guidance for the Preparation of Contaminant-Free Containers, April 1989). Decontamination procedures consisted of a soapy water rinse, tap water rinse, triple hexane rinse, and a triple rinse of deionized water. Rinsate samples were collected to ensure cross-contamination did not occur during sample collection.

All data were evaluated for precision, accuracy, and completeness by COE's North Pacific Division Materials Laboratory in Troutdale, Oregon. Laboratory quality control (QC) comprised at least 10% of each data set and consisted of blanks, duplicates/replicates, spikes, standards, and QC check samples. Control limits were defined by the particular analytical method as well as the QC acceptance criteria outlined in EPA's Test Methods for Evaluating Solid Wastes SW-846 and EPA's Methods for Chemical Analysis of Water and Wastes. All generated data were reviewed by comparison to the guidelines established in SW-846, Chapter 1 (Quality Control).

4.3 SUMMARY OF FIELD ACTIVITIES

A summary of the major field activities conducted at the site and the dates they were conducted is presented in Table 4-1, participating COE and E & E staff are listed in Table 4-2. During the preparation for fieldwork, COE determined that there was no historical basis for WCC's claim of trichlorobenzene contamination of the site; BNA analyses were to be kept to a minimum, and if needed, later such analyses could be obtained under a modification to the delivery order (COE 1990a). Consequently, BNA data are only sparsely available.

4.3.1 Asbestos Sampling

Asbestos bulk sampling was performed in four areas on two different materials in the underground bunker. Two pipe insulation bulk samples were collected, one sample (collected in triple volume as a QA/QC sample) from a pipe located in the sewer ejector pit room, and one sample from the transformer room. Two floor tile samples were collected one sample from the transformer room, and one sample near the west entrance to the transformer room. One asbestos sample was collected from the concrete pad of the transmitter annex.

Asbestos sampling did not perfectly adhere to the work plan because it was not a routine task for the samplers. The discrepancies, however, are minor and do not influence the results. Bulk asbestos samples were not saturated with amended water (30% detergent). Samples were collected using a utility knife; a portion of pipe wrapping, approximately 6 cm by 6 cm in size, was collected in a plastic sample bag. Sample locations were not covered with duct tape as recommended. Pieces of floor tile were also collected for analysis, two samples from within the bunker and one sample from the transmitter annex concrete pad.

4.3.2 Dioxin Sampling

Four samples (two being QA/QC duplicates) of solid waste were collected for dioxin analysis. One sample was collected from the remains of a small fire on the floor of the room directly south of the transformer room in the bunker. The other sample, collected in triple volume for QA/QC purposes, was collected from oily residues in a cableway. A hexane rinsate sample was also analyzed.

4.3.3 Solid Waste Sampling

Eleven solid waste samples were collected from areas containing soil, dried oil, and animal residue within the bunker for PCB analysis. Samples were collected using dedicated stainless-steel spoons; sampling devices still remain within the bunker.

4.3.4 Soil Sampling

Soils collected in this investigation were analyzed for BNAs and PCBs. Both discreet grab and composite surface soil samples were collected throughout the site. All surface soil samples were collected at a depth of 0 to 6 inches using pre-cleaned stainless-steel spatulas. Discreet grab samples were collected using a stainless-steel spatula and placed directly into the appropriate prelabeled containers. Composite samples were composed of four to six equal volume aliquots, 0 to 6 inches in depth, oriented around a single point. Aliquots were collected using a stainless-steel spatula and homogenized in a stainless-steel bowl. Sampling implements were decontaminated prior to the collection of each sample.

Soil sampling was performed at grids outside the northwest entrance to the bunker, around the power hut concrete pad, around the transformer hut concrete pad, around both the original transmitter annex and the transmitter annex concrete pads. Biased grab soil samples were collected from the site grid in stained areas, areas of stressed vegetation, low areas, dump areas, and roadways. The number of sampling locations per grid was based upon the radius of the sampling area as per EPA recommendations outlined in Field Manual For Grid sampling of PCB Spill Sites to Verify Cleanup (EPA 1986).

4.3.5 WIPE SAMPLING

Wipe samples were collected within the bunker from locations on the floor and the walls. Samples were also collected from the concrete pads of the power hut, the transformer hut, and the transmitter annex.

Wipe samples were collected from the concrete surfaces using glass wool saturated with hexane. Pre-formed wire templates of 10 cm by 10 cm were used to mark the sampling locations. Pre-cut plugs of glass wool were placed in 40 ml vials with approximately 5 ml of hexane prior to the sampling activities. The glass wool plugs saturated in hexane were removed from the vials using stainless-steel forceps. After allowing excess hexane to drain off the glass wool, the templated area was swathed with the plug until the hexane had disappeared. The glass wool was then returned to the vial. The stainless-steel forceps were decontaminated with a hexane rinse between samples.

Two blank samples consisting of glass wool and hexane were analyzed by the laboratory as blind matrix blank samples.

4.3.6 Borehole Sampling

Borehole drilling was conducted at the Roosevelt Road Transmitter Site from May 25, 1990 to June 9, 1990 by COE personnel. Drilling was accomplished using all-terrain rotary drilling equipment with hollow-stem auger and concrete coring capabilities. A total of 23 borings were drilled at the site. Table 4-3 summarizes the locations and depths of the borings drilled at the Roosevelt Road Transmitter Site. Drilling record logs for all boreholes are provided in Appendix A.

Boreholes BH-1 through BH-9 required the removal of concrete cores prior to soil augering and sampling at each location. Initially, a concrete core 10 inches in diameter was removed from each hole. During drilling activities, the ambient air and corehole were monitored for organic vapors using a photoionization detector (HNu). Upon removal of the concrete core, the corehole was backfilled with sand and covered with bentonite pellets and a plastic sheet until soil augering was to occur.

Soil augering at all the borehole locations was conducted using an 8-inch hollow-stem auger. Boreholes were drilled to a depth of approximately 30 feet, or until refusal. The water table is quite deep and was not reached during the borehole drilling program. Logging of subsurface conditions at each borehole was completed by the collection of continuous split-spoon samples. The split-spoon samples and drill cuttings were monitored for organic vapors using an HNu.

4.3.7 Field Screening for Organic Vapor

During drilling operations, continuous monitoring was performed using a photoionization detector (HNu). Both the ambient air and the spilt-spoon were monitored during sample collection. Previous sampling activities had shown a correlation between HNu readings and positive PCB results (COE 1988). This correlation was also evident during these sampling activities. Associated positive PCB results and HNu readings above background are presented in Appendix C.

4.4 SUMMARY OF SAMPLES BY LOCATION

Tables 4-4 through 4-13 present a summary of the number, type, location, and rationale for samples collected during the field investigation.

4.4.1 Bunker Samples

E & E conducted sampling within the bombproof bunker on June 13 and 14, 1990. Twenty-six wipe samples were collected from oil-stained areas of the concrete floor and walls of the bunker, four of these were QA/QC samples. In addition, a total of 11 solid waste samples were also collected from areas containing soil, dried oil, and animal residues within the bunker (two of these were QA/QC samples). Also, four dioxin samples were collected from the room where burning of materials appeared to have occurred (two of these were QA/QC samples); and four asbestos samples were collected from pipe wrappings and floor tiles within the bunker. Sampling locations are indicated in Figure 4-1, and Table 4-4 provides a summary of the sample numbers and rationale associated with each of the samples collected within the concrete bunker.

4.4.2 Transmitter Annex Samples

Sampling was conducted on and around the transmitter annex on May 22, 1990; June 12, 1990; and June 15, 1990. Nine wipe samples were collected from the concrete foundation of the transmitter annex (two of these were QA/QC samples). In addition, one asbestos sample was collected from floor tile at the transmitter annex. Seventeen composite surface soil samples were collected from areas surrounding the transmitter annex (two of these were QA/QC samples); and 38 grab surface soil samples were collected from grid locations (six of these samples were QA/QC samples). Borehole drilling occurred at this location from May 30, 1990 to June 8, 1990. Seventy-nine samples were collected from the 11 boreholes. Fifteen of these samples were collected for QA/QC purposes. Figures 4-2 through 4-5 indicate sampling locations in and around the transmitter annex and Table 4-5 provides a summary of the sample numbers and rationale associated with each of the samples collected at the transmitter annex.

4.4.3 Original Transmitter Annex Samples

Sampling on and around the original transmitter annex took place on May 23, 1990; May 29, 1990; and June 11, 1990. Eleven composite surface soil samples were collected from areas surrounding the original transmitter annex (two of these were QA/QC samples); 38 grab surface soil samples were collected from grid locations surrounding the original transmitter annex, (two of these were QA/QC samples). Borehole drilling occurred at this location on June 8, 1990. Eighteen samples were collected from the four boreholes (two of these were QA/QC samples). Figures 4-6 and 4-7 indicate sampling locations in and around the original transmitter annex and Table 4-6 provides a summary of the sample numbers and rationale associated with each of the samples collected at the original transmitter annex.

4.4.4 Transformer Hut Samples

Sampling was conducted on and around the transformer hut on may 23, 1990 and June 12, 1990. Thirty-seven grab surface soil samples were collected from grid locations surrounding the transformer hut (six of these were QA/QC samples). In addition, five wipe samples were collected from the concrete foundation of the transformer hut (two of these were QA/QC samples). Borehole drilling was conducted at this location on June 7, 1990. Twelve samples were collected from the four boreholes, (two of these were QA/QC samples). Figure 4-8 indicates sampling locations in and around the transformer hut and Table 4-7 provides a summary of the sample numbers and rationale associated with each of the samples collected at the transformer hut.

4.4.5 Power Control Hut Samples

Sampling on and around the power control hut occurred on May 23, 1990 and June 15, 1990. Thirty-one grab surface soil samples were collected from grid locations surrounding the power control hut (six of these were QA/QC samples). Two wipe samples were collected from the concrete foundation of the power control hut. Borehole drilling was conducted at this location on June 7, 1990. Twelve grab samples were collected from the four boreholes. Figures 4-9 and 4-10 indicate sampling locations in and around the Power Control Hut and Table 4-8 provides a summary of the sample numbers and rationale associated with each of the samples collected in and around the power control hut.

4.4.6 Northwest Bunker Entrance Samples

A total of 14 grab surface soil samples were collected by E & E at grid locations near the northwest entrance to the bunker on June 18, 1990, (four of these were QA/QC samples). Figures 4-11 and 4-12 indicate sampling locations around the northwest entrance to the bunker and Table 4-9 provides a summary of the sample numbers and rationale associated with each of the samples collected around the northeast entrance to the bunker.

4.4.7 Site Grid Samples

In an effort to examine waste characteristics at the entire Roosevelt Road Transmitter Site, grid sampling was conducted throughout the site area on June 18, 1990. Twenty-seven grab surface soil samples were collected from biased locations (four of these were QA/QC samples). Figure 4-13 indicates sampling locations of the site grid sampling and Table 4-10 provides a summary of the sample numbers and rationale associated with each of the samples collected from the site grid.

4.4.8 Quality Assurance/Quality Control Sampling

Quality assurance/quality control (QA/QC) samples, blanks, duplicates, and spikes; were collected to assess the laboratories' precision, accuracy, comparability, and completeness. All QA/QC samples are referenced as such in Tables 4-4 through 4-10, and listed in Tables 4-11 through 4-13.

Two sets of QA/QC samples were collected, one set for the COE QA laboratory for external QA purposes and one set for analysis by the project laboratory for internal QC purposes.

Field duplicate samples were collected for precision purposes to verify the reproducibility of data. One field duplicate sample was collected for every 10 samples of a particular matrix and was submitted to both the project laboratory and the QA laboratory. Field duplicates for most analyses except volatiles, wipe samples, and asbestos samples, consisted of a fraction of homogenized sample material collected from a designated sampling location. The field duplicates for volatiles, wipe samples, and asbestos samples were co-located. Field duplicates were not identified but labeled as other field samples on the chain-of-custody forms.

Trip blanks, samples of organic-free deionized water (ASTM Type II), were provided by COE. Trip blanks were included in all shipments containing samples for volatile analysis. Trip blanks were not identified but labeled as other volatile samples on chain-of-custody forms.

Equipment rinsate samples were collected to ensure that collection equipment had been properly decontaminated and that cross-contamination did not occur during sample collection. Rinsate blanks were collected from a split-spoon and a stainless-steel bowl and spoon. A hexane rinsate sample was prepared by pouring hexane over a decontaminated stainless-steel spoon and was analyzed for dioxin. Two hexane and glass wool blanks were also analyzed. Sampling equipment blanks were not identified but labeled like other samples.

Table 4-1

SUMMARY OF FIELD ACTIVITIES

Activity	Location	Date
Site Reconnaissance		May 18, 1990; May 21, 1990
Drilling	TA	May 18 – June 7, 1990
	OTA	June 9, 1990
	TH	June 9, 1990
	PH	June 8, 1990
Sampling	Bunker	June 13 – June 14, 1990
	TA	May 22; June 12; June 15, 1990
	OTA	May 23; May 29; June 11, 1990
	TH	May 23; June 12, 1990
	PH	May 23; June 15, 1990
	NEB	June 18, 1990
	SG	June 18, 1990

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Key:

TA = Transmitter annex
OTA = Original transmitter annex
TH = Transmitter hut
PH = Power control hut
NEB = Northwest entrance to bunker
SG = Site grid

Table 4-2

ON-SITE PERSONNEL

Personnel	Duration
U.S. Army Corps of Engineers	
Dave Nesting	5/21-23, 29-31, 6/1-2, 4-9, 11-15, 18-20, 22, 25-26, 1990
Willard Farrell	5/21, 6/5-6, 13-14, 1990
Keith Mitchell, Driller	5/18, 24-25, 29-31, 6/1-2, 4-9, 22, 25-26, 1990
Carl Mitchell, Driller	5/23-25, 29-31, 6/1-2, 4-9, 25, 1990
Lizette Boyer, Helper	5/30-31, 1990
Claire Yeager	6/7, 1990
Ajmal Ilias	6/7, 1990
Dave Williams	6/20, 1990
Eddie Brooks	6/20, 1990
Ecology and Environment, Inc.	
Lynn Fischer, Project Manager	5/31, 6/1, 12-15, 18-19, 22, 25-26, 1990
Mark Sienkiewicz, Field Investigator	5/18, 21-23, 6/4-9, 11, 13, 1990
Michael Schmetzer, Engineer	5/30, 1990
Becky Architzel, Geologist	5/21-25, 29-31, 6/1-2, 1990

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Table 4-3

BORING LOCATIONS AND DEPTHS

Boring Number	Date	Location	Depth (feet)	Concrete Core
BH-1	5/30/90	TA	26	Yes
BH-2	5/31/90	TA	20	Yes
BH-3	6/01/90	TA	11	Yes
BH-4	6/01/90	TA	11	Yes
BH-5	6/02/90	TA	4	Yes
BH-6	6/02/90	TA	29	Yes
BH-7	6/04/90	TA	21	Yes
BH-8	6/05/90	TA	18	Yes
BH-9	6/05/90	TA	26	Yes
BH-10	6/06/90	TA	30	No
BH-11	6/08/90	TA	30	No
BH-12	6/08/90	PH	6	No
BH-13	6/08/90	PH	6	No
BH-14	6/08/90	PH	6	No
BH-15	6/08/90	PH	6	No
BH-16	6/09/90	OTA	10	No
BH-17	6/09/90	OTA	10	No
BH-18	6/09/90	OTA	10	No
BH-19	6/09/90	OTA	10	No
BH-20	6/09/90	TH	4	No
BH-21	6/09/90	TH	11	No
BH-22	6/09/90	TH	6	No
BH-23	6/09/90	TH	4	No

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Key:

TA = Transmitter annex
PH = Power control hut
OTA = Original transmitter annex
TH = Transformer hut

Table 4-4

BUNKER SAMPLING LOCATIONS AND RATIONALE

Sample Number	Matrix	Location	Rationale
90RRTS263MI	Asbestos	A-1, pipe wrapping	Determine the quantity and type of asbestos present
90RRTS264MI	Asbestos	A-1, pipe wrapping	Duplicate of 90RRTS263MI
90RRTS265MI	Asbestos	A-1, pipe wrapping	QA of 90RRTS263MI
90RRTS267MI	Asbestos	A-2, floor tile	Determine the quantity and type of asbestos present
90RRTS269MI	Asbestos	A-3, pipe wrapping	Determine the quantity and type of asbestos present
90RRTS274SW	Dioxin	D-1, oily residue in cableway	Determine the presence of dioxin contamination
90RRTS275SW	Dioxin	D-1, oily residue in cableway	Duplicate of 90RRTS274SW
90RRTS276SW	Dioxin	D-1, oily residue in cableway	QA of 90RRTS274SW
90RRTS279SW	Dioxin	D-1, fire area, ashes	Determine the presence of dioxin contamination
90RRTS262WS	Wipe	BW-1, wall	Determine the extent of surface contamination
90RRTS266WS	Wipe	BW-2, wall	Determine the extent of surface contamination
90RRTS268WS	Wipe	BW-3, wall	Determine the extent of surface contamination
90RRTS295WS	Wipe	BW-4, wall	Determine the extent of surface contamination
90RRTS270WS	Wipe	BW-5, wall	Determine the extent of surface contamination
90RRTS271WS	Wipe	BW-6, wall	Determine the extent of surface contamination
90RRTS272WS	Wipe	BW-6, wall	Duplicate of 90RRTS271WS
90RRTS273WS	Wipe	BW-6, wall	QA of 90RRTS271WS
90RRTS277WS	Wipe	BW-7, wall	Determine the extent of surface contamination
90RRTS290WS	Wipe	BW-8, wall	Determine the extent of surface contamination

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Table 4-4 (Cont.)

Sample Number	Matrix	Location	Rationale
90RRTS291WS	Wipe	BW-9, floor	Determine the extent of surface contamination
90RRTS292WS	Wipe	BW-9, floor	Duplicate of 90RRTS291WS
90RRTS293WS	Wipe	BW-9, floor	QA of 90RRTS291WS
90RRTS294WS	Wipe	BW-10, floor	Determine the extent of surface contamination
90RRTS296WS	Wipe	BW-11, floor	Determine the extent of surface contamination
90RRTS297WS	Wipe	BW-12, floor	Determine the extent of surface contamination
90RRTS298WS	Wipe	BW-13, floor	Determine the extent of surface contamination
90RRTS299WS	Wipe	BW-14, floor	Determine the extent of surface contamination
90RRTS300WS	Wipe	BW-15, floor	Determine the extent of surface contamination
90RRTS301WS	Wipe	BW-16, floor	Determine the extent of surface contamination
90RRTS302WS	Wipe	BW-17, floor	Determine the extent of surface contamination
90RRTS303WS	Wipe	BW-18, floor	Determine the extent of surface contamination
90RRTS304WS	Wipe	BW-19, floor	Determine the extent of surface contamination
90RRTS305WS	Wipe	BW-20, floor	Determine the extent of surface contamination
90RRTS306WS	Wipe	BW-21, floor	Determine the extent of surface contamination
90RRTS307WS	Wipe	BW-22, floor	Determine the extent of surface contamination
90RRTS278SW	Solid waste	BG-1, east cableway	Determine the extent of contamination inside the bunker
90RRTS280SW	Solid waste	BG-2, east side	Determine the extent of contamination inside the bunker
90RRTS281SW	Solid waste	BG-2, east side	Duplicate of 90RRTS280SW
90RRTS282SW	Solid waste	BG-2, east side	QA of 90RRTS280SW

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Table 4-4 (Cont.)

Sample Number	Matrix	Location	Rationale
90RRTS283SW	Solid waste	BG-3, east side	Determine the extent of contamination inside the bunker
90RRTS284SW	Solid waste	BG-4, sewage ejector pit	Determine the extent of contamination inside the bunker
90RRTS285SW	Solid waste	BG-5, pump well pit	Determine the extent of contamination inside the bunker
90RRTS286SW	Solid waste	BG-6, north stairwell	Determine the extent of contamination inside the bunker
90RRTS287SW	Solid waste	BG-7, north cableway	Determine the extent of contamination inside the bunker
90RRTS288SW	Solid waste	BG-8, north cableway	Determine the extent of contamination inside the bunker
90RRTS289SW	Solid waste	BG-9, north cableway	Determine the extent of contamination inside the bunker

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Table 4-5

TRANSMITTER ANNEX SAMPLING LOCATIONS AND RATIONALE

Sample	Matrix	Location and Depth (feet)	Rationale
90RRTS01WS	Wipe	W-1	Determine the extent of surface contamination
90RRTS02WS	Wipe	W-2	Determine the extent of surface contamination
90RRTS03WS	Wipe	W-3	Determine the extent of surface contamination
90RRTS04WS	Wipe	W-4	Determine the extent of surface contamination
90RRTS05WS	Wipe	W-5	Determine the extent of surface contamination
90RRTS06WS	Wipe	W-6	Determine the extent of surface contamination
90RRTS07WS	Wipe	W-7	Determine the extent of surface contamination
90RRTS08WS	Wipe	W-3	Duplicate of 90RRTS03WS
90RRTS09WS	Wipe	W-3	QA of 90RRTS03WS
90RRTS36SL	Soil	BH-1, (0 - 1)	Determine the extent of subsurface soil contamination
90RRTS37SL	Soil	BH-1, (4 - 6)	Determine the extent of subsurface soil contamination
90RRTS38SL	Soil	BH-1, (10 - 12)	Determine the extent of subsurface soil contamination
90RRTS39SL	Soil	BH-1, (10 - 12)	Determine the extent of subsurface soil contamination
90RRTS40SL	Soil	BH-1, (10 - 12)	Determine the extent of subsurface soil contamination
90RRTS41SL	Soil	BH-1, (14 - 16)	Determine the extent of subsurface soil contamination
90RRTS42SL	Soil	BH-1, (19 - 21)	Determine the extent of subsurface soil contamination
90RRTS43SL	Soil	BH-1, (24 - 26)	Determine the extent of subsurface soil contamination
90RRTS44SL	Soil	BH-2, (0 - 3)	Determine the extent of subsurface soil contamination
90RRTS45SL	Soil	BH-2, (3 - 5)	Determine the extent of subsurface soil contamination

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Table 4-5 (Cont.)

Sample	Matrix	Location and Depth (feet)	Rationale
90RRTS46SL	Soil	BH-2, (5 - 7)	Determine the extent of subsurface soil contamination
90RRTS47SL	Soil	BH-2, (7 - 10)	Determine the extent of subsurface soil contamination
90RRTS48SL	Soil	BH-2, (10 - 16)	Determine the extent of subsurface soil contamination
90RRTS49SL	Soil	BH-2, (16 - 20)	Determine the extent of subsurface soil contamination
90RRTS50SL	Soil	BH-3, (0 - 3)	Determine the extent of subsurface soil contamination
90RRTS51SL	Soil	BH-3, (3 - 5)	Determine the extent of subsurface soil contamination
90RRTS52SL	Soil	BH-3, (5 - 8)	Determine the extent of subsurface soil contamination
90RRTS53SL	Soil	BH-3, (5 - 8)	Duplicate of 90RRTS53SL
90RRTS54SL	Soil	BH-3, (5 - 8)	QA of 90RRTS53SL
90RRTS55SL	Soil	BH-3, (8 - 11)	Determine the extent of subsurface soil contamination
90RRTS56SL	Soil	BH-4, (0 - 2)	Determine the extent of subsurface soil contamination
90RRTS57SL	Soil	BH-4, (2 - 4)	Determine the extent of subsurface soil contamination
90RRTS58SL	Soil	BH-4, (2 - 4)	Determine the extent of subsurface soil contamination
90RRTS59SL	Soil	BH-4, (2 - 4)	Determine the extent of subsurface soil contamination
90RRTS60SL	Soil	BH-4, (4 - 6)	Determine the extent of subsurface soil contamination
90RRTS61SL	Soil	BH-4, (6 - 11)	Determine the extent of subsurface soil contamination
90RRTS62SL	Soil	BH-5, (0 - 2)	Determine the extent of subsurface soil contamination
90RRTS63SL	Soil	BH-5, (2 - 4)	Determine the extent of subsurface soil contamination
90RRTS64SL	Soil	BH-6, (0 - 2)	Determine the extent of subsurface soil contamination
90RRTS65SL	Soil	BH-6, (2 - 4)	Determine the extent of subsurface soil contamination

Table 4-5 (Cont.)

Sample	Matrix	Location and Depth (feet)	Rationale
90RRTS66SL	Soil	BH-6, (4 - 6)	Determine the extent of subsurface soil contamination
90RRTS67SL	Soil	BH-6, (4 - 6)	Duplicate of 90RRTS66SL
90RRTS68SL	Soil	BH-6, (4 - 6)	QA of 90RRTS66SL
90RRTS69SL	Soil	BH-6, (6 - 10)	Determine the extent of subsurface soil contamination
90RRTS70SL	Soil	BH-6, (10 - 15)	Determine the extent of subsurface soil contamination
90RRTS71SL	Soil	BH-6, (15 - 20)	Determine the extent of subsurface soil contamination
90RRTS72SL	Soil	BH-6, (20 - 29)	Determine the extent of subsurface soil contamination
90RRTS73SL	Soil	BH-7, (0 - 2)	Determine the extent of subsurface soil contamination
90RRTS74SL	Soil	BH-7, (4 - 6)	Determine the extent of subsurface soil contamination
90RRTS75SL	Soil	BH-7, (8 - 10)	Determine the extent of subsurface soil contamination
90RRTS76SL	Soil	BH-7, (10 - 16)	Determine the extent of subsurface soil contamination
90RRTS77SL	Soil	BH-7, (10 - 16)	Duplicate of 90RRTS76SL
90RRTS78SL	Soil	BH-7, (10 - 16)	QA of 90RRTS76SL
90RRTS79SL	Soil	BH-7, (16 - 21)	Determine the extent of subsurface soil contamination
90RRTS80SL	Soil	BH-8, (0 - 2)	Determine the extent of subsurface soil contamination
90RRTS81SL	Soil	BH-8, (0 - 2)	Determine the extent of subsurface soil contamination
90RRTS82SL	Soil	BH-8, (0 - 2)	Duplicate of 90RRTS81SL
90RRTS83SL	Soil	BH-8, (0 - 2)	QA of 90RRTS81SL
90RRTS84SL	Soil	BH-8, (2 - 4)	Determine the extent of subsurface soil contamination
90RRTS85SL	Soil	BH-8, (4 - 6)	Determine the extent of subsurface soil contamination

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Table 4-5 (Cont.)

Sample	Matrix	Location and Depth (feet)	Rationale
90RRTS86SL	Soil	BH-8, (6 - 10)	Determine the extent of subsurface soil contamination
90RRTS87SL	Soil	BH-8, (10 - 18)	Determine the extent of subsurface soil contamination
90RRTS88SL	Soil	BH-9, (0 - 2)	Determine the extent of subsurface soil contamination
90RRTS89SL	Soil	BH-9, (2 - 4)	Determine the extent of subsurface soil contamination
90RRTS90SL	Soil	BH-9, (7 - 9)	Determine the extent of subsurface soil contamination
90RRTS91SL	Soil	BH-9, (10 - 11)	Determine the extent of subsurface soil contamination
90RRTS92SL	Soil	BH-9, (14 - 16)	Determine the extent of subsurface soil contamination
90RRTS93SL	Soil	BH-9, (19 - 21)	Determine the extent of subsurface soil contamination
90RRTS94SL	Soil	BH-9, (19 - 21)	Duplicate of 90RRTS93SL
90RRTS95SL	Soil	BH-9, (19 - 21)	QA of 90RRTS93SL
90RRTS96SL	Soil	BH-9, (24 - 26)	Determine the extent of subsurface soil contamination
90RRTS97SL	Soil	BH-10, (0 - 2)	Determine the extent of subsurface soil contamination
90RRTS98SL	Soil	BH-10, (2 - 4)	Determine the extent of subsurface soil contamination
90RRTS99SL	Soil	BH-10, (4 - 6)	Determine the extent of subsurface soil contamination
90RRTS100SL	Soil	BH-10, (9 - 11)	Determine the extent of subsurface soil contamination
90RRTS101SL	Soil	BH-10, (14 - 16)	Determine the extent of subsurface soil contamination
90RRTS102SL	Soil	BH-10, (19 - 21)	Determine the extent of subsurface soil contamination
90RRTS103SL	Soil	BH-10, (22 - 23)	Determine the extent of subsurface soil contamination
90RRTS104SL	Soil	BH-10, (29 - 30)	Determine the extent of subsurface soil contamination
90RRTS105SL	Soil	BH-11, (0 - 2)	Determine the extent of subsurface soil contamination

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Table 4-5 (Cont.)

Sample	Matrix	Location and Depth (feet)	Rationale
90RRTS106SL	Soil	BH-11, (3 - 4)	Determine the extent of subsurface soil contamination
90RRTS107SL	Soil	BH-11, (4 - 6)	Determine the extent of subsurface soil contamination
90RRTS108SL	Soil	BH-11, (7 - 9)	Determine the extent of subsurface soil contamination
90RRTS109SL	Soil	BH-11, (14 - 16)	Determine the extent of subsurface soil contamination
90RRTS110SL	Soil	BH-11, (19 - 21)	Determine the extent of subsurface soil contamination
90RRTS111SL	Soil	BH-11, (24 - 26)	Determine the extent of subsurface soil contamination
90RRTS112SL	Soil	BH-11, (24 - 26)	Duplicate of 90RRTS111SL
90RRTS113SL	Soil	BH-11, (24 - 26)	QA of 90RRTS111SL
90RRTS114SL	Soil	BH-11, (28 - 30)	Determine the extent of subsurface soil contamination
90RRTS232SL	Soil	G-65, Grid, west side of platform	Determine the extent of surface soil contamination
90RRTS233SL	Soil	G-66, Grid, west side of platform	Determine the extent of surface soil contamination
90RRTS234SL	Soil	G-67, Grid, west side of platform	Determine the extent of surface soil contamination
90RRTS235SL	Soil	G-68, Grid, west side of platform	Determine the extent of surface soil contamination
90RRTS236SL	Soil	G-69, Grid, west side of platform	Determine the extent of surface soil contamination
90RRTS237SL	Soil	G-70, Grid, west side of platform	Determine the extent of surface soil contamination
90RRTS238SL	Soil	G-71, Grid, west side of platform	Determine the extent of surface soil contamination
90RRTS239SL	Soil	G-72, Grid, west side of platform	Determine the extent of surface soil contamination
90RRTS240SL	Soil	G-73, Grid, west side of platform	Determine the extent of surface soil contamination
90RRTS241SL	Soil	G-74, Grid, west side of platform	Determine the extent of surface soil contamination
90RRTS242SL	Soil	G-75, Grid, west side of platform	Determine the extent of surface soil contamination

Table 4-5 (Cont.)

Sample	Matrix	Location and Depth (feet)	Rationale
90RRTS243SL	Soil	G-76, Grid, west side of platform	Determine the extent of surface soil contamination
90RRTS244SL	Soil	G-77, Grid, west side of platform	Determine the extent of surface soil contamination
90RRTS245SL	Soil	G-78, Grid, west side of platform	Determine the extent of surface soil contamination
90RRTS246SL	Soil	G-78, Grid, west side of platform	Duplicate of 90RRTS245SL
90RRTS247SL	Soil	G-78, Grid, west side of platform	QA of 90RRTS245SL
90RRTS248SL	Soil	G-79, Grid, west side of platform	Determine the extent of surface soil contamination
90RRTS249SL	Soil	G-80, Grid, west side of platform	Determine the extent of surface soil contamination
90RRTS250SL	Soil	G-81, Cableway, south end of platform	Determine the extent of surface soil contamination
90RRTS251SL	Soil	G-82, Cableway, south end of platform	Determine the extent of surface soil contamination
90RRTS252SL	Soil	G-83, Grid, east side of platform	Determine the extent of surface soil contamination
90RRTS253SL	Soil	G-84, Grid, east side of platform	Determine the extent of surface soil contamination
90RRTS254SL	Soil	G-85, Grid, east side of platform	Determine the extent of surface soil contamination
90RRTS255SL	Soil	G-86, Grid, east side of platform	Determine the extent of surface soil contamination
90RRTS256SL	Soil	G-87, Grid, east side of platform	Determine the extent of surface soil contamination
90RRTS257SL	Soil	G-88, Grid, east side of platform	Determine the extent of surface soil contamination
90RRTS258SL	Soil	G-89, Grid, east side of platform	Determine the extent of surface soil contamination
90RRTS259SL	Soil	G-89, Grid, east side of platform	Duplicate of 90RRTS258SL
90RRTS260SL	Soil	G-89, Grid, east side of platform	QA of 90RRTS258SL
90RRTS261SL	Soil	G-90, Grid, east side of platform	Determine the extent of surface soil contamination
90RRTS309SL	Soil	C-10, Composite, southwest corner of platform	Determine the extent of surface soil contamination

Table 4-5 (Cont.)

Sample	Matrix	Location and Depth (feet)	Rationale
90RRTS310SL	Soil	C-11, Composite, southwest corner of platform	Determine the extent of surface soil contamination
90RRTS311SL	Soil	C-12, Composite, southwest corner of platform	Determine the extent of surface soil contamination
90RRTS312SL	Soil	C-13, Composite, south edge of platform	Determine the extent of surface soil contamination
90RRTS313SL	Soil	C-14, Composite, south edge of platform	Determine the extent of surface soil contamination
90RRTS314SL	Soil	C-15, Composite, south edge of platform	Determine the extent of surface soil contamination
90RRTS315SL	Soil	C-16, Composite, south edge of platform	Determine the extent of surface soil contamination
90RRTS316SL	Soil	C-17, Composite, east side of platform	Determine the extent of surface soil contamination
90RRTS317SL	Soil	C-18, Composite, east side of platform	Determine the extent of surface soil contamination
90RRTS318SL	Soil	C-19, Composite, east side of platform	Determine the extent of surface soil contamination
90RRTS319SL	Soil	C-20, Composite, east side of platform	Determine the extent of surface soil contamination
90RRTS320SL	Soil	C-21, Composite, east side of platform	Determine the extent of surface soil contamination
90RRTS321SL	Soil	C-22, Composite, east side of platform	Determine the extent of surface soil contamination
90RRTS322SL	Soil	C-23, Composite, east side of platform	Determine the extent of surface soil contamination
90RRTS323SL	Soil	C-23, Composite, east side of platform	Duplicate of 90RRTS322SL
90RRTS324SL	Soil	C-23, Composite, east platform	QA of 90RRTS322SL
90RRTS325SL	Soil	C-24, Composite, east platform	Determine the extent of surface soil contamination
90RRTS326SL	Soil	G-91, Grid, northeast platform	Determine the extent of surface soil contamination
90RRTS327SL	Soil	G-91, Grid, northeast platform	Determine the extent of surface soil contamination
90RRTS328SL	Soil	G-91, Grid, northeast platform	Determine the extent of surface soil contamination
90RRTS329SL	Soil	G-92, Grid, northeast platform	Determine the extent of surface soil contamination

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Table 4-5 (Cont.)

Sample	Matrix	Location and Depth (feet)	Rationale
90RRTS330SL	Soil	G-93, Grid, northeast platform	Determine the extent of surface soil contamination
90RRTS331SL	Soil	G-94, Grid, northeast platform	Determine the extent of surface soil contamination
90RRTS332SL	Soil	G-95, Grid, northeast platform	Determine the extent of surface soil contamination
90RRTS333SL	Soil	G-96, Grid, northeast platform	Determine the extent of surface soil contamination
90RRTS334MI	Asbestos	A-4, Tile, northeast platform	Determine the quantity and type of asbestos present
90RRTS335MI	Dioxin	D-3, Hexane rinsate	Determine the presence of dioxin contamination

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Table 4-6

ORIGINAL TRANSMITTER ANNEX SAMPLING LOCATIONS AND RATIONALE

Sample	Matrix	Location and Depth (feet)	Rationale
90RRTS20SL	Soil	G-1, South Cableway	Determine the extent of surface soil contamination
90RRTS21SL	Soil	G-2, south Cableway	Determine the extent of surface soil contamination
90RRTS22SL	Soil	G-3, Grid, south side	Determine the extent of surface soil contamination
90RRTS23SL	Soil	G-4, Grid, south side	Determine the extent of surface soil contamination
90RRTS24SL	Soil	G-5, Grid, south side	Determine the extent of surface soil contamination
90RRTS25SL	Soil	G-6, Grid, south side	Determine the extent of surface soil contamination
90RRTS26SL	Soil	G-7, Grid, south side	Determine the extent of surface soil contamination
90RRTS27SL	Soil	G-8, Grid, south side	Determine the extent of surface soil contamination
90RRTS28SL	Soil	G-8, Grid, south side	Duplicate of 90RRTS27SL
90RRTS29SL	Soil	G-8, Grid, south side	QA of 90RRTS27SL
90RRTS30SL	Soil	G-9, Grid, south side	Determine the extent of surface soil contamination
90RRTS31SL	Soil	G-10, Grid, south side	Determine the extent of surface soil contamination
90RRTS32SL	Soil	G-11, Grid, south side	Determine the extent of surface soil contamination
90RRTS33SL	Soil	G-12, Grid, south side	Determine the extent of surface soil contamination
90RRTS34SL	Soil	G-13, Grid, south side	Determine the extent of surface soil contamination
90RRTS35SL	Soil	G-14, Grid, south side	Determine the extent of surface soil contamination
90RRTS128SL	Soil	BH-16, (0 - 2)	Characterize potential subsurface soil contamination

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Table 4-6 (Cont.)

Sample	Matrix	Location and Depth (feet)	Rationale
90RRTS129SL	Soil	BH-16, (2 - 4)	Characterize potential subsurface soil contamination
90RRTS130SL	Soil	BH-16, (2 - 4)	Duplicate of 90RRTS129SL
90RRTS131SL	Soil	BH-16, (2 - 4)	QA of 90RRTS129SL
90RRTS132SL	Soil	BH-16, (4 - 6)	Characterize potential subsurface soil contamination
90RRTS133SL	Soil	BH-16, (8 - 10)	Characterize potential subsurface soil contamination
90RRTS134SL	Soil	BH-17, (0 - 2)	Characterize potential subsurface soil contamination
90RRTS135SL	Soil	BH-17, (2 - 4)	Characterize potential subsurface soil contamination
90RRTS136SL	Soil	BH-17, (4 - 6)	Characterize potential subsurface soil contamination
90RRTS137SL	Soil	BH-17, (8 - 10)	Characterize potential subsurface soil contamination
90RRTS138SL	Soil	BH-18, (0 - 2)	Characterize potential subsurface soil contamination
90RRTS139SL	Soil	BH-18, (2 - 4)	Characterize potential subsurface soil contamination
90RRTS140SL	Soil	BH-18, (4 - 6)	Characterize potential subsurface soil contamination
90RRTS141SL	Soil	BH-18, (8 - 10)	Characterize potential subsurface soil contamination
90RRTS142SL	Soil	BH-19, (0 - 2)	Characterize potential subsurface soil contamination
90RRTS143SL	Soil	BH-19, (2 - 4)	Characterize potential subsurface soil contamination
90RRTS144SL	Soil	BH-19, (6 - 8)	Characterize potential subsurface soil contamination
90RRTS145SL	Soil	BH-19, (8 - 10)	Characterize potential subsurface soil contamination
90RRTS159SL	Soil	G-16, Grid, south side	Determine the extent of surface soil contamination
90RRTS160SL	Soil	G-17, Grid, south side	Determine the extent of surface soil contamination

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Table 4-6 (Cont.)

Sample	Matrix	Location and Depth (feet)	Rationale
90RRTS161SL	Soil	G-18, Grid, south side	Determine the extent of surface soil contamination
90RRTS162SL	Soil	G-19, Grid, south side	Determine the extent of surface soil contamination
90RRTS163SL	Soil	G-20, Grid, south side	Determine the extent of surface soil contamination
90RRTS164SL	Soil	G-20, Grid, south side	Determine the extent of surface soil contamination
90RRTS165SL	Soil	G-20, Grid, south side	Determine the extent of surface soil contamination
90RRTS166SL	Soil	G-21, Grid, south side	Determine the extent of surface soil contamination
90RRTS167SL	Soil	G-22, Grid, south side	Determine the extent of surface soil contamination
90RRTS168SL	Soil	G-23, Grid, south side	Determine the extent of surface soil contamination
90RRTS169SL	Soil	G-24, Grid, south side	Determine the extent of surface soil contamination
90RRTS170SL	Soil	G-25, Grid, south side	Determine the extent of surface soil contamination
90RRTS171SL	Soil	G-26, Grid, south side	Determine the extent of surface soil contamination
90RRTS172SL	Soil	G-26, Grid, south side	Determine the extent of surface soil contamination
90RRTS173SL	Soil	G-27, Grid, south side	Determine the extent of surface soil contamination
90RRTS174SL	Soil	G-28, Grid, south side	Determine the extent of surface soil contamination
90RRTS175SL	Soil	G-29, Grid, south side	Determine the extent of surface soil contamination
90RRTS176SL	Soil	G-29, Grid, south side	Determine the extent of surface soil contamination
90RRTS177SL	Soil	G-30, Grid, south side	Determine the extent of surface soil contamination
90RRTS178SL	Soil	G-30, Grid, south side	Determine the extent of surface soil contamination
90RRTS179SL	Soil	G-31, Grid, south side	Determine the extent of surface soil contamination

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Table 4-6 (Cont.)

Sample	Matrix	Location and Depth (feet)	Rationale
90RRTS180SL	Soil	G-32, Grid, south side	Determine the extent of surface soil contamination
90RRTS181SL	Soil	G-33, Oil stain, north cableway	Determine the extent of surface soil contamination
90RRTS182SL	Soil	C-1, Potential spillage under wood platform	Determine the extent of surface soil contamination
90RRTS183SL	Soil	C-2, North platform perimeter composite	Determine the extent of surface soil contamination
90RRTS184SL	Soil	C-3, North platform perimeter composite	Determine the extent of surface soil contamination
90RRTS185SL	Soil	C-4, North platform perimeter composite	Determine the extent of surface soil contamination
90RRTS186SL	Soil	C-5, North platform perimeter composite	Determine the extent of surface soil contamination
90RRTS187SL	Soil	C-6, North platform perimeter composite	Determine the extent of surface soil contamination
90RRTS188SL	Soil	C-6, North platform perimeter omposite	Determine the extent of surface soil contamination
90RRTS189SL	Soil	C-6, North platform perimeter composite	Determine the extent of surface soil contamination
90RRTS190SL	Soil	C-7, North platform perimeter composite	Determine the extent of surface soil contamination
90RRTS191SL	Soil	C-8, North platform perimeter composite	Determine the extent of surface soil contamination
90RRTS192SL	Soil	C-9, North platform perimeter composite	Determine the extent of surface soil contamination
90RRTS193SL	Soil	G-26, Grid, south side	Determine the extent of surface soil contamination

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Table 4-7

TRANSFORMER HUT SAMPLING LOCATIONS AND RATIONALE

Sample	Matrix	Location and Depth (feet)	Rationale
90RRTS10WS	Wipe	W-8, generator platform	Characterize the potential for surface contamination
90RRTS11WS	Wipe	W-9, center of concrete	Characterize the potential for surface contamination
90RRTS12WS	Wipe	W-9, center of concrete	Duplicate of 90RRTS11WS
90RRTS13WS	Wipe	W-9, center of concrete	QA of 90RRTS11WS
90RRTS14WS	Wipe	W-10, center of concrete	Characterize the potential for surface contamination
90RRTS15WS	Wipe	W-11, center of concrete	Characterize the potential for surface contamination
90RRTS146SL	Soil	BH-20, (0 - 2)	Characterize potential subsurface soil contamination
90RRTS147SL	Soil	BH-20, (2 - 4)	Characterize potential subsurface soil contamination
90RRTS148SL	Soil	BH-21, (0 - 2)	Characterize potential subsurface soil contamination
90RRTS149SL	Soil	BH-21, (2 - 4)	Characterize potential subsurface soil contamination
90RRTS150SL	Soil	BH-21, (2 - 4)	Duplicate of 90RRTS149WS
90RRTS151SL	Soil	BH-21, (2 - 4)	QA of 90RRTS149WS
90RRTS152SL	Soil	BH-21, (9 - 11)	Characterize potential subsurface soil contamination
90RRTS153SL	Soil	BH-22, (0 - 2)	Characterize potential subsurface soil contamination
90RRTS154SL	Soil	BH-22, (2 - 4)	Characterize potential subsurface soil contamination
90RRTS155SL	Soil	BH-22, (4 - 6)	Characterize potential subsurface soil contamination
90RRTS156SL	Soil	BH-20, (0 - 2)	Characterize potential subsurface soil contamination

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Table 4-7 (Cont.)

Sample	Matrix	Location and Depth (feet)	Rationale
90RRTS157SL	Soil	BH-20, (2 - 4)	Characterize potential subsurface soil contamination
90RRTS195SL	Soil	G-34, Grid, west side	Determine the extent of surface soil contamination
90RRTS196SL	Soil	G-35, Grid, west side	Determine the extent of surface soil contamination
90RRTS197SL	Soil	G-36, Grid, west side	Determine the extent of surface soil contamination
90RRTS198SL	Soil	G-37, Grid, west side	Determine the extent of surface soil contamination
90RRTS199SL	Soil	G-38, Grid, west side	Determine the extent of surface soil contamination
90RRTS200SL	Soil	G-39, Grid, west side	Determine the extent of surface soil contamination
90RRTS201SL	Soil	G-40, Grid, west side	Determine the extent of surface soil contamination
90RRTS202SL	Soil	G-41, Grid, west side	Determine the extent of surface soil contamination
90RRTS203SL	Soil	G-42, Grid, west side	Determine the extent of surface soil contamination
90RRTS204SL	Soil	G-43, Grid, west side	Determine the extent of surface soil contamination
90RRTS205SL	Soil	G-44, Grid, west side	Determine the extent of surface soil contamination
90RRTS206SL	Soil	G-45, Grid, west side	Determine the extent of surface soil contamination
90RRTS207SL	Soil	G-46, Grid, west side	Determine the extent of surface soil contamination
90RRTS208SL	Soil	G-47, Grid, east side	Determine the extent of surface soil contamination
90RRTS209SL	Soil	G-48, Grid, east side	Determine the extent of surface soil contamination
90RRTS210SL	Soil	G-49, Grid, west side	Determine the extent of surface soil contamination
90RRTS211SL	Soil	G-49, Grid, west side	Duplicate of 90RRTS210SL
90RRTS212SL	Soil	G-49, Grid, west side	QA of 90RRTS210SL

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Table 4-7 (Cont.)

Sample	Matrix	Location and Depth (feet)	Rationale
90RRTS213SL	Soil	G-50, Grid, west side	Determine the extent of surface soil contamination
90RRTS214SL	Soil	G-51, Grid, east side	Determine the extent of surface soil contamination
90RRTS215SL	Soil	G-52, Grid, east side	Determine the extent of surface soil contamination
90RRTS216SL	Soil	G-53, Grid, east side	Determine the extent of surface soil contamination
90RRTS217SL	Soil	G-53, Grid, east side	Duplicate of 90RRTS216SL
90RRTS218SL	Soil	G-53, Grid, east side	QA of 90RRTS216SL
90RRTS219SL	Soil	G-54, Grid, east side	Determine the extent of surface soil contamination
90RRTS220SL	Soil	G-54, Grid, east side	Duplicate of 90RRTS219SL
90RRTS221SL	Soil	G-54, Grid, east side	QA of 90RRTS219SL
90RRTS222SL	Soil	G-55, Grid, east side	Determine the extent of surface soil contamination
90RRTS223SL	Soil	G-56, Grid, east side	Determine the extent of surface soil contamination
90RRTS224SL	Soil	G-57, Grid, east side	Determine the extent of surface soil contamination
90RRTS225SL	Soil	G-58, Grid, east side	Determine the extent of surface soil contamination
90RRTS226SL	Soil	G-59, Grid, east side	Determine the extent of surface soil contamination
90RRTS227SL	Soil	G-60, Grid, east side	Determine the extent of surface soil contamination
90RRTS228SL	Soil	G-61, Grid, east side	Determine the extent of surface soil contamination
90RRTS229SL	Soil	G-62, Grid, east side	Determine the extent of surface soil contamination
90RRTS230SL	Soil	G-63, Grid, east side	Determine the extent of surface soil contamination
90RRTS231SL	Soil	G-64, Grid, east side	Determine the extent of surface soil contamination

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Table 4-8

POWER CONTROL HUT SAMPLING LOCATIONS AND RATIONALE

Sample	Matrix	Location and Depth (feet)	Rationale
90RRTS16WS	Wipe	W-12	Characterize the potential for surface contamination
90RRTS17WS	Wipe	W-13	Characterize the potential for surface contamination
90RRTS115SL	Soil	BH-12, (0 - 2)	Characterization of potential subsurface soil contamination
90RRTS116SL	Soil	BH-12, (2 - 4)	Characterization of potential subsurface soil contamination
90RRTS117SL	Soil	BH-12, (4 - 6)	Characterization of potential subsurface soil contamination
90RRTS118SL	Soil	BH-13, (0 - 2)	Characterization of potential subsurface soil contamination
90RRTS119SL	Soil	BH-13, (2 - 4)	Characterization of potential subsurface soil contamination
90RRTS120SL	Soil	BH-13, (4 - 6)	Characterization of potential subsurface soil contamination
90RRTS121SL	Soil	BH-14, (0 - 2)	Characterization of potential subsurface soil contamination
90RRTS122SL	Soil	BH-14, (2 - 4)	Characterization of potential subsurface soil contamination
90RRTS123SL	Soil	BH-14, (4 - 6)	Characterization of potential subsurface soil contamination
90RRTS124SL	Soil	BH-15, (0 - 2)	Characterization of potential subsurface soil contamination
90RRTS125SL	Soil	BH-15, (4 - 6)	Characterization of potential subsurface soil contamination
90RRTS126SL	Soil	BH-15, (4 - 6)	Duplicate of 90RRTS125SL
90RRTS127SL	Soil	BH-15, (4 - 6)	QA of 90RRTS125SL
90RRTS339SL	Soil	G-97, Grid, south side	Determine the extent of surface soil contamination
90RRTS340SL	Soil	G-98, Grid, south side	Determine the extent of surface soil contamination

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Table 4-8 (Cont.)

Sample	Matrix	Location and Depth (feet)	Rationale
90RRTS341SL	Soil	G-98, Grid, south side	Duplicate of 90RRTS340SL
90RRTS342SL	Soil	G-98, Grid, south side	QA of 90RRTS340SL
90RRTS343SL	Soil	G-99, Grid, south side	Determine the extent of surface soil contamination
90RRTS344SL	Soil	G-100, Grid, south side	Determine the extent of surface soil contamination
90RRTS345SL	Soil	G-101, Grid, south side	Determine the extent of surface soil contamination
90RRTS346SL	Soil	G-102, Grid, south side	Determine the extent of surface soil contamination
90RRTS347SL	Soil	G-103, Grid, south side	Determine the extent of surface soil contamination
90RRTS348SL	Soil	G-104, Grid, south side	Determine the extent of surface soil contamination
90RRTS349SL	Soil	G-105, Grid, south side	Determine the extent of surface soil contamination
90RRTS350SL	Soil	G-106, Grid, south side	Determine the extent of surface soil contamination
90RRTS351SL	Soil	G-107, Grid, south side	Determine the extent of surface soil contamination
90RRTS352SL	Soil	G-108, Grid, north side	Determine the extent of surface soil contamination
90RRTS353SL	Soil	G-109, Grid, north side	Determine the extent of surface soil contamination
90RRTS354SL	Soil	G-110, Grid, north side	Determine the extent of surface soil contamination
90RRTS355SL	Soil	G-110, Grid, north side	Duplicate of 90RRTS354SL
90RRTS356SL	Soil	G-110, Grid, north side	QA of 90RRTS354SL
90RRTS357SL	Soil	G-111, Grid, north side	Determine the extent of surface soil contamination
90RRTS358SL	Soil	G-112, Grid, north side	Determine the extent of surface soil contamination
90RRTS359SL	Soil	G-113, Grid, north side	Determine the extent of surface soil contamination

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Table 4-8 (Cont.)

Sample	Matrix	Location and Depth (feet)	Rationale
90RRTS360SL	Soil	G-113, Grid, north side	Duplicate of 90RRTS359SL
90RRTS361SL	Soil	G-113, Grid, north side	QA of 90RRTS359SL
90RRTS362SL	Soil	G-114, Grid, north side	Determine the extent of surface soil contamination
90RRTS363SL	Soil	G-115, Grid, north side	Determine the extent of surface soil contamination
90RRTS364SL	Soil	G-116, Grid, north side	Determine the extent of surface soil contamination
90RRTS365SL	Soil	G-117, Grid, north side	Determine the extent of surface soil contamination
90RRTS366SL	Soil	G-118, Grid, north side	Determine the extent of surface soil contamination
90RRTS367SL	Soil	G-119, Grid, north side	Determine the extent of surface soil contamination
90RRTS368SL	Soil	G-120, Grid, north side	Determine the extent of surface soil contamination
90RRTS369SL	Soil	G-121, Grid, north side	Determine the extent of surface soil contamination

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Table 4-9

NORTHWEST BUNKER ENTRANCE SAMPLING LOCATIONS AND RATIONALE

Sample	Matrix	Location	Rationale
90RRTS370SL	Soil	G-122, grid	Determine the extent of surface soil contamination
90RRTS371SL	Soil	G-123, grid	Determine the extent of surface soil contamination
90RRTS372SL	Soil	G-124, grid	Determine the extent of surface soil contamination
90RRTS373SL	Soil	G-125, grid	Determine the extent of surface soil contamination
90RRTS374SL	Soil	G-126, grid	Determine the extent of surface soil contamination
90RRTS375SL	Soil	G-127, grid	Determine the extent of surface soil contamination
90RRTS376SL	Soil	G-127, grid	Duplicate of 90RRTS375SL
90RRTS377SL	Soil	G-127, grid	QA of 90RRTS375SL
90RRTS378SL	Soil	G-128, grid	Determine the extent of surface soil contamination
90RRTS379SL	Soil	G-129, grid	Determine the extent of surface soil contamination
90RRTS380SL	Soil	G-130, grid	Determine the extent of surface soil contamination
90RRTS381SL	Soil	G-130, grid	Duplicate of 90RRTS380SL
90RRTS382SL	Soil	G-130, grid	QA of 90RRTS380SL
90RRTS383SL	Soil	G-131, grid	Determine the extent of surface soil contamination

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Table 4-10

SITE GRID SAMPLING LOCATIONS AND RATIONALE

Sample	Matrix	Location	Rationale
90RRTS385SL	Soil	G-133	Determine the extent of contamination on-site
90RRTS386SL	Soil	G-134	Determine the extent of contamination on-site
90RRTS387SL	Soil	G-135	Determine the extent of contamination on-site
90RRTS388SL	Soil	G-136	Determine the extent of contamination on-site
90RRTS389SL	Soil	G-137	Determine the extent of contamination on-site
90RRTS390SL	Soil	G-138	Determine the extent of contamination on-site
90RRTS391SL	Soil	G-139	Determine the extent of contamination on-site
90RRTS392SL	Soil	G-139	Duplicate of 90RRTS391SL
90RRTS393SL	Soil	G-139	QA of 90RRTS391SL
90RRTS394SL	Soil	G-140	Determine the extent of contamination on-site
90RRTS395SL	Soil	G-141	Determine the extent of contamination on-site
90RRTS396SL	Soil	G-142	Determine the extent of contamination on-site
90RRTS397SL	Soil	G-143	Determine the extent of contamination on-site
90RRTS398SL	Soil	G-144	Determine the extent of contamination on-site
90RRTS399SL	Soil	G-145	Determine the extent of contamination on-site
90RRTS400SL	Soil	G-146	Determine the extent of contamination on-site
90RRTS401SL	Soil	G-147	Determine the extent of contamination on-site
90RRTS402SL	Soil	G-148	Determine the extent of contamination on-site
90RRTS403SL	Soil	G-148	Duplicate of 90RRTS402SL
90RRTS404SL	Soil	G-148	QA of 90RRTS402SL
90RRTS405SL	Soil	G-149	Determine the extent of contamination on-site
90RRTS406SL	Soil	G-150	Determine the extent of contamination on-site
90RRTS407SL	Soil	G-151	Determine the extent of contamination on-site
90RRTS408SL	Soil	G-152	Determine the extent of contamination on-site
90RRTS409SL	Soil	G-153	Determine the extent of contamination on-site
90RRTS410SL	Soil	G-154	Determine the extent of contamination on-site
90RRTS411SL	Soil	G-155	Determine the extent of contamination on-site

02[IL]KM6120/1479/19

Table 4-11

GRAB SURFACE SOIL QA/QC SAMPLES

Sample/Duplicate Number	QA Duplicate Number	Location
90RRTS27SL/90RRTS28SL	90RRTS29SL	OTA G-8
90RRTS164SL/90RRTS165SL	90RRTS166SL	OTA G-20
90RRTS176SL/90RRTS177SL	90RRTS178SL	OTA G-30
90RRTS210SL/90RRTS211SL	90RRTS212SL	TH G-49
90RRTS216SL/90RRTS217SL	90RRTS218SL	TH G-53
90RRTS219SL/90RRTS220SL	90RRTS221SL	TH G-54
90RRTS245SL/90RRTS246SL	90RRTS247SL	TA G-78
90RRTS258SL/90RRTS259SL	90RRTS260SL	TA G-89
90RRTS236SL/90RRTS327SL	90RRTS238SL	TA G-91
90RRTS340SL/90RRTS341SL	90RRTS342SL	PH G-98
90RRTS354SL/90RRTS355SL	90RRTS356SL	PH G-110
90RRTS359SL/90RRTS360SL	90RRTS361SL	PH G-113
90RRTS375SL/90RRTS376SL	90RRTS377SL	NEB G-127
90RRTS380SL/90RRTS381SL	90RRTS382SL	NEB G-130
90RRTS391SL/90RRTS392SL	90RRTS393SL	SG G-139
90RRTS402SL/90RRTS403SL	90RRTS404SL	SG G-148

02[IL]KM6120/1449/26

Key:

OTA = Original Transmitter Annex
TH = Transformer Hut
TA = Transmitter Annex
PH = Power Control Hut
NEB = Northeast Entrance Bunker
SG = Site Grid

Table 4-12

BOREHOLE QA/QC SAMPLES

Sample/Duplicate Number	QA Duplicate Number	Location	Depth (feet)
90RRTS38SL/90RRTS39SL	90RRTS40SL	TA,BH-1	10 - 12
90RRTS52SL/90RRTS53SL	90RRTS54SL	TA,BH-3	5 - 8
90RRTS57SL/90RRTS58SL	90RRTS59SL	TA,BH-4	2 - 4
90RRTS66SL/90RRTS67SL	90RRTS68SL	TA,BH-6	4 - 6
90RRTS76SL/90RRTS77SL	90RRTS78SL	TA,BH-7	10 - 16
90RRTS81SL/90RRTS82SL	90RRTS83SL	TA,BH-8	0 - 2
90RRTS93SL/90RRTS94SL	90RRTS95SL	TA,BH-9	19 - 21
90RRTS111SL/90RRTS112SL	90RRTS113SL	TA,BH-11	24 - 26
90RRTS125SL/90RRTS126SL	90RRTS127SL	PH,BH-15	4 - 6
90RRTS129SL/90RRTS130SL	90RRTS131SL	OTA,BH-16	2 - 4
90RRTS149SL/90RRTS150SL	90RRTS151SL	TH,BH-21	2 - 4

02[IL]KM6120/1450/25

Key:

OTA = Original Transmitter Annex
TH = Transformer Hut
TA = Transmitter Annex
PH = Power Control Hut

Table 4-13

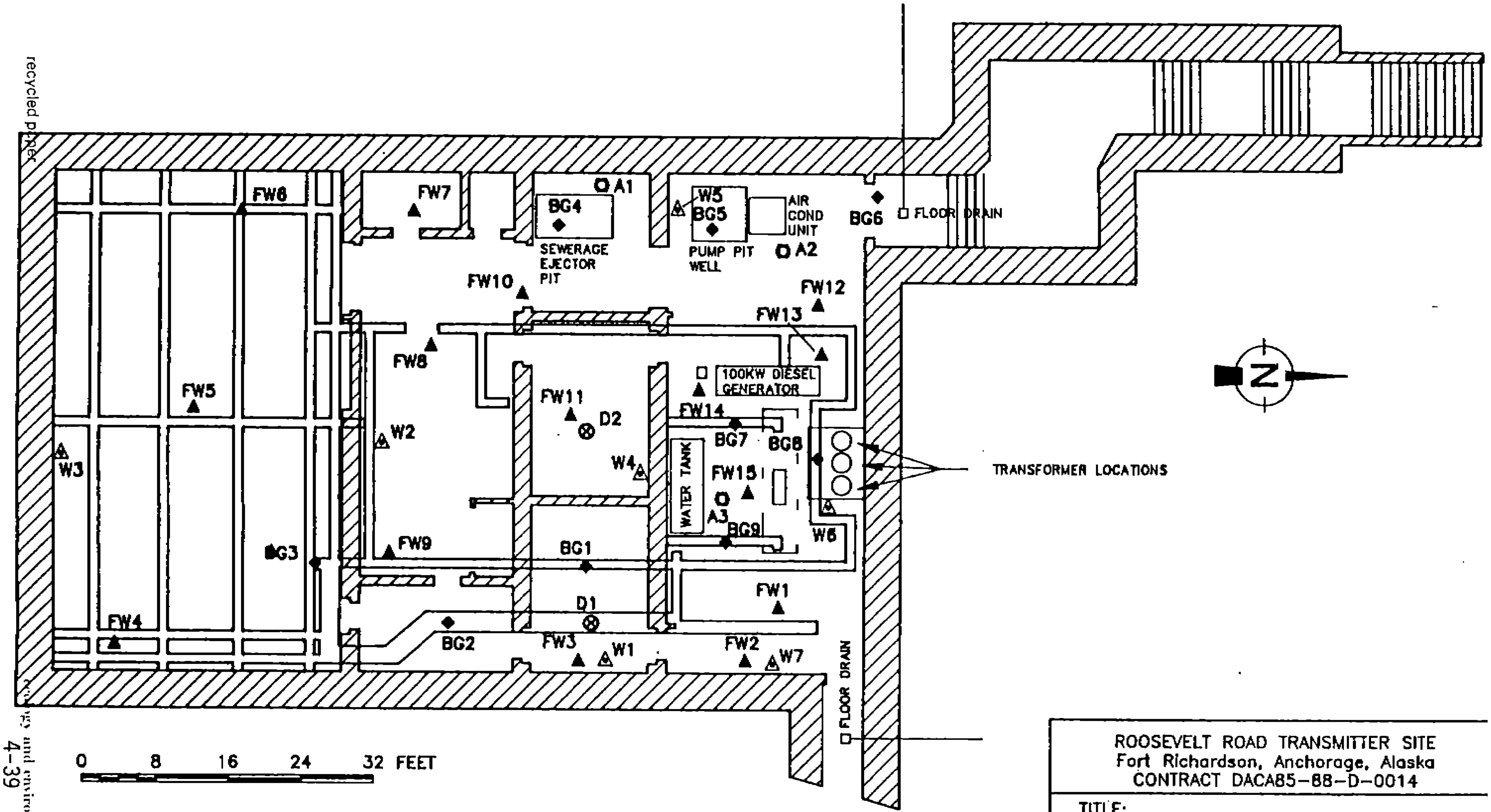
ADDITIONAL QA/QC SAMPLES

Sample/Duplicate Number	QA Duplicate Number	Location	Sample Type
90RRTS271WS/90RRTS272WS	90RRTS273WS	B,BW-6	Wipe
90RRTS291WS/90RRTSW92WS	90RRTS293WS	B,BW-9	Wipe
90RRTS03WS/90RRTS08WS	90RRTS09WS	TA,W-3	Wipe
90RRTS11WS/90RRTS12WS	90RRTS13WS	TH,W-9	Wipe
90RRTS187SL/90RRTS188SL	90RRTS189SL	OTA,C-6	Composite Soil
90RRTS322SL/90RRTS323SL	90RRTS324SL	TA,C-23	Composite Soil
90RRTS263MI/90RRTS264MI	90RRTS265MI	B,A-1	Asbestos
90RRTS274SW/90RRTS275SW	90RRTS276SW	B,D-1	Dioxin
90RRTS280SW/90RRTS281SW	90RRTS282SW	B,BG-2	Solid Waste

02[IL]KM6120/1451/25

Key:

B = Bunker
TA = Transmitter Annex
TH = Transformer Hut
OTA = Original Transmitter Annex



LEGEND

- ◆ Bunker Grab Samples
- ▲ Floor Wipe Samples
- △ Wall Wipe Samples
- ⊗ Dioxin Samples
- O Asbestos Samples

ROOSEVELT ROAD TRANSMITTER SITE
Fort Richardson, Anchorage, Alaska
CONTRACT DACA85-88-D-0014

TITLE:

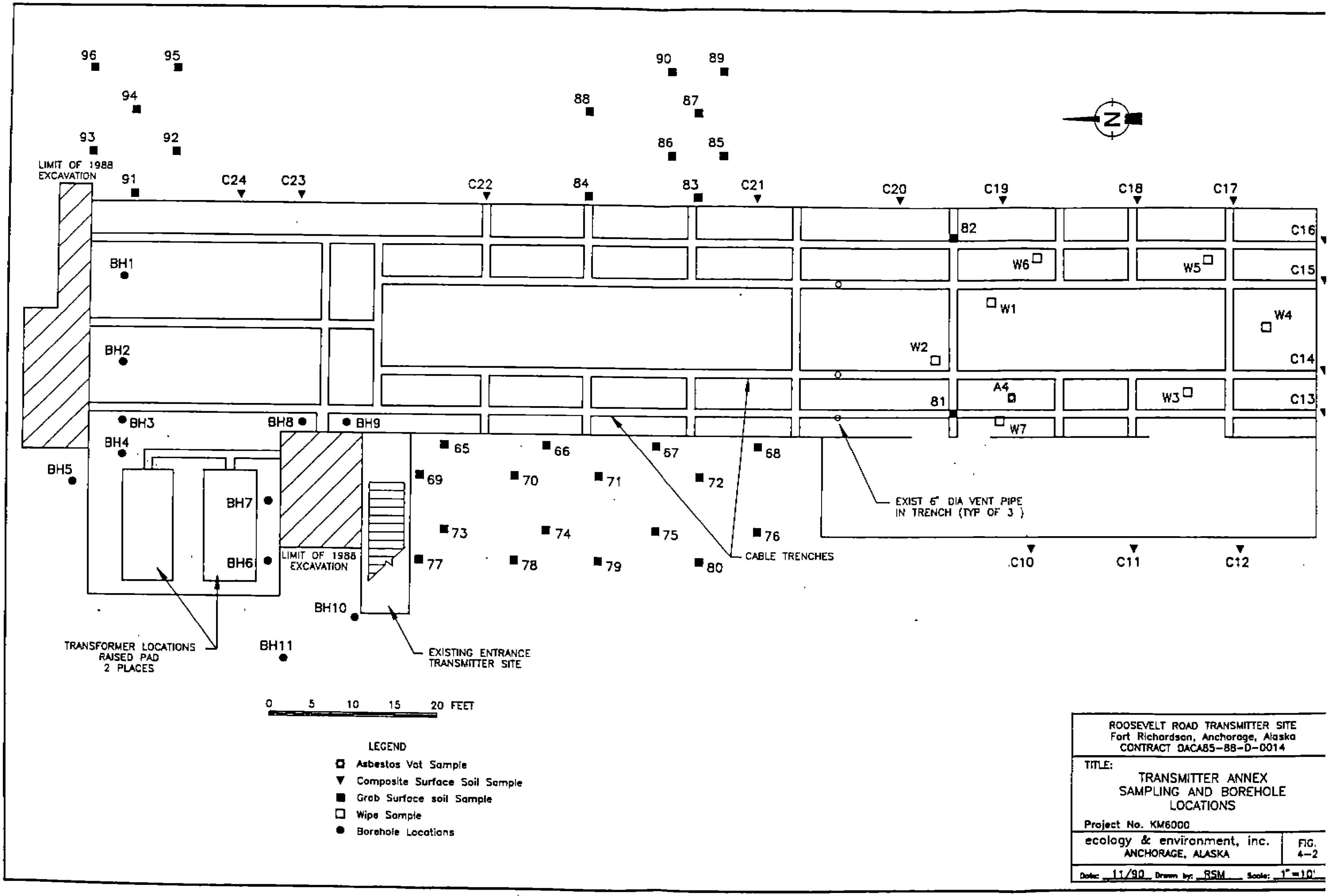
UNDERGROUND BUNKER SAMPLE LOCATIONS

Project No. KM6000

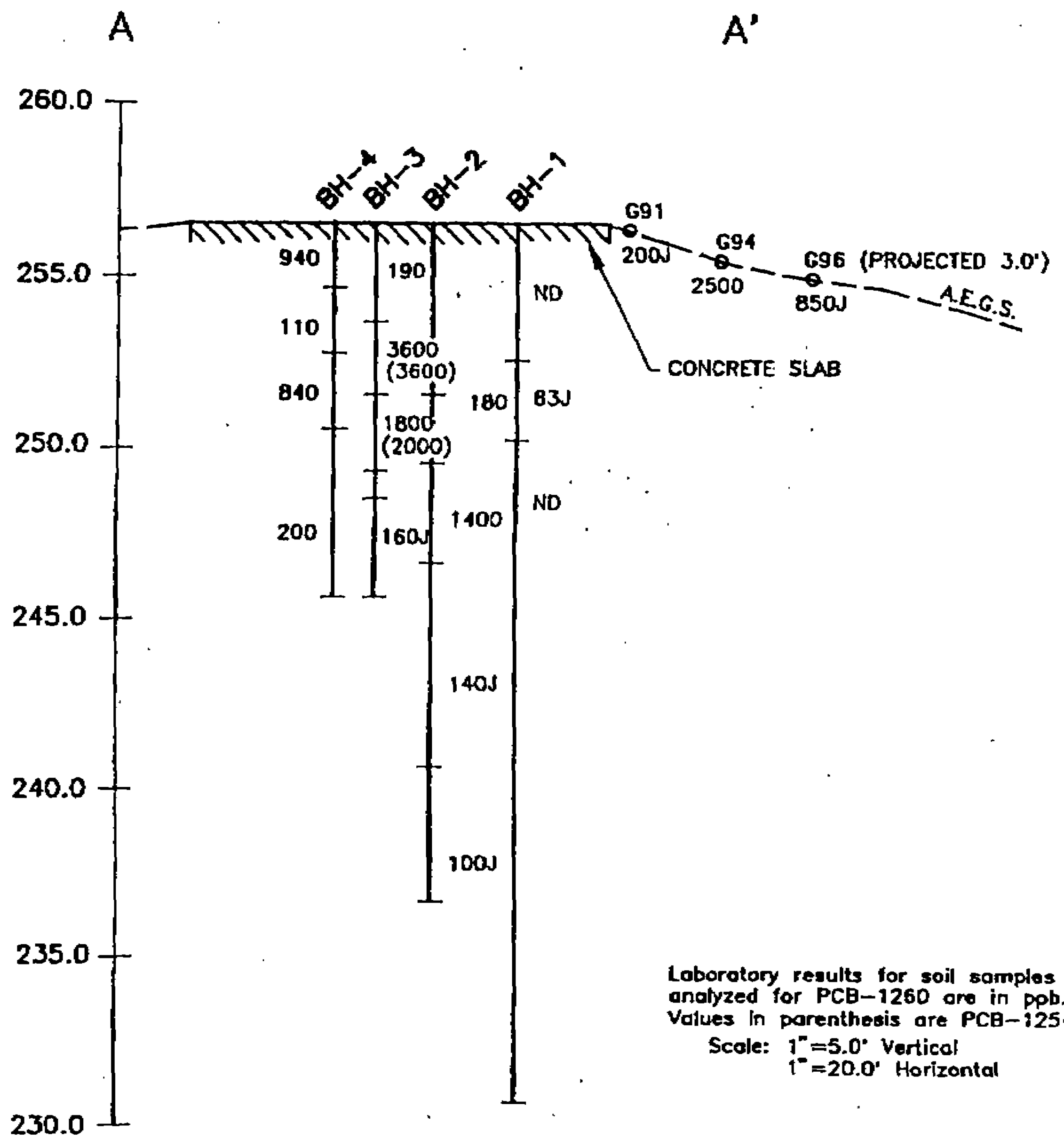
ecology & environment, inc.
ANCHORAGE, ALASKA

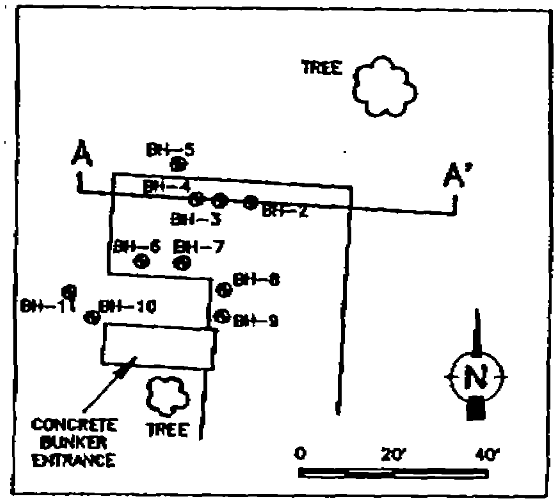
FIG. 4-1

Date: 11/90 Drawn by: RSM Scale: ____


96
95
94
93
92
91
LIMIT OF 1988 EXCAVATION
90
89
88
87
86
85
84
83
C24
C23
C22
C21
C20
C19
C18
C17
C16
C15
C14
C13
C10
C11
C12
82
81
W1
W2
W3
W4
W5
W6
W7
A4
BH1
BH2
BH3
BH4
BH5
BH6
BH7
BH8
BH9
BH10
BH11
65
66
67
68
69
70
71
72
73
74
75
76
77
78
79
80
EXIST 6" DIA VENT PIPE IN TRENCH (TYP OF 3)
CABLE TRENCHES
LIMIT OF 1988 EXCAVATION
TRANSFORMER LOCATIONS RAISED PAD 2 PLACES
EXISTING ENTRANCE TRANSMITTER SITE
N
0 5 10 15 20 FEET
LEGEND
Asbestos Vat Sample
Composite Surface Soil Sample
Grab Surface soil Sample
Wipe Sample
Borehole Locations
ROOSEVELT ROAD TRANSMITTER SITE
Fort Richardson, Anchorage, Alaska
CONTRACT DACA85-88-D-0014
TITLE:
TRANSMITTER ANNEX SAMPLING AND BOREHOLE LOCATIONS
Project No. KM6000
ecology & environment, inc.
ANCHORAGE, ALASKA
FIG. 4-2
Date: 11/90
Drawn by: RSM
Scale: 1"=10'

OUA 0000467





TRANSMITTER ANNEX

Laboratory results for soil samples analyzed for PCB-1260 are in ppb. Values in parenthesis are PCB-1254.

Scale: 1" = 5.0' Vertical
1" = 20.0' Horizontal

ROOSEVELT ROAD TRANSMITTER SITE
Fort Richardson, Anchorage, Alaska
CONTRACT DACA85-88-D-0014

TITLE:

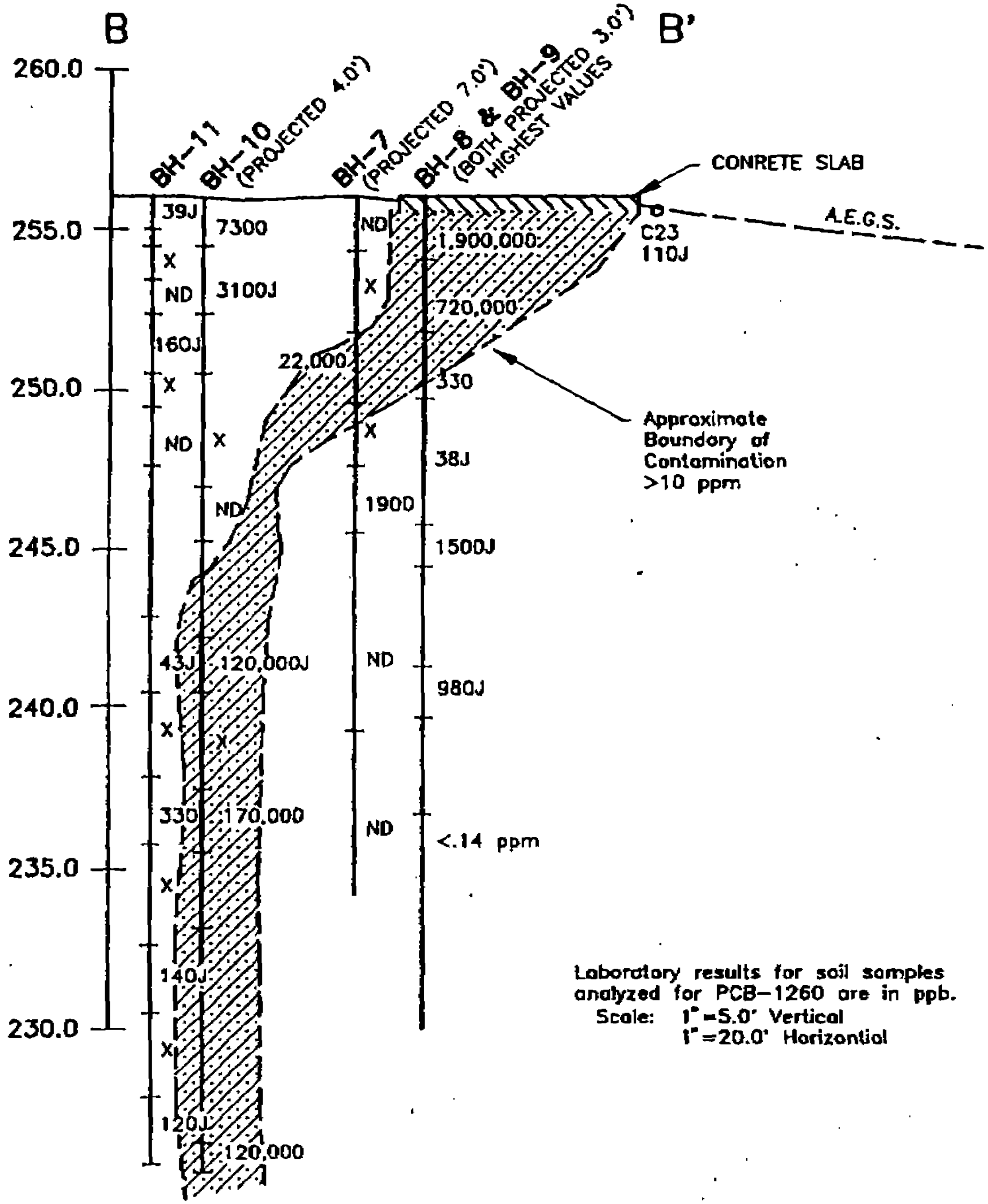
TRANSMITTER ANNEX
CROSS SECTION A-A'

Project No. KM6120

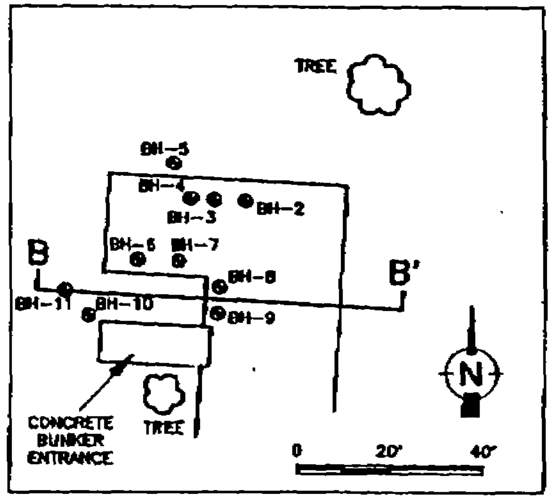
ecology & environment, inc.
ANCHORGAE, ALASKA

FIG. 4-3

Date: 03/91 Drawn by: RSM Scale:



Laboratory results for soil samples analyzed for PCB-1260 are in ppb.
Scale: 1"=5.0' Vertical
1"=20.0' Horizontial

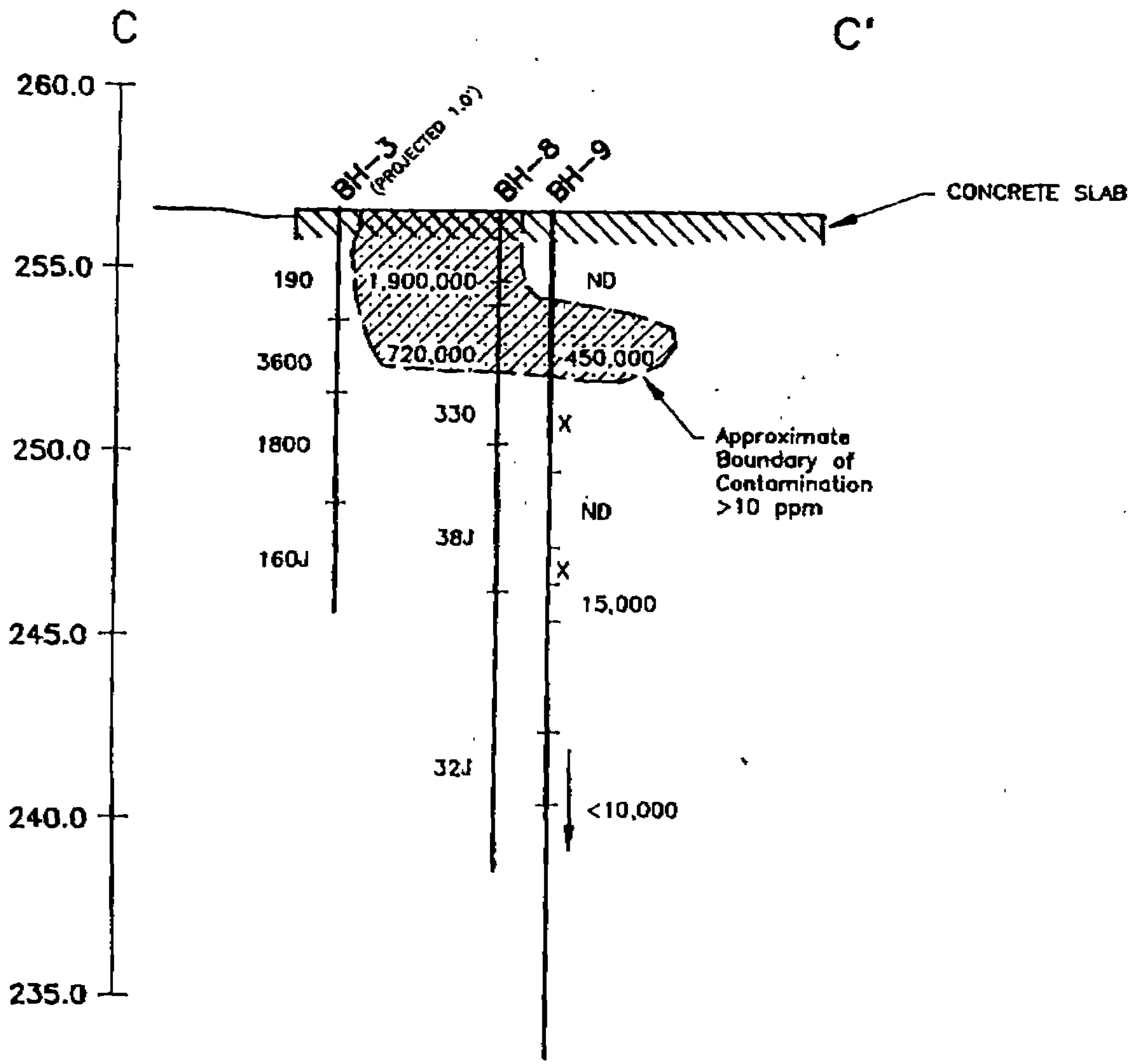


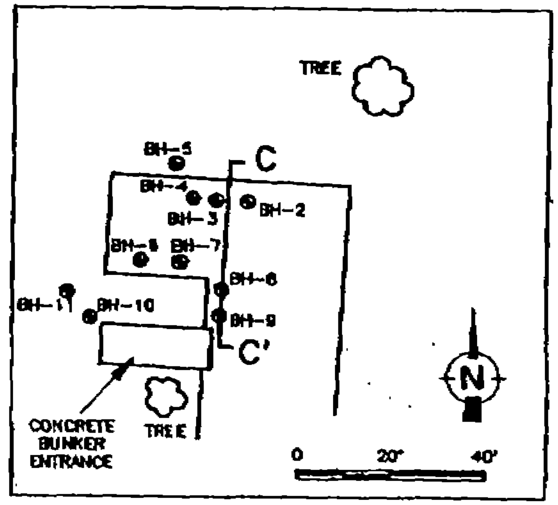
TRANSMITTER ANNEX

ROOSEVELT ROAD TRANSMITTER SITE Fort Richardson, Anchorage, Alaska CONTRACT DACA85-88-D-0014	
TITLE: TRANSMITTER ANNEX CROSS SECTION B-B' Project No. KM6120	
ecology & environment, inc. ANCHORAGE, ALASKA	FIG. 4-4
Date: 03/91 Drawn by: RSM	

4-44

OUA 0000469



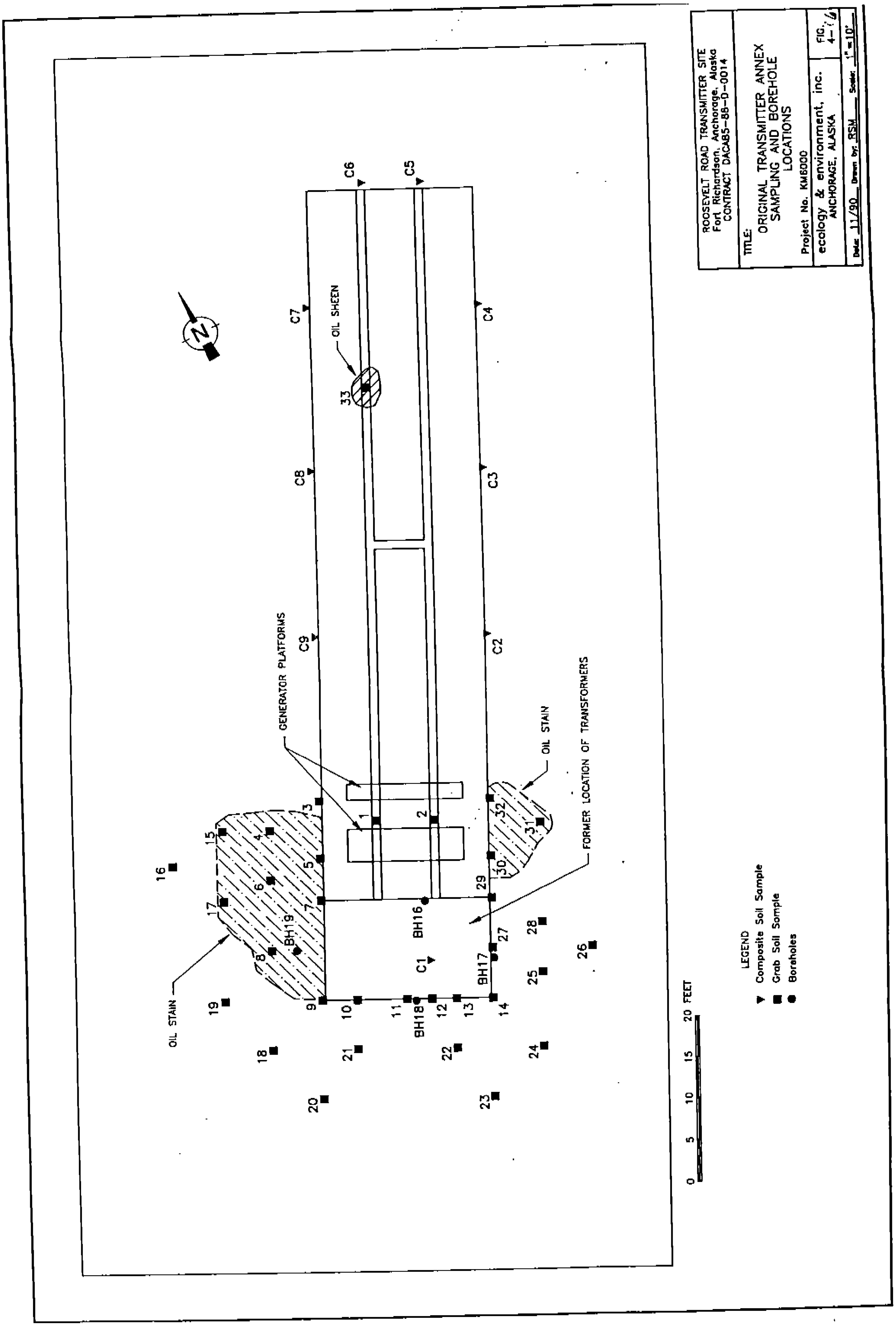


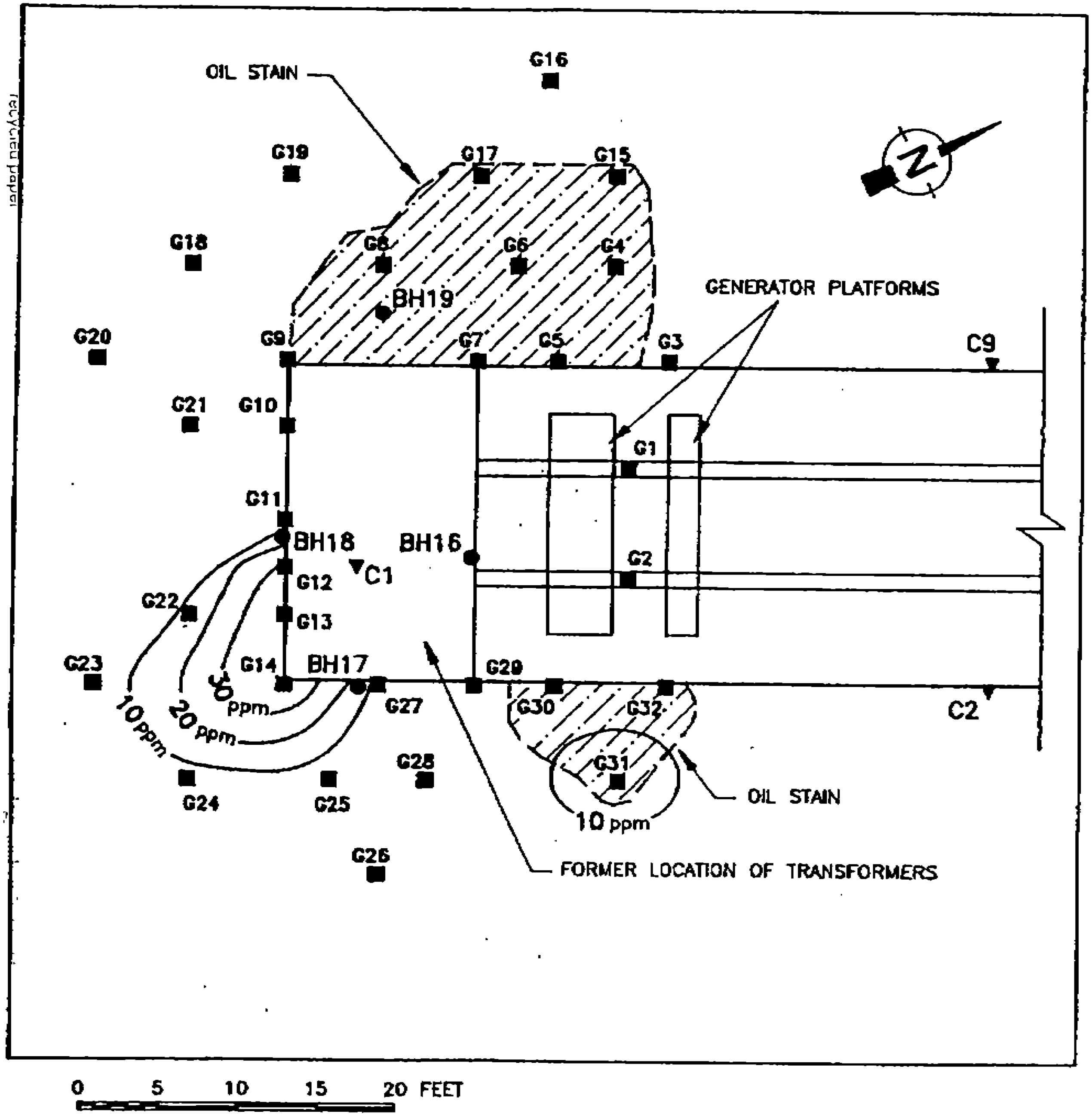
TRANSMITTER ANNEX

Laboratory results for soil samples analyzed for PCB-1260 are in ppb.
Scale: 1" =5.0' Vertical
1" =20.0' Horizontal

ROOSEVELT ROAD TRANSMITTER SITE Fort Richardson, Anchorage, Alaska CONTRACT DACA85-88-D-0014
TITLE: TRANSMITTER ANNEX CROSS SECTION C-C' Project No. KM6120
ecology & environment, inc. ANCHORGAE, ALASKA — FIG. 4-5
Date: 03/91 Drawn by: RSM Scale:

OUA 0000471


ROOSEVELT ROAD TRANSMITTER SITE
Fort Richardson, Anchorage, Alaska
CONTRACT DACA85-88-D-0014
TITLE:
ORIGINAL TRANSMITTER ANNEX
SAMPLING AND BOREHOLE
LOCATIONS
Project No. KM6000
ecology & environment, inc.
ANCHORAGE, ALASKA
FIG. 4-16
Date: 11/90 Drawn by: RSM Scale: 1"=10'
N
OIL SHEEN
GENERATOR PLATFORMS
OIL STAIN
FORMER LOCATION OF TRANSFORMERS
OIL STAIN
C1 C2 C3 C4 C5 C6 C7 C8 C9
BH16 BH17 BH18 BH19
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33
0 5 10 15 20 FEET
LEGEND
Composite Soil Sample
Grab Soil Sample
Boreholes



LEGEND

- ▼ Composite Soil Sample
- ■ Grab Soil Sample
- ● Boreholes

ROOSEVELT ROAD TRANSMITTER SITE
Fort Richardson, Anchorage, Alaska
CONTRACT DACA85-88-D-0014

TITLE:

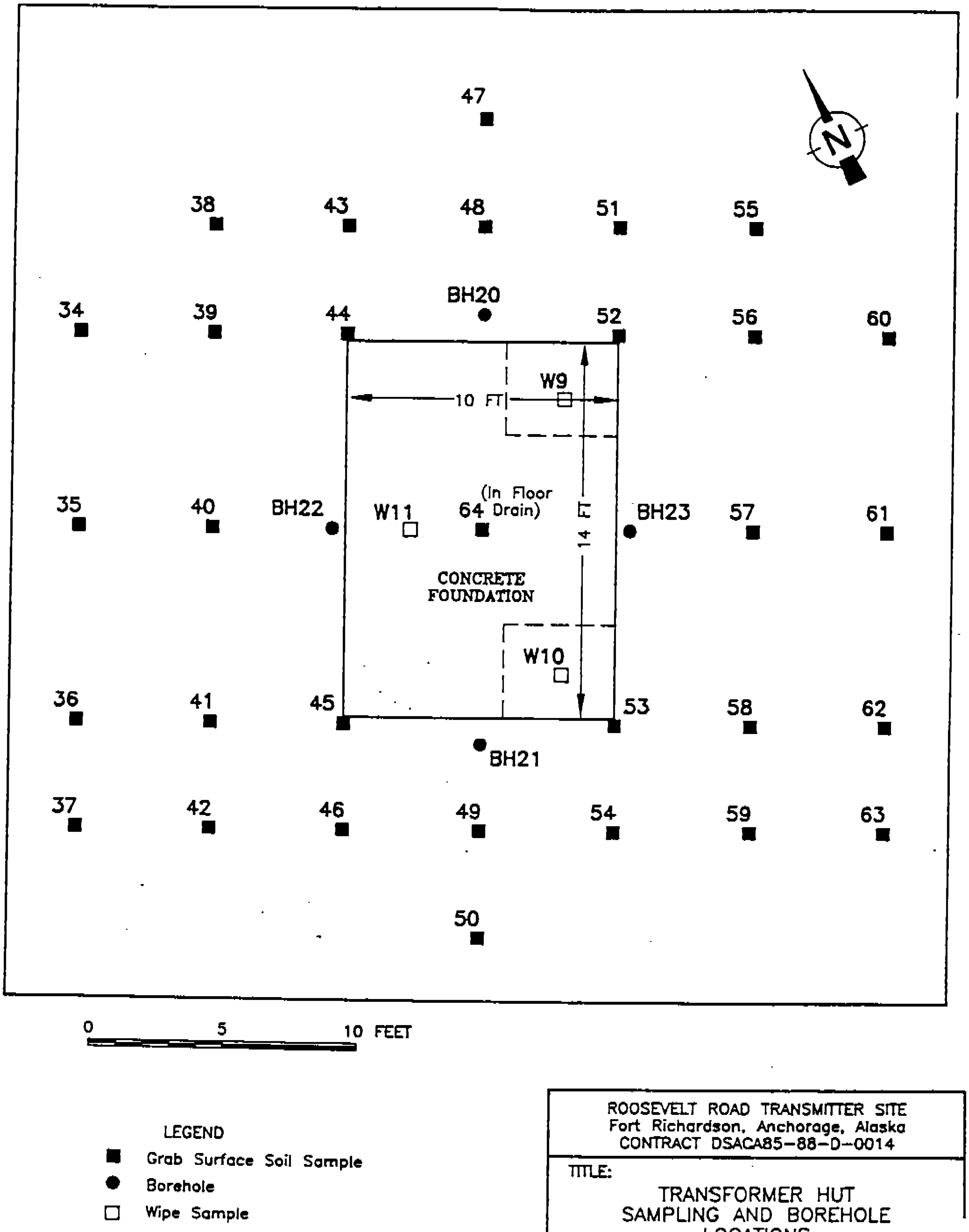
ORIGINAL TRANSMITTER ANNEX
PCB ISOCONTOUR MAP

Project No. KM6120

ecology & environment, inc.
ANCHORAGE, ALASKA

FIG. 4-7

Date: 03/91 Drawn by: RSM Scale:



ROOSEVELT ROAD TRANSMITTER SITE
Fort Richardson, Anchorage, Alaska
CONTRACT DSACA85-88-D-0014

TITLE:

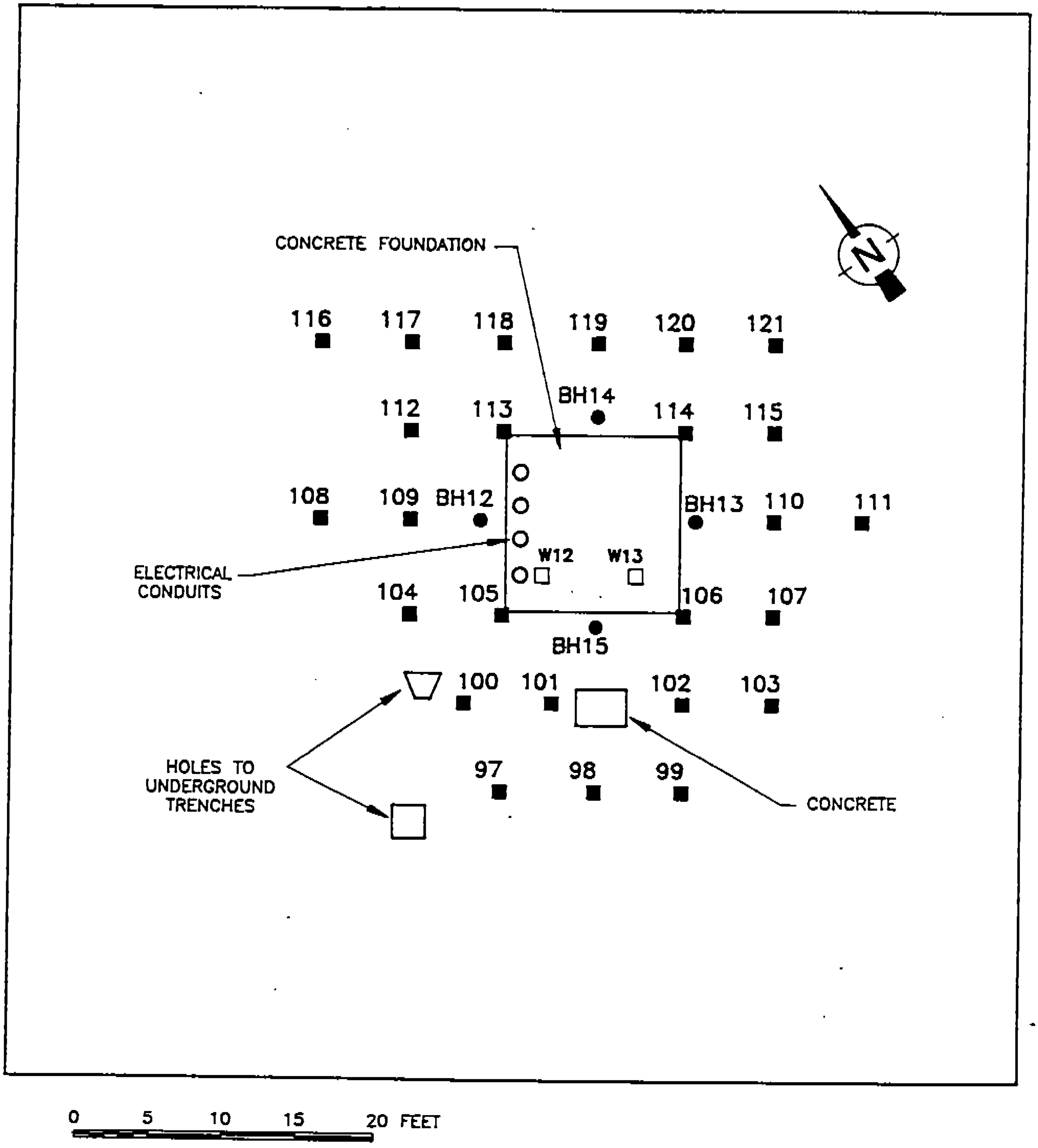
TRANSFORMER HUT SAMPLING AND BOREHOLE LOCATIONS

Project No. KM6000

ecology & environment, inc.
DENVER, COLORADO

FIG. 4- 8

Date: 11/90 Drawn by: RSM Scale: 1"=5'

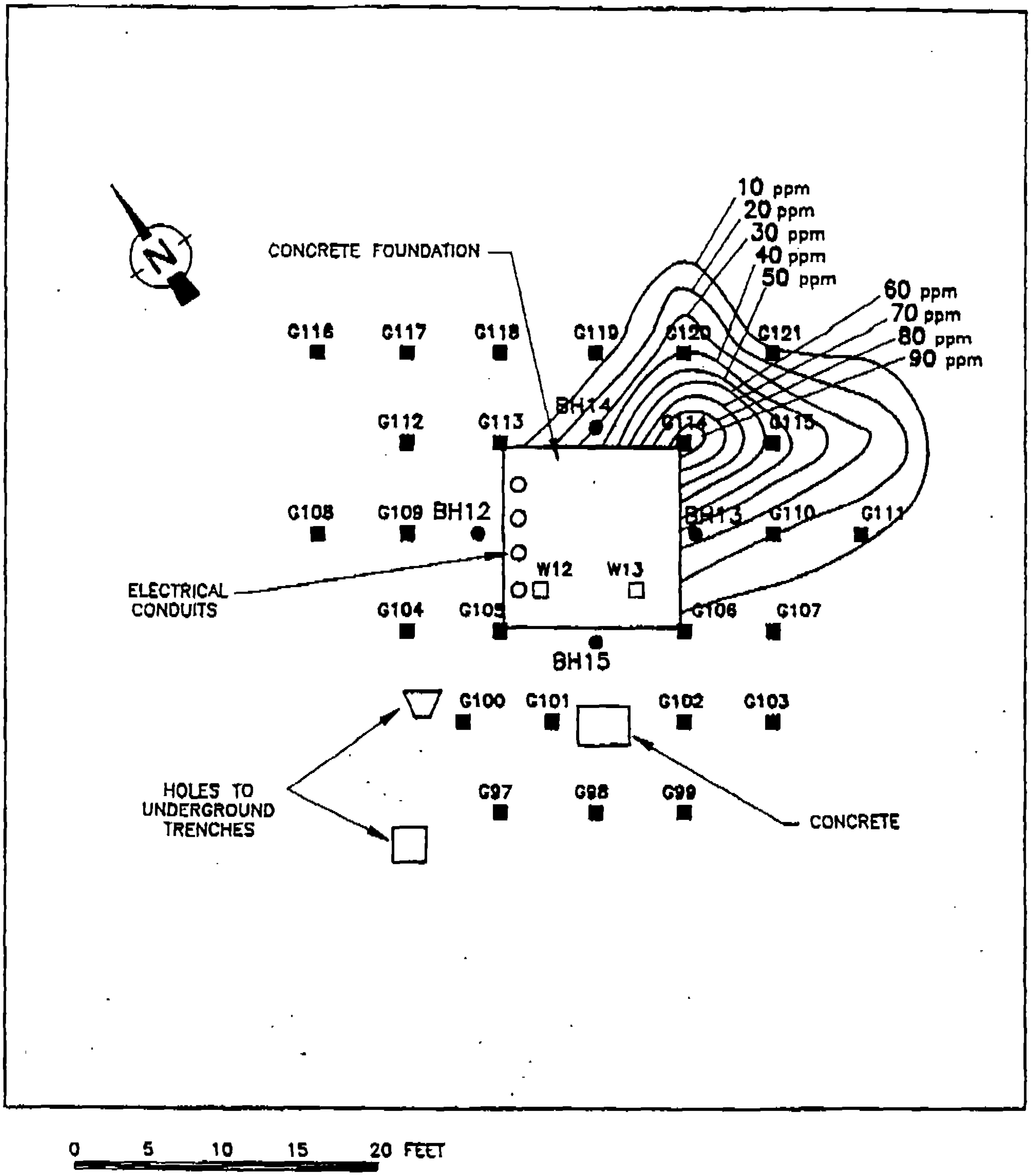


LEGEND

- ■ Grab Surface Soil Sample
- □ Wipe Sample
- ● Borehole

ROOSEVELT ROAD TRANSMITTER SITE Fort Richardson, Anchorage, Alaska CONTRACT DACA85-88-D-0014	
TITLE: POWER CONTROL HUT SAMPLING AND BOREHOLE LOCATIONS Project No. KM6000	
ecology & environment, inc. ANCHORAGE, ALASKA	FIG. 4- 9
Date: 11/90 Drawn by: RSM Scale: 1"=10'	

recycled paper



LEGEND
- ■ Grab Surface Soil Sample
- □ Wipe Sample
- ● Borehole

ROOSEVELT ROAD TRANSMITTER SITE
Fort Richardson, Anchorage, Alaska
CONTRACT DACA85-88-D-0014

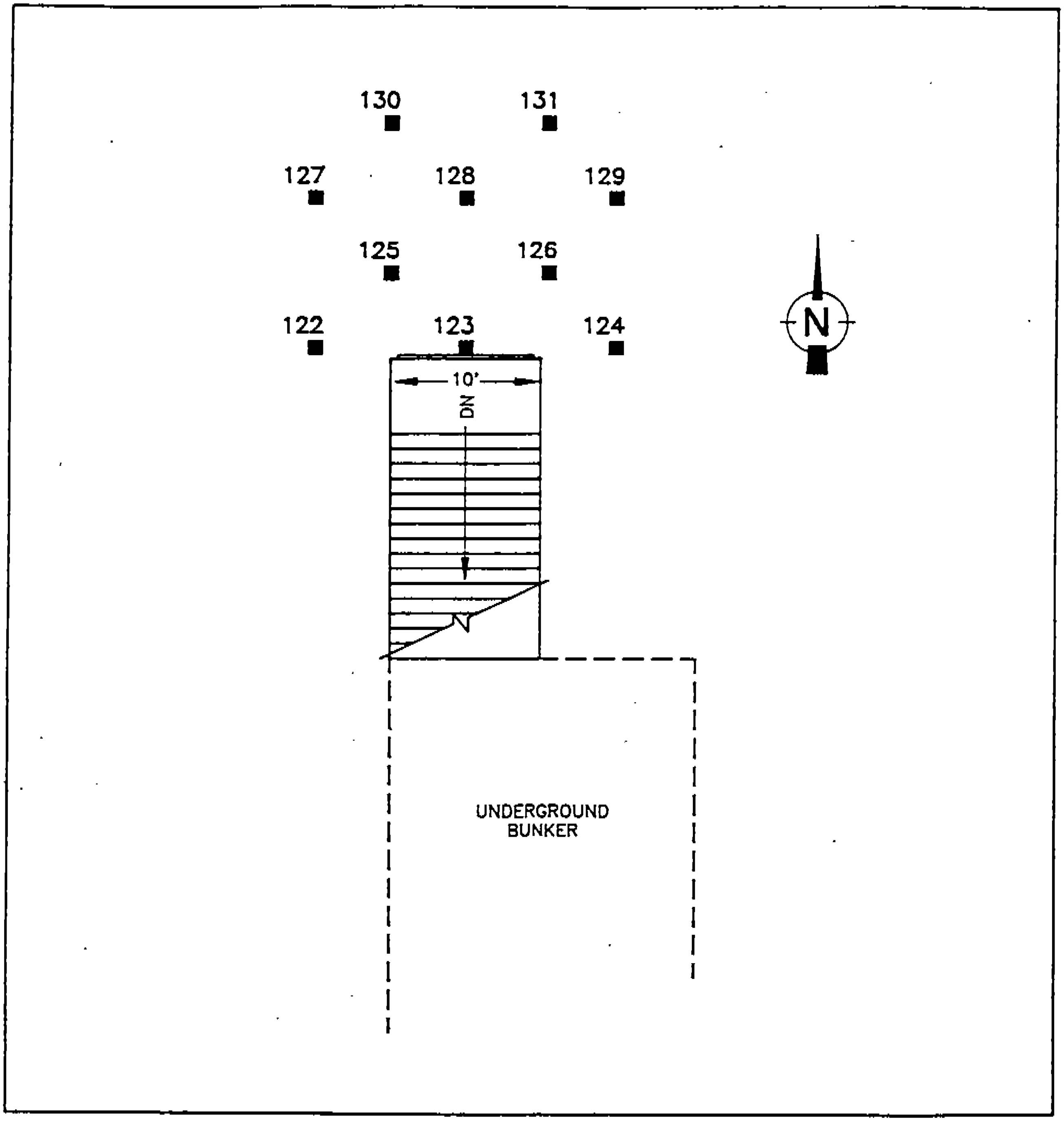
TITLE:
POWER CONTROL HUT
PCB ISOCONTOUR MAP

Project No. KM8120

ecology & environment, inc.
ANCHORAGE, ALASKA

FIG. 4-10

Date: 11/90 Drawn by: RSM Scale: 1"=10'



0 5 10 15 20 FEET

LEGEND

■ Grab Surface Soil Sample

ROOSEVELT ROAD TRANSMITTER SITE
Fort Richardson, Anchorage, Alaska
CONTRACT DACA85-88-D-0014

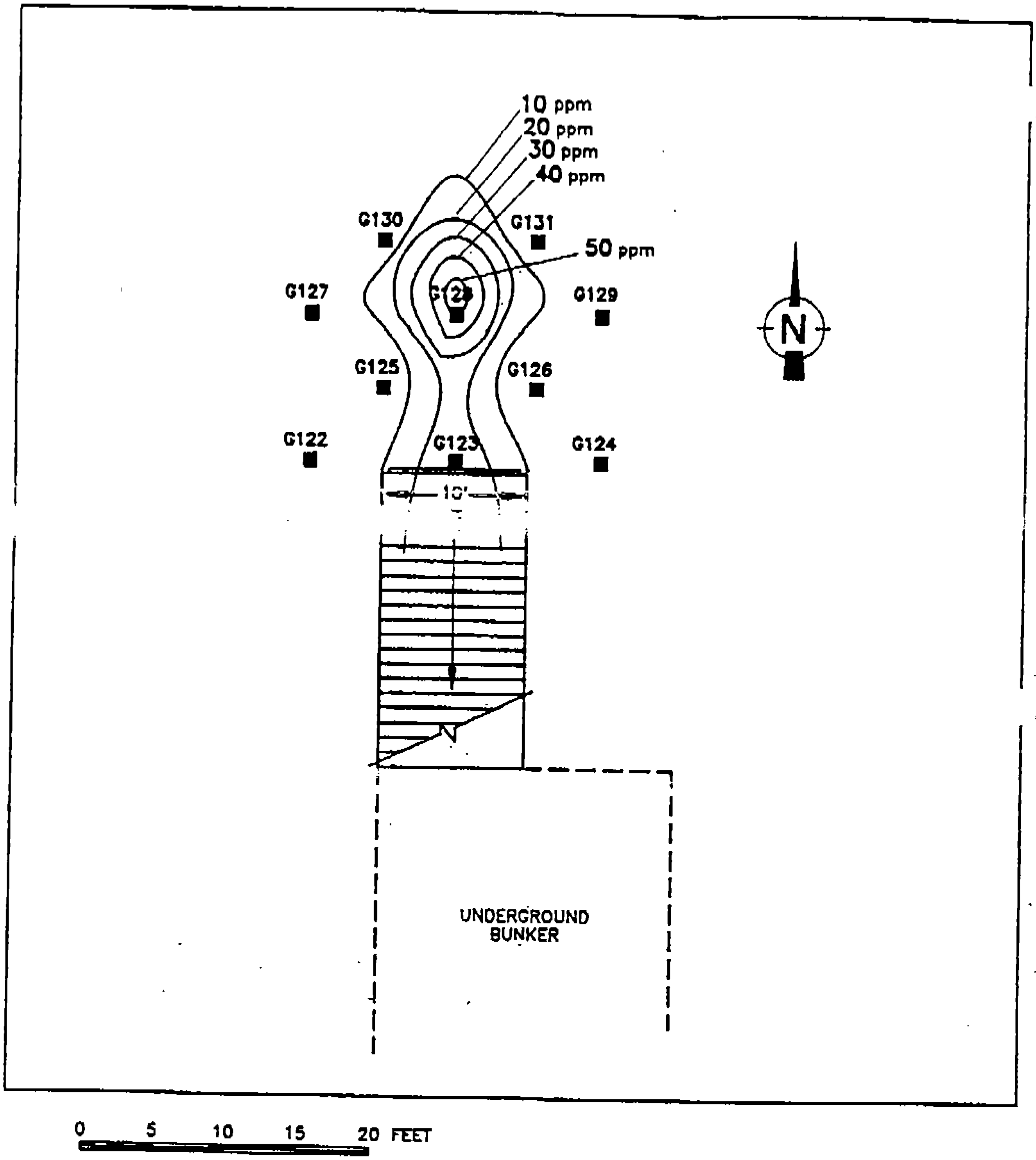
TITLE:
NORTH WEST ENTRANCE
UNDERGROUND
BUNKER SAMPLING LOCATIONS

Project No. KM6000

ecology & environment, inc.
ANCHORAGE, ALASKA

FIG. 4- 11

Date: 11/90 Drawn by: RSM Scale: 1" = 10'



LEGEND

■ Grab Surface Soil Sample

ROOSEVELT ROAD TRANSMITTER SITE
Fort Richardson, Anchorage, Alaska
CONTRACT DACA85-88-D-0014

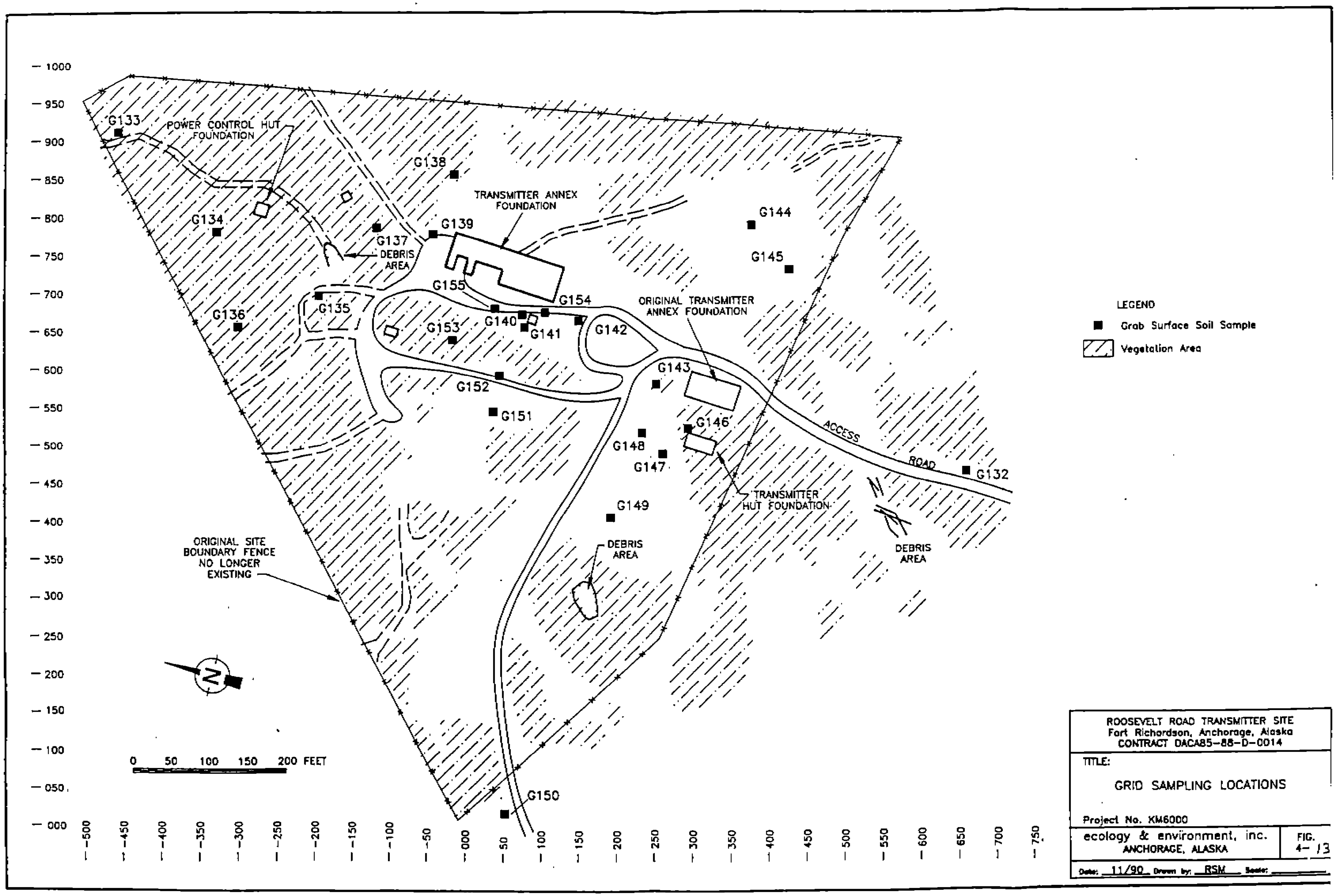
TITLE:

NORTH WEST ENTRANCE
UNDERGROUND
PCB ISOCONTOUR MAP

Project No. KM6120

ecology & environment, inc.
ANCHORAGE, ALASKA

FIG. 4-12



ROOSEVELT ROAD TRANSMITTER SITE
Fort Richardson, Anchorage, Alaska
CONTRACT DACA85-88-D-0014

TITLE:

GRID SAMPLING LOCATIONS

Project No. KM6000

ecology & environment, inc.
ANCHORAGE, ALASKA

FIG. 4-13

Date: 11/90 Drawn by: RSM Scale:

5. RESULTS AND SIGNIFICANCE OF FINDINGS

Analytical results from sampling activities conducted at the Roosevelt Road Transmitter Site are compiled in Tables 5-1 through 5-8 of this report. Corresponding sampling locations are illustrated in Figures 4-1 through 4-7. As previously mentioned, data were reviewed by COE's North Pacific Division Materials Laboratory in Troutdale, Oregon.

5.1 QUALITY ASSURANCE/QUALITY CONTROL

5.1.1 Data Validation

Analytical data were reviewed by COE's North Pacific Division (CENPD) Materials Laboratory in Troutdale, Oregon, and are presented in a report titled Chemical Quality Assurance Report Roosevelt Road Transmitter Site (see Appendix D) (COE 1990b). All project data were deemed acceptable with the exception of one set of dioxin/furan data and some metal data.

The project samples were analyzed by ARDL, Inc., Mt. Vernon, Illinois. Dioxin/furan samples were subcontracted to Chemwest Analytical Laboratories, Sacramento, California. Asbestos samples were analyzed by Walker and Ward, Inc., Evansville, Indiana. The QA samples were analyzed by Southwest Laboratory of Oklahoma, Broken Arrow, Oklahoma and by the CENPD Materials Laboratory in Troutdale, Oregon.

5.1.1.1 Organic Data

The organic parameters analyzed for were VOCs, BNAs, PCBs, TPH, and dioxin/furans. All organic data with the exception of some dioxin/furan data were deemed acceptable by CENPD. Dioxin/furan data reported had surrogate recoveries for samples 90RRTS274SW, 90RRTS275SW, and 90RRTS279SW above the allowable QC limit (75% to 125%). The matrix spike/matrix spike duplicate (MS/MSD) data for the dioxin/furan analysis of the previously mentioned samples were low, and the quantitation of these data is questionable; reported values are probably biased low.

5.1.1.2 Inorganic Data

The inorganic data quantitation is questionable due to low matrix spike recoveries for the following metals: cadmium, chromium, copper, lead, silver, thallium, and zinc. Positive results reported for these samples are probably biased low, and false negatives may exist. In addition, relative percent differences (RPDs) were high for duplicate results of both cadmium and zinc. Total phosphorous spike recoveries were high, and for this reason the reported results for the sample 90RRTS384SL (G-132) collected to aid in revegetation considerations should be considered a high estimate.

5.1.2 Laboratory Controls

Holding times were met for all analyses with the exception of one set of BNA data on which the extraction holding time limit was missed by three days.

Contamination detected in laboratory method blanks included methylene chloride, chloroform, acetone, and bis(2ethylhexyl)phthalate. Each of these is considered a common laboratory contaminant. All associated positive results were flagged "B."

No calibration data were provided for review, nor were they referred to in the QA report issued by CENPD.

5.1.2.1 Trip Blanks

Trip blanks, organic-free deionized water (ASTM Type II), which accompanied the sample containers sent into the field from the time they left the COE-Alaska laboratory, were included in each shipment containing VOA samples. Two trip blanks were analyzed for this project. Both methylene chloride and chloroform were detected in these samples. The methylene chloride is a result of laboratory contamination. The chloroform may be due to laboratory contamination as well. While it was detected in a trip blank, the chloroform may have been in the deionized water used to create the trip blank. Results are presented in Table 5-8.

5.1.2.2 Sampling Equipment Blanks

Sampling equipment blanks, or rinsate samples, are collected to determine potential contamination of samples resulting from sample collection devices (augers, mixing bowls, stainless-steel spoons, etc.). Aqueous rinsate blanks were prepared for each sample collection implement used and were analyzed for all targeted analytes. Rinsate blanks were prepared from a split-spoon and stainless-steel spoon and mixing bowl. Results are tabulated in Table 5-8. Only bis(2-ethylhexyl)-phthalate was detected in the analysis of the rinsate samples.

5.1.2.3 Hexane Rinsate

A hexane rinsate sample was analyzed for dioxin/furans. It was prepared by passing reagent grade hexane over a decontaminated stainless-steel spoon. No dioxin/furans were detected in the hexane rinsate. Results are tabulated in Table 5-1.

5.1.2.4 Matrix Blanks

Two samples of glass wool soaked in reagent grade hexane, were analyzed for PCBs to show that the sample collection method was not a source of contamination, and that the matrix itself did not result in analytical anomalies. No PCBs were detected in either sample. Results are presented in Table 5-6.

5.1.2.5 Field Duplicates

Of the 338 soil, wipe, solid waste, asbestos, dioxin, and sludge samples collected across the site, 38 blind duplicates were analyzed by the project laboratories. In addition, 38 quality assurance samples were analyzed by the QA laboratory. The majority of the data were classified as acceptable by CENPD with a few exceptions attributed to non-homogenous/non-identical samples.

Disagreement in the dioxin/furan data is in part due to the project laboratory reporting on a wet weight basis while the QA laboratory reported on a dry weight basis. Additional discrepancies included the following:

- Chloroform (45 ppb) was detected in the project laboratories' analysis of the trip blank, and not detected by the QA laboratory;

- Results for the duplicate wipe samples (four were analyzed) had incongruent data for values near the detection limit (0.1 to 1.0 µg) and reported values differing by a factor of 4. CENPD considered this acceptable for wipe samples;

- Soil samples (90RRTS129SL, 90RRTS130SL, and 90RRTS131SL) had reported values of ND for all PCBs except Aroclor 1260; the project laboratory reported values of 3,100 ppb and 4,100 ppb, while the QA laboratory reported 21,870 ppb. CENPD considered this acceptable and stated the discrepancy was due to non-identical samples or non-homologous aliquots used for analysis;

- Soil samples (90RRTS187SL, 90RRTS188SL, and 90RRTS189SL) agreed for the nondetected Aroclors; however, Aroclor 1254 results were 2500 ppb, ND, and 290 ppb, respectively. The % moisture calculated for these samples was 12, 9, and 13.8 respectively. CENPD considered these results to be acceptable, noting that the samples were probably non-identical as indicated by the % moisture variances;

- Solid waste samples (90RRTS280SW, 90RRTS281SW, and 90RRTS282SW) agreed for the nondetected PCBs; however, Aroclor 1260 was detected at 880,000 ppm, 410,000 ppm, and 1,000,000 ppm, respectively. The large numerical difference reported is irrelevant since the values detected are so much greater than the cleanup level. The large quantitative differences can be attributed to the sensitivity limits of the instrumentation;

- Soil samples (90RRTS340SL, 90RRTS341SL, and 90RRTS342SL) agreed for all the nondetected PCBs; however, Aroclor 1260 was reported at the following values respectively (ND, 340 ppb, 922 ppb); % moisture values reported did not agree. It can be assumed that these samples were non-homologous;

- Volatile QA/QC samples (90RRTS414SG, 90RRTS415SG, and 90RRTS416SG) agreed with the following exceptions: project laboratory analytical data agreed for all the analytes except 1,2-dichloroethane, 1,2-dichloroethene (total), and ethylbenzene; reported values for these analytes were low and near the reported detection limit. Project laboratory and QA laboratory data did not agree for chloroform, 1,2-dichloroethane, tetrachloroethene, ethylbenzene, and 1,1-dichloroethene. Chloroform was reported in the volatile trip blanks. 1,2-Dichloroethane, tetrachloroethene, and ethylbenzene detection limits for the QA laboratory are above the amounts detected by the project laboratory. There is a large discrepancy in the 1,1-dichloroethene results; the QA laboratory detected 19,320 ppb while the project laboratory detected nothing above the detection limit. Without reviewing the raw data it is difficult to rationalize the discrepancy; and

- o Inorganic QA/QC samples (90RRTS414SG, 90RRTS415SG, and 90RRTS416SG) results agreed with the exception of silver (11 ppm, ND, and 33 ppm, respectively. Results for 90RRTS414SG (11 ppm) are questionable due to internal QC problems (COE 1990b).

5.2 ANALYTICAL RESULTS

The analytical results referred to in this section are tabulated in Tables 5-2 through 5-8 of this report. Sample locations corresponding to the data are illustrated in Figures 4-1 through 4-7. Tables 4-4 through 4-10 describe sample type, location, and rationale for each sample collected during the investigation. A discussion of the data follows in subsequent paragraphs.

5.2.1 Asbestos

Samples collected for asbestos analysis were analyzed by EPA Method 600/04-82-020, results are tabulated in Table 5-2. Two materials were analyzed for asbestos, pipe wrapping, and floor tiling.

All samples contained chrysotile asbestos at levels ranging from less than 1% to 60% by volume. Sample 90RRTS269MI (A-3), pipe insulation collected from the transformer room was found to contain 60% by volume. Aside from chrysotile, no other form of asbestos was detected in any sample collected.

Since access to the bunker is limited and the pipe wrapping and the majority at the floor tiling is intact, no action is necessary. However, if remediation is to occur within the bunker, both sources will again need to be inspected. We recommend a warning sign be posted on the bunker entrance stating that asbestos is present inside.

5.2.2 Dioxin

Dioxin samples were analyzed by EPA Method 8280, results are tabulated in Table 5-3. Dioxin/furan analysis was performed to help characterize contamination within the bunker. Charred debris in the underground bunker prompted this analysis; incomplete combustion of PCB materials often results in PCDD and PCDF isomers (see Appendix B). Two locations were sampled for dioxin/furans.

The most toxic isomer, TCDD, was not detected; however, both samples contained various PCDD and PCDF isomers. PCDDs and PCDFs are unwanted trace contaminants resulting from chlorinated phenols, PCBs, and various other combustion sources. PCDDs and PCDFs are persistent and not very mobile. They exhibit low water solubilities, low rates of biodegradation and a high affinity for soils. PCBs are mobile in non-aqueous phase organic liquids. Due to the location of the PCDD and PCDF contamination, it seems unlikely that non-aqueous phase organic liquids will come in contact with the existing contamination and influence mobilization.

As with the asbestos, since access to the bunker is limited a warning sign is recommended on the bunker entrance stating that dioxin contamination is present inside.

5.2.3 Solid Waste

Solid waste samples collected from soil, oil, and animal residues within the bunker were analyzed by EPA Methods 8270 and 8080 for BNAs and PCBs, respectively. Results are tabulated in Table 5-4. Sample locations are depicted in Figure 4-1.

The solid waste samples were collected to characterize possible contamination in the residual transformer oils inside the underground bunker. Each of the 11 solid waste samples contained Aroclor 1260 in levels ranging from 4,000 ppb to 1,000,000,000 ppb (100%). PCBs are chemically stable compounds that persist in the environment for long periods of time. Aroclors are soluble in most aliphatic and aromatic solvents, and are highly resistant to the action of strong alkalis, strong acids, and high temperatures (see Appendix B).

The BNA compound 1,2,4-trichlorobenzene (reported at 34 ppb), which is commonly used in dielectric fluid mixtures, was detected at a level below the MRL. Only one sample underwent BNA analysis; high chlorobenzene results in the subsurface soil samples suggest that higher chlorobenzene levels may exist within the bunker.

5.2.4 Wipe Samples

Wipe samples collected from inside the bunker, and from concrete pads of the power hut, transformer hut, and transmitter annex were analyzed by EPA Method 8080 for PCBs. Results are tabulated in Table 5-6.

Wipe samples were collected to verify the presence and characterize the extent of contamination in the underground bunker and at known and suspected electrical equipment locations on the site.

Aroclor 1254 was detected in two samples from the power hut concrete pad (W-12, W-13). Aroclor 1260 was detected in wipe samples from sampling locations at both the transmitter annex and the transformer hut at levels ranging from 1.2 $\mu g/100cm^2$ to 5.4 $\mu g/100cm^2$. Wipe samples inside the bunker had concentrations ranging from 1 $\mu g/100cm^2$ to 200,000 $\mu g/100cm^2$ for Aroclor 1260. In fact, samples were collected throughout the bunker and all the bunker wipe samples were positive for Aroclor 1260. No positive values were reported for either blank (glass wool and hexane) sample analyzed.

5.2.5 Soil Samples

5.2.5.1 Background Soil Sample

One sample, 90RRTS384SL (G-132), was used to characterize background soil conditions at the site. This sample was analyzed for pcbs, bnas, sieve analysis and the revegetation parameters (ammonia as nitrogen, nitrate, total phosphorous, and pH). It was collected approximately 70 feet north of the intersection of roosevelt road and the site access road, and about 20 feet east of the site access roadway in an area currently overgrown by small trees and shrubs. Engineering asbuilt drawings from the 1940s show that a garage was situated in this area at one time. Bis(2-ethylhexyl)phthalate (320 μg/kg) was the only targeted analyte detected in this sample. It is a common laboratory contaminant and was also reported in a blank sample associated with this sample, therefore, it can be considered irrelevant.

5.2.5.2 Surface Soil

Surface soil samples were collected both as grabs and composites from various gridded locations across the site. Soils were analyzed by

EPA Methods 8270 and 8080 for BNAs and PCBs, respectively. Results are tabulated in Table 5-5. Sample locations are presented in Figures 4-2 through 4-7.

Surface soil samples used to determine the extent of contamination on site detected concentrations of PCB and BNA analytes. Aroclor 1260 was detected in levels ranging from 88.7 ppb to 3,300,000 ppb in surface soil samples.

Aroclor 1254 was detected in two QA/QC samples and in two composite samples collected near the transmitter annex (985 ppb in sample 90RRTS187SL [C-6] and 2,500 ppb in sample 90FFTS189SL [C-6]). No other Aroclor (1221, 1232, 1242 or 1248) was detected in any soil sample. (Aroclor 1254 was also detected in two wipe samples collected at the power hut concrete pad.)

Eight surface soil samples were analyzed for BNA compounds. Aside from the common laboratory contaminant, bis(2-ethylhexyl)phthalate, the following regulated compounds were detected: benzyl alcohol (110 ppb), benzoic acid (95 ppb), fluoranthene (1,300 and 2,500 ppb), pyrene (3,200 and 9,900 ppb), chrysene (1,300 and 2,700 ppb), benzo(b)fluoranthene (2,000 ppb), and benzo(k)fluoranthene (3,400 ppb). Both benzyl alcohol and benzoic acid were detected in sample 90RRTS389SL (G-137), collected at the north side of the transmitter annex pad from native soil near the outside edge of the fill area. Both compounds were detected below the required level of detection (MRL) for EPA Method 8270. The other positive results were detected in samples 90RRTS398SL (G-144) and 90RRTS399SL (G-145); both samples were collected from visibly stained soils which lacked vegetation. The area where they were collected once housed storage buildings and appeared to have been paved with gravel (see Figure 4-7). These detected contaminants, fluoranthene, pyrene, chrysene, benzo(b)fluoranthene, and benzo(k)fluoranthene, are associated with petroleum and coal tar products. No chlorobenzenes were detected in the eight surface soil samples that were analyzed for BNAs. Chlorobenzene was detected at high levels in the subsurface soils (76,000 ppb in BH-9 at 2 to 4 feet). We assume this is a result of the 1978 cleanup activity that involved diesel washing of the PCB-contaminated transmitter annex floor.

Volatile organic analysis (VOA) was not performed on any surface soils collected on site. Cesspool VOA results suggest organic solvents were present at the site; most notably 4-methylphenol, trichloroethene, tetrachloroethene, and 1,2-dichloroethane, which are all RCRA toxic characteristic (TC) constituents. Metal results from the soils and sludges collected at the cesspool were high for barium (2,700 ppm), lead (1,200 ppm), mercury (110 ppm), and zinc (2,000 ppm). It is highly possible that waste solvents, paint thinners, battery wastes, and other hazardous waste constituents were dumped directly into the cesspool; however, since neither volatile nor metals analysis was performed on any surface soil samples, we do not know the extent of the problem on the site. RCRA permitting, the Land Ban regulations and cleanup decisions will all be impacted by this lack of information. In light of this, additional sampling will be recommended as part of the remedial measures (see Section 7).

5.2.5.3 Borehole Samples

Subsurface soil samples were collected from 23 boreholes situated around the concrete pads still existing (power hut, transformer hut, transmitter annex, and original transmitter annex). These samples were analyzed by EPA Methods 8270, 8080, and modified 8015 for BNAs, PCBs, and TPH identification. Results are tabulated in Table 5-7.

Borehole sampling was performed to determine the vertical extent of contaminant migration near the remaining concrete pads. No positive PCB results were obtained from samples collected at the four boreholes placed around the transformer hut (BH-20, BH-21, BH-22, and BH-23). Aroclor 1254 was detected at values of 3,600 ppb, 2,000 ppb, and 1,900 ppb in three samples collected from BH-3 located at the north end of the transmitter annex. Aroclor 1254 was not detected in any other borehole sample. Aroclor 1260 was detected in values ranging from 83 ppb to 1,900,000 ppb in samples collected from boreholes situated at the transmitter annex. Concentrations greater than 10 ppm are tabulated by borehole in Table 5-1.

Aroclor 1260 was also detected in boreholes located around the power hut concrete pad at values ranging from 49 ppb to 1,200 ppb. All positive results at this location were less than the method required detection limit. A result of 1,200 ppb was reported for Aroclor 1260 in sample 90RRTS124SL (BH-15) collected at a depth of 0 to 2 feet. This borehole is located along the north edge of the concrete pad. At the original transmitter annex, Aroclor 1260 was detected at levels ranging from 170 ppb to 21,870 ppb; the highest value was detected at a depth of 2 to 4 feet in BH-16 which was drilled at the south edge of the concrete pad.

The following BNA compounds were detected in the borehole samples: 1,2,4-trichlorobenzene at levels ranging from 22 ppb to 765,000 ppb; hexachlorobenzene at levels ranging from 35 ppb to 1,100 ppb; 1,2-dichlorobenzene at 114 ppb; 1,3-dichlorobenzene at 330 ppb; 1,4-dichlorobenzene at 270 ppb; and the common laboratory contaminants bis(2ethylhexyl)phthalate and di-n-butylphthalate. Sample 90RRTS141SL (BH-18) was analyzed for TPH identification and no POL compounds were identified.

Very few subsurface soil samples were analyzed for BNAs and none for VOAs. The presence of chlorinated solvents will impact cleanup recommendations and more sampling will be required to determine the extent of this contamination on site. The extent of contamination at BH-10 is unknown since the deepest sample collected (at 29 to 20 feet) was analyzed only for PCBs.

5.2.5.4 Cesspool Samples

Soil and sludge samples were collected from the two cesspool locations identified on the asbuilts. A backhoe was used to access these areas. It is assumed that the southern most cesspool (see Figure 2-2) once existed approximately 50 feet north of the remaining transformer hut concrete pad. It was identified during excavation activities by a strong septic odor and an open-ended sewer pipe. Sample 90RRTS413SG (G-156) was collected at this location from a mixture of excrement and soil at a depth of approximately 12 feet. The other cesspool was discovered intact, 170 feet west and 50 feet south of the sealed northwest entrance to the bunker. Two samples were collected at this location. One sample, collected in triple volume for QA/QC purposes, was obtained from the sewer pipe collar at the tank junction; the other sample was sludge from inside the cesspool. The samples collected from these locations were analyzed for PCBs, BNAs, VOCs, and metals. Results for these samples can be found at the end of Table 5-5.

Cesspool sampling was performed to determine if on-site areas may have been contaminated by past hazardous and toxic waste (HTW) disposal practices. Results confirm the presence of quite a few regulated pollutants; most notably 4-methylphenol, trichloroethene, tetrachloroethene, 1,2-dichloroethene, barium, lead, and mercury.

Aroclor 1260 was detected in the four samples collected at the northernmost cesspool location at levels ranging from 4,183 ppb to 5,600 ppb.

5.3 SUMMARY

The sample summary matrix (see Figure 5-1) presents an overview of the samples collected at the Roosevelt Road Transmitter Site. It illustrates where data gaps exist as well as areas with contamination at levels of concern (above regulatory action levels).

Table 5-1

TRANSMITTER ANNEX BOREHOLE RESULTS
LEVELS OF AROCLOR 1260 ABOVE 10 PPM

Borehole	Depth (feet)	Amount	Location
BH-7	4 - 6	22,000 ppb	East side of transmitter annex concrete pad
BH-8	0 - 2	1,900,000 ppb	East side of transmitter annex concrete pad
BH-8	2 - 4	720,000 ppb	East side of transmitter annex concrete pad
BH-9	2 - 4	450,000 ppb	East side of transmitter annex concrete pad
BH-9	10 -11	15,000 ppb	East side of transmitter annex concrete pad
BH-10	14 -16	120,000 ppb	East side of transmitter annex concrete pad
BH-10	19 -21	170,000 ppb	East side of transmitter annex concrete pad
BH-10	22 -23	510,000 ppb	East side of transmitter annex concrete pad
BH-10	29 -30	120,000 ppb	East side of transmitter annex concrete pad

02[IL]KM6120/1453/24

Table 5-2

ASBESTOS CONTENT ANALYTICAL RESULTS
ROOSEVELT ROAD TRANSMITTER SITE
ANCHORAGE, ALASKA
CONTRACT NO. DACA85-88-D-0014
DELIVERY ORDER NO. 12
(% BY VOLUME)

Sample Number:	90RRTS263MI	90RRTS264MI	90RRTS265MI	90RRTS267MI	90RRTS269MI	90RRTS308MI	90RRTS334MI
Description:	Pipe Wrapping Ejector Pit	Pipe Wrapping Ejector Pit	Pipe Wrapping Ejector Pit	Floor Tile	Pipe Wrapping	Tile	Tile Transmitter
Location:	Bunker, A-1	Bunker, A-1	Bunker, A-1	Bunker, A-2	Bunker, A-3	Bunker, A-4	Annex, A-5*
Asbestos Identification							
Chrysotile Asbestos	<1	5	2	5	60	8	13
Amosite Asbestos	--	--	--	--	4	--	--
Crocidolite Asbestos	--	--	--	--	--	--	--
Anthophyllite Asbestos	--	--	--	--	--	--	--
Actinolite Asbestos	--	--	--	--	--	--	--
Tremolite Asbestos	--	--	--	--	--	--	--
Total Fibrous Asbestos	--	--	--	--	--	--	--
Fibrous Glass	--	--	--	--	--	--	--
Cellulose	97	93	--	79	--	--	--
Synthetics	--	--	95	--	--	--	--
Other Fibrous Components	--	--	--	--	--	--	--

02[IL]KM6120/1443/2

Key at end of table.

Table 5-2 (Cont.)

Sample Number:	90RRTS263MI	90RRTS264MI	90RRTS265MI	90RRTS267MI	90RRTS269MI	90RRTS308MI	90RRTS334MI
Description:	Pipe Wrapping Ejector Pit	Pipe Wrapping Ejector Pit	Pipe Wrapping Ejector Pit	Floor Tile	Pipe Wrapping	Tile	Tile Transmitter
Location:	Bunker, A-1	Bunker, A-1	Bunker, A-1	Bunker, A-2	Bunker, A-3	Bunker, A-4	Annex, A-5*
Non-Fibrous Components	--	--	--	--	--	--	--
Calcite	--	--	--	--	--	40	40
Quartz	--	--	--	--	--	<1	<1
Lizardite	--	--	--	--	--	10	4
Tar	--	--	--	--	--	3	3
Binder	--	--	--	--	--	38	39
Hair	2	2	--	15	25	--	--
Polamide Fibers	--	--	--	1	--	--	--
Calcium Carbonate	--	--	--	--	11	--	--

02[IL]KM6120/1443/2

Key:

-- = Non-detected.

*A-5 - The tar mastic contains approximately 35% Chrysotile. The tile contains approximately 12% Chrysotile.

Table 5-3

DIOXIN SAMPLING ANALYTICAL RESULTS
ROOSEVELT ROAD TRANSMITTER SITE
ANCHORAGE, ALASKA
CONTRACT NO. DACA85-88-D-0014
DELIVERY ORDER NO. 12
(RESULT IN µg/kg, ppb)

Sample Number:	90RRTS274SW		90RRTS275SW		90RRTS276SW		90RRTS279SW		90RRTS	
Description:	Oily Residue		Oily Residue		Oily Residue		Ashes		Hexane Rinsate Transmitter	
Location:	Bunker, D-1		Bunker, D-1		Bunker, D-1		Bunker, D-2		Annex, D-3	
Dioxins		D.L.		D.L.		D.L.		D.L.		D.L.
2,3,7,8-TCDD	ND	4.1	NA	NA	ND	2.6	ND	3.3	ND	4.4
Total Tetra CDD	ND	2.4	ND	883.7	ND	3.6	ND	4.5	ND	3.4
Total Penta CDD	85.5	N/A	ND	2.22	ND	19.7	ND	31.7	ND	7.8
Total Hexa CDD	389	N/A	33.92	N/A	352	N/A	68.2	N/A	ND	11.6
Total Hepta CDD	209	N/A	106.5	N/A	170	N/A	68.7	N/A	ND	10.4
Total Octa CDD	62.2	N/A	66.67	N/A	55.8	N/A	31.0	N/A	ND	11.7
2,3,7,8-TCDF	13.0	N/A	NA	NA	7.0	N/A	ND	6.4	ND	1.3
Total Tetra CDF	201	N/A	380.9	N/A	206	N/A	ND	96.7	ND	2.4
Total Penta CDF	963	N/A	374.1	N/A	638	N/A	ND	167	ND	2.9
Total Hexa CDF	2970(S)	N/A	252.6	N/A	3300	N/A	1180	N/A	ND	3.6
Total Hepta CDF	3700(S)	N/A	840.9	N/A	3090	N/A	1310	N/A	ND	5.5
Total Octa CDF	4600(S)	N/A	4545	N/A	5430(S)	N/A	2580	N/A	ND	8.5

02[IL]KM6120/1490/5

Key:

D.L. = Detection limit.
NA = Not analyzed.
N/A = Not appropriate.
ND = Not detected above quantitation limit.
S = Saturated.

Table 5-4

SOLID WASTE SAMPLING RESULTS
ROOSEVELT ROAD TRANSMITTER SITE
ANCHORAGE, ALASKA
CONTRACT NO. DACA85-88-D-0014
DELIVERY ORDER NO. 12
(RESULTS IN µg/kg, ppb)

	Sample Number:	90RRTS278SW	90RRTS280SW	90RRTS281SW	90RRTS282SW	90RRTS283SW	90RRTS284SW
Parameter	Location:	Bunker, BG-1	Bunker, BG-2	Bunker, BG-2	Bunker, BG-2	Bunker, BG-3	Bunker, BG-4
PCBs							
Aroclor 1016		<750000	<41000000	<38000000	<4000000	<390000	<26000
Aroclor 1221		<750000	<41000000	<38000000	<4000000	<390000	<26000
Aroclor 1232		<750000	<41000000	<38000000	<4000000	<390000	<26000
Aroclor 1242		<750000	<41000000	<38000000	<4000000	<390000	<26000
Aroclor 1248		<750000	<41000000	<38000000	<4000000	<390000	<26000
Aroclor 1254		<1500000	<81000000	<76000000	<4000000	<770000	<53000
Aroclor 1260		820000(J)	88000000(J)	410000000(J)	1000000000	1200000	130000

02[IL]KM6120/1491/2

Key at end of table.

Table 5-4 (Cont.)

Parameter	Sample Number: Location:	90RRTS285SW Bunker, BG-5	90RRTS286SW Bunker, BG-6	90RRTS287SW Bunker, BG-7	90RRTS288SW Bunker, BG-8	90RRTS289SW Bunker, BG-9
PCBs						
Aroclor 1016		<2600	<28000	<32000000	<24000000	<260000
Aroclor 1221		<2660	<28000	<32000000	<24000000	<260000
Aroclor 1232		<2600	<28000	<32000000	<24000000	<260000
Aroclor 1242		<2600	<28000	<32000000	<24000000	<260000
Aroclor 1248		<2600	<28000	<32000000	<24000000	<260000
Aroclor 1254		<5100	<56000	<63000000	<49000000	<520000
Aroclor 1260		4000(J)	36000(J)	210000000	330000000	2500000
BNAs						
1,2,4-Trichlorobenzene			34(J)			
Bis (2ethylhexyl)phthalate			610(B)			

02(IL)KM6120/1491/2

Key:

(B) = The material was deleted in the blanks.
(J) = The associate numerical value is an estimated quantity. Presence of the material is reliable.

Table 5-5

Soil Sampling Analytical Results
Roosevelt Road Transmitter Site
Anchorage, Alaska
Contract No. DACA85-88-D-0014
Delivery Order No. 12
(Results in μg/kg, ppb)

Parameter	Sample Number: / Location:	90RRTS20SL G-1 OTA	90RRTS21SL G-2 OTA	90RRTS22SL G-3 OTA	90RRTS23SL G-4 OTA	90RRTS24SL G-5 OTA	90RRTS25SL G-6 OTA	90RRTS26SL G-7 OTA	90RRTS27SL G-8 OTA	90RRTS28SL G-8 OTA	90RRTS29SL G-8 OTA
PCBs											
Aroclor 1016		<1600	<1400	<900	<1000	<910	<880	<880	<910	<920	<80
Aroclor 1221		<1600	<1400	<900	<1000	<910	<880	<880	<910	<920	<80
Aroclor 1232		<1600	<1400	<900	<1000	<910	<880	<880	<910	<920	<80
Aroclor 1242		<1600	<1400	<900	<1000	<910	<880	<880	<910	<920	<80
Aroclor 1248		<1600	<1400	<900	<1000	<910	<880	<880	<910	<920	<80
Aroclor 1254		<3100	<2900	<1800	<2000	<1800	<1800	<1800	<1800	<1800	<160
Aroclor 1260		8600	16000	<1800	<2000	<1800	<1800	<1800	<1800	<1800	<160

02[IL]KM6120/1492/0

Key at end of table.

Table 5-5 (Cont.)

Parameter	Sample Number:	90RRTS30SL G-9	90RRTS31SL G-10	90RRTS32SL G-11	90RRTS33SL G-12	90RRTS34SL G-13	90RRTS35SL G-14	90RRTS159SL G-15	90RRTS160SL G-16	90RRTS161SL G-17	90RRTS162SL G-18
	Location:	OTA	OTA	OTA	OTA	OTA	OTA	OTA	OTA	OTA	OTA
PCBs											
Aroclor 1016		<1100	<1100	<140	<15000	<14000	<11000	<840	<4200	<4200	<980
Aroclor 1221		<1100	<1100	<140	<15000	<14000	<11000	<840	<4200	<4200	<980
Aroclor 1232		<1100	<1100	<140	<15000	<14000	<11000	<840	<4200	<4200	<980
Aroclor 1242		<1100	<1100	<140	<15000	<14000	<11000	<840	<4200	<4200	<980
Aroclor 1248		<1100	<1100	<140	<15000	<14000	<11000	<840	<4200	<4200	<980
Aroclor 1254		<2100	<2100	<280	<30000	<28000	<23000	<1700	<8300	<8400	<2000
Aroclor 1260		<2100	<2100	<280	32000	25000(J)	37000	7300	<8300	<8400	<2000

02(IL)KM6120/1492/0

Key at end of table.

Table 5-5 (Cont.)

Parameter	Sample Number: Location:	90RRTS163SL G-19 OTA	90RRTS164SL G-20 OTA	90RRTS165SL G-20 OTA	90RRTS166SL G-20 OTA	90RRTS167SL G-21 OTA	90RRTS168SL G-22 OTA	90RRTS169SL G-23 OTA	90RRTS170SL G-24 OTA	90RRTS171SL G-25 OTA	90RRTS172SL G-26 OTA
PCBs											
Aroclor 1016		<1100	<1000	<930	<80	<880	<1000	<1000	<920	<1500	<120
Aroclor 1221		<1100	<1000	<930	<80	<880	<1000	<1000	<920	<1500	<120
Aroclor 1232		<1100	<1000	<930	<80	<880	<1000	<1000	<920	<1500	<120
Aroclor 1242		<1100	<1000	<930	<80	<880	<1000	<1000	<920	<1500	<120
Aroclor 1248		<1100	<1000	<930	<80	<880	<1000	<1000	<920	<1500	<120
Aroclor 1254		<2100	<2100	<1900	<160	<1800	<2000	<2000	<1800	<2900	<250
Aroclor 1260		<2100	<2100	<1900	<160	<1800	10000	<2000	<1800	<2900	<250

02[IL]KM6120/1492/0

Key at end of table.

recycled paper

Table 5-5 (Cont.)

Parameter	Sample Number: / Location:	90RRTS173SL G-27 OTA	90RRTS174SL G-28 OTA	90RRTS175SL G-29 OTA	90RRTS176SL G-30 OTA	90RRTS177SL G-30 OTA	90RRTS178SL G-30 OTA	90RRTS179SL G-31 OTA	90RRTS180SL G-32 OTA	90RRTS181SL G-33 OTA	90RRTS182SL C-1 OTA
PCBs											
Aroclor 1016		<900	<1400	<1100	<1300	<1300	<320	<950	<1200	<16000	<8800
Aroclor 1221		<900	<1400	<1100	<1300	<1300	<320	<950	<1200	<16000	<8800
Aroclor 1232		<900	<1400	<1100	<1300	<1300	<320	<950	<1200	<16000	<8800
Aroclor 1242		<900	<1400	<1100	<1300	<1300	<320	<950	<1200	<16000	<8800
Aroclor 1248		<900	<1400	<1100	<1300	<1300	<320	<950	<1200	<16000	<8800
Aroclor 1254		<1800	<2800	<2200	<2500	<2600	<320	<1900	<2400	<33000	<18000
Aroclor 1260		<1800	<2800	<2200	<2500	<2600	<320	15000	<2400	<33000	4500(J)

02[IL]KM6120/1492/0

Key at end of table.

Table 5-5 (Cont.)

Parameter	Sample Number: Location:	90RRTS183SL C-2 OTA	90RRTS184SL C-3 OTA	90RRTS185SL C-4 OTA	90RRTS186SL C-5 OTA	90RRTS187SL C-6 OTA	90RRTS188SL C-6 OTA	90RRTS189SL C-6 OTA	90RRTS190SL C-7 OTA	90RRTS191SL C-8 OTA	90RRTS192SL C-9 OTA
PCBs											
Aroclor 1016		<1000	<1000	<1000	<940	<910	<880	<80	<870	<98	<84
Aroclor 1221		<1000	<1000	<1000	<940	<910	<880	<80	<870	<98	<84
Aroclor 1232		<1000	<1000	<1000	<940	<910	<880	<80	<870	<98	<84
Aroclor 1242		<1000	<1000	<1000	<940	<910	<880	<80	<870	<98	<84
Aroclor 1248		<1000	<1000	<1000	<940	<910	<880	<80	<870	<98	<84
Aroclor 1254		<2000	<2100	<2000	<1900	2500	<1800	985	<1700	<200	<170
Aroclor 1260		<2000	<2100	<2000	<1900	1700	<1800	290	<1700	<200	<170

02[IL]KM6120/1492/0

Key at end of table.

Table 5-5 (Cont.)

Parameter	Sample Number: Location:	90RRTS193SL G-26 OTA	90RRTS194SL G-29 OTA	90RRTS195SL G-34 TH	90RRTS196SL G-35 TH	90RRTS197SL G-36 TH	90RRTS198SL G-37 TH	90RRTS199SL G-38 TH	90RRTS200SL G-39 TH	90RRTS201SL G-40 TH	90RRTS202SL G-41 TH
PCBs											
Aroclor 1016				<870	<83	<83	<830	<890	<7300	<5800	<4300
Aroclor 1221				<870	<83	<83	<830	<890	<7300	<5800	<4300
Aroclor 1232				<870	<83	<83	<830	<890	<7300	<5800	<4300
Aroclor 1242				<870	<83	<83	<830	<890	<7300	<5800	<4300
Aroclor 1248				<870	<83	<83	<830	<890	<7300	<5800	<4300
Aroclor 1254				<1700	<170	<170	<1700	<1800	<15000	<12000	<8600
Aroclor 1260				<1700	<170	<170	<1700	<1800	<15000	<12000	<8600
BNAs											
Bis-(2ethylhexyl)phthalate		190(JB)	160(JB)								

02[IL]KM6120/1492/0

Key at end of table.

OUA 0000501

Table 5-5 (Cont.)

Parameter	Sample Number:	90RRTS203SL	90RRTS204SL	90rRTS205SL	90RRTS206SL	90RRTS207SL	90RRTS208SL	90RRTS209SL	90RRTS210SL	90RRTS211Sl	90RRTS212SL
		G-42	G-43	G-44	G-45	G-46	G-47	G-48	G-49	G-49	G-49
	Location:	TH	TH	TH	TH	TH	TH	TH	TH	TH	TH
PCBs											
Aroclor 1016		<820	<1000	<920	<830	<980	<85	<850	<83	<86	<80
Aroclor 1221		<820	<1000	<920	<830	<980	<85	<850	<83	<86	<80
Aroclor 1232		<820	<1000	<920	<830	<980	<85	<850	<83	<86	<80
Aroclor 1242		<820	<1000	<920	<830	<980	<85	<850	<83	<86	<80
Aroclor 1248		<820	<1000	<920	<830	<980	<85	<850	<83	<86	<80
Aroclor 1254		<1600	<2100	<1800	<1700	<2000	<170	<1700	<170	<170	<160
Aroclor 1260		<1600	<2100	<1800	<1700	<2000	<170	<1700	210	<170	517

02[IL]KM6120/1492/0

Key at end of table.

Table 5-5 (Cont.)

Parameter	Sample Number: / Location:	90RRTS213SL G-50 TH	90RRTS214SL G-51 TH	90RRTS215SL G-52 TH	90RRTS216SL G-53 TH	90RRTS217SL G-53 TH	90RRTS218SL G-53 TH	90RRTS219SL G-54 TH	90RRTS220SL G-54 TH	90RRTS221SL G-54 TH	90RRTS222SL G-55 TH
PCBs											
Aroclor 1016		<870	<830	<83	<84	<85	<80	<90	<92	<80	<850
Aroclor 1221		<870	<830	<83	<84	<85	<80	<90	<92	<80	<850
Aroclor 1232		<870	<830	<83	<84	<85	<80	<90	<92	<80	<850
Aroclor 1242		<870	<830	<83	<84	<85	<80	<90	<92	<80	<850
Aroclor 1248		<870	<830	<83	<84	<85	<80	<90	<92	<80	<850
Aroclor 1254		<1700	<1700	<170	<170	<170	<160	<180	<180	<160	<1700
Aroclor 1260		<1700	<1700	<170	280	130(J)	<160	<180	<180	<160	<1700

02[IL]KM6120/1492/0

Key at end of table.

Table 5-5 (Cont.)

Parameter	Sample Number: Location:	90RRTS223SL G-56 TH	90RRTS224SL G-57 TH	90RRTS225SL G-58 TH	90RRTS226SL G-59 TH	90RRTS227SL G-60 TH	90RRTS228SL G-61 TH	90RRTS229SL G-62 TH	90RRTS230SL G-63 TH	90RRTS231SL G-64 TH	90RRTS232SL G-65 TA
PCBs											
Aroclor 1016		<830	<840	<840	<860	<85	<900	<110	<890	<1600	<980
Aroclor 1221		<830	<840	<840	<860	<85	<900	<110	<890	<1600	<980
Aroclor 1232		<830	<840	<840	<860	<85	<900	<110	<890	<1600	<980
Aroclor 1242		<830	<840	<840	<860	<85	<900	<110	<890	<1600	<980
Aroclor 1248		<830	<840	<840	<860	<85	<900	<110	<890	<1600	<980
Aroclor 1254		<1700	<1700	<1700	<1700	<170	<1800	<210	<1800	<3300	<2000
Aroclor 1260		<1700	<1700	<1700	<1700	<170	<1800	<210	<1800	7300	8000

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Key at end of table.

Table 5-5 (Cont.)

Parameter	Sample Number:	90RRTS233SL G-66	90RRTS234SL G-67	90RRTS235SL G-68	90RRTS236SL G-69	90RRTS237SL G-70	90RRTS238SL G-71	90RRTS239SL G-72	90RRTS240SL G-73	90RRTS241SL G-74	90RRTS242SL G-75
	Location:	TA	TA	TA	TA	TA	TA	TA	TA	TA	TA
PCBs											
Aroclor 1016		<1500	<910	<86	<900	<820	<82	<86	<850	<960	<890
Aroclor 1221		<1500	<910	<86	<900	<820	<82	<86	<850	<960	<890
Aroclor 1232		<1500	<910	<86	<900	<820	<82	<86	<850	<960	<890
Aroclor 1242		<1500	<910	<86	<900	<820	<82	<86	<850	<960	<890
Aroclor 1248		<1500	<910	<86	<900	<820	<82	<86	<850	<960	<890
Aroclor 1254		<3000	<1800	<170	<1800	<1600	<160	<170	<1700	<1900	<1800
Aroclor 1260		5500	1300(J)	370	<1800	1900	980	240	2300	1200(J)	740(J)

02[IL]KM6120/1492/0

Key at end of table.

Table 5-5 (Cont.)

Parameter	Sample Number:	90RRTS243SL	90RRTS244SL	90RRTS245SL	90RRTS246SL	90RRTS247SL	90RRTS248SL	90RRTS249SL	90RRTS250SL	90RRTS251SL	90RRTS252SL
		G-76	G-77	G-78	G-78	G-78	G-79	G-80	G-81	G-82	G-83
	Location:	TA	TA	TA	TA	TA	TA	TA	TA	TA	TA
PCBs											
Aroclor 1016		<89	<830	<820	<820	<80	<870	<850	<85	<1700	<930
Aroclor 1221		<89	<830	<820	<820	<80	<870	<850	<85	<1700	<930
Aroclor 1232		<89	<830	<820	<820	<80	<870	<850	<85	<1700	<930
Aroclor 1242		<89	<830	<820	<820	<80	<870	<850	<85	<1700	<930
Aroclor 1248		<89	<830	<820	<820	<80	<870	<850	<85	<1700	<930
Aroclor 1254		<180	<1700	<1700	<1600	<160	<1700	<1700	<170	<3300	<1900
Aroclor 1260		270	<1700	1100(J)	2600	3658	450(J)	540(J)	310	55000	950(J)

02[IL]KM6120/1492/0

Key at end of table.

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Table 5-5 (Cont.)

Parameter	Sample Number: / Location:	90RRTS253SL G-84	90RRTS254SL G-85	90RRTS255SL G-86	90RRTS256SL G-87	90RRTS257SL G-88	90RRTS258SL G-89	90RRTS259SL G-89	90RRTS260SL G-89	90RRTS261SL G-90	90RRTS309SL C-10
		TA	TA	TA	TA	TA	TA	TA	TA	TA	TA
PCBs											
Aroclor 1016		<890	<88	<870	<930	<94	<850	<86	<80	<9500	<920
Aroclor 1221		<890	<88	<870	<930	<94	<850	<86	<80	<9500	<920
Aroclor 1232		<890	<88	<870	<930	<94	<850	<86	<80	<9500	<920
Aroclor 1242		<890	<88	<870	<930	<94	<850	<86	<80	<9500	<920
Aroclor 1248		<890	<88	<870	<930	<94	<850	<86	<80	<9500	<920
Aroclor 1254		<1800	<180	<1700	<1900	<190	<1700	<170	<160	<19000	<1800
Aroclor 1260		2800	490	1500(J)	570(J)	1700	1400(J)	770	894	79000	710(J)

02(IL)KM6120/1492/0

Key at end of table.

ecology and environment

OUA 0000507

Table 5-5 (Cont.)

Parameter	Sample Number: / Location:	90RRTS310SL C-11 TA	90RRTS311S1 C-12 TA	90RRTS312SL C-13 TA	90RRTS313SL C-14 TA	90RRTS314SL C-15 TA	90RRTS315SL C-16 TA	90RRTS316SL C-17 TA	90RRTS317SL C-18 TA	90RRTS318SL C-19 TA	90RRTS319SL C-20 TA
PCBs											
Aroclor 1016		<1200	<130	<1100	<980	<1000	<1100	<92	<950	<180	<500
Aroclor 1221		<1200	<130	<1100	<980	<1000	<1100	<92	<950	<180	<500
Aroclor 1232		<1200	<130	<1100	<980	<1000	<1100	<92	<950	<180	<500
Aroclor 1242		<1200	<130	<1100	<980	<1000	<1100	<92	<950	<180	<500
Aroclor 1248		<1200	<130	<1100	<980	<1000	<1100	<92	<950	<180	<500
Aroclor 1254		<2400	<250	<2100	<2000	<2100	<2200	<180	<1900	<350	<1000
Aroclor 1260		2400	390	8200	4300	4100	760(J)	1400	3000	420	310(J)

02[IL]KM6120/1492/0

Key at end of table.

Table 5-5 (Cont.)

Parameter	Sample Number: / Location:	90RRTS320SL C-21	90RRTS321SL C-22	90RRTS322SL C-23	90RRTS323SL C-23	90RRTS324S1 C-23	90RRTS325SL C-24	90RRTS326SL G-91	90RRTS327SL G-91	90RRTS328SL G-91	90RRTS329SL G-92
		TA	TA	TA	TA	TA	TA	TA	TA	TA	TA
PCBs											
Aroclor 1016		<95	<96	<83	<83	<30	<320,000	<110	<110	<80	<10,000
Aroclor 1221		<95	<96	<83	<83	<30	<320,000	<110	<110	<80	<10,000
Aroclor 1232		<95	<96	<83	<83	<30	<320,000	<110	<110	<80	<10,000
Aroclor 1242		<95	<96	<83	<83	<30	<320,000	<110	<110	<80	<10,000
Aroclor 1248		<95	<96	<83	<83	<30	<320,000	<110	<110	<80	<10,000
Aroclor 1254		<190	<190	<170	<170	<30	<640,000	<230	<230	<160	<20,000
Aroclor 1260		410	1300	110(J)	74(J)	88.7	3,300,000	730	200(J)	2536	5000(J)

02[IL]KM6120/1492/0

Key at end of table.

Table 5-5 (Cont.)

Parameter	Sample Number: / Location:	90RRTS330SL G-93 TA	90RRTS331SL G-94 TA	90RRTS332SL G-95 TA	90RRTS333SL G-96 TA	90RRTS339SL G-97 TA	90RRTS340SL G-98 TA	90RRTS341SL G-98 TA	90RRTS342SL G-98 TA	90RRTS343SL G-99 TA	90RRTS344SL G-100 TA
PCBs											
Aroclor 1016		<10,000	<1000	<980	<1100	<88	<200	<1100	<80	<230	<99
Aroclor 1221		<10,000	<1000	<980	<1100	<88	<200	<1100	<80	<230	<99
Aroclor 1232		<10,000	<1000	<980	<1100	<88	<200	<1100	<80	<230	<99
Aroclor 1242		<10,000	<1000	<980	<1100	<88	<200	<1100	<80	<230	<99
Aroclor 1248		<10,000	<1000	<980	<1100	<88	<200	<1100	<80	<230	<99
Aroclor 1254		<21000	<2100	<2000	<2100	<180	<400	<2200	<160	<450	<200
Aroclor 1260		32000	2500	500(J)	850(J)	140(J)	<400	340(J)	922	740	210
BNAs											
Bis-(2ethylhexyl)phthalate			450(B)								

02[IL]KM6120/1492/0

Key at end of table.

Table 5-5 (Cont.)

Parameter	Sample Number: Location:	90RRTS345SL G-101 PH	90RRTS346SL G-102 PH	90RRTS347SL G-103 PH	90RRTS348SL G-104 PH	90RRTS349SL G-105 PH	90RRTS350SL G-106 PH	90RRTS351SL G-107 PH	90RRTS352SL G-108 PH	90RRTS353SL G-109 PH	90RRTS354SL G-110 PH
PCBs											
Aroclor 1016		<230	<290	<220	<95	<99	<1200	<180	<960	<1000	<90
Aroclor 1221		<230	<290	<220	<95	<99	<1200	<180	<960	<1000	<90
Aroclor 1232		<230	<290	<220	<95	<99	<1200	<180	<960	<1000	<90
Aroclor 1242		<230	<290	<220	<95	<99	<1200	<180	<960	<1000	<90
Aroclor 1248		<230	<290	<220	<95	<99	<1200	<180	<960	<1000	<90
Aroclor 1254		<460	<570	<440	<190	<200	<2500	<360	<1900	<2100	<180
Aroclor 1260		800	870	350(J)	<190	<200	420(J)	460	210(J)	390(J)	3700

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Key at end of table.

Table 5-5 (Cont.)

Parameter	Sample Number:	90RRTS355SL	90RRTS356SL	90RRTS357SL	90RRTS358SL	90RRTS359SL	90RRTS360SL	90RRTS361SL	90RRTS362SL	90RRTS363SL	90RRTS364SL
		G-110	G-110	G-111	G-112	G-113	G-113	G-113	G-114	G-115	G-116
	Location:	PH	PH	PH	PH	PH	PH	PH	PH	PH	PH
PCBs											
Aroclor 1016		<180	<800	<890	<800	<950	<91	<80	<1400	<990	<130
Aroclor 1221		<180	<800	<890	<800	<950	<91	<80	<1400	<990	<130
Aroclor 1232		<180	<800	<890	<800	<950	<91	<80	<1400	<990	<130
Aroclor 1242		<180	<800	<890	<800	<950	<91	<80	<1400	<990	<130
Aroclor 1248		<180	<800	<890	<800	<950	<91	<80	<1400	<990	<130
Aroclor 1254		<360	<1600	<1800	<1600	<1900	<180	<160	<2800	<2000	<260
Aroclor 1260		4100	19220	12000	<1600	850(J)	820	3520	100000	59000	<260

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Key at end of table.

Table 5-5 (Cont.)

Parameter	Sample Number: Location:	90RRTS365SL G-117 PH	90RRTS366SL G-118 PH	90RRTS367SL G-119 PH	90RRTS368SL G-120 PH	90RRTS369SL G-121 PH	90RRTS370SL G-122 NEB	90RRTS371SL G-123 NEB	90RRTS372SL G-124 NEB	90RRTS373SL G-125 NEB	90RRTS374SL G-126 NEB
PCBs											
Aroclor 1016		<920	<1400	<110	<9000	<1000	<1500	<12000	<9400	<12000	<990
Aroclor 1221		<920	<1400	<110	<9000	<1000	<1500	<12000	<9400	<12000	<990
Aroclor 1232		<920	<1400	<110	<9000	<1000	<1500	<12000	<9400	<12000	<990
Aroclor 1242		<920	<1400	<110	<9000	<1000	<1500	<12000	<9400	<12000	<990
Aroclor 1248		<920	<1400	<110	<9000	<1000	<1500	<12000	<9400	<12000	<990
Aroclor 1254		<1800	<2800	<220	<18000	<2000	<3000	<25000	<19000	<25000	<2000
Aroclor 1260		<1800	<2800	<220	35000	4600	1400(J)	30000	5800(J)	12000(J)	730(J)

02[IL]KM6120/1492/0

Key at end of table.

Table 5-5 (Cont.)

Parameter	Sample Number: Location:	90RRTS375SL G-127 NEB	90RRTS376SL G-127 NEB	90RRTS377SL G-127 NEB	90RRTS378SL G-128 NEB	90RRTS379SL G-129 NEB	90RRTS380SL G-130 NEB	90RRTS381SL G-130 NEB	90RRTS382SL G-130 NEB	90RRTS383SL G-131 NEB	90RRTS384SL G-132 (Re-veg)
PCBs											
Aroclor 1016		<8600	<8500	NA	<8900	<950	<840	<840	<80	<8800	<890
Aroclor 1221		<8600	<8500	NA	<8900	<950	<840	<840	<80	<8800	<890
Aroclor 1232		<8600	<8500	NA	<8900	<950	<840	<840	<80	<8800	<890
Aroclor 1242		<8600	<8500	NA	<8900	<950	<840	<840	<80	<8800	<890
Aroclor 1248		<8600	<8500	NA	<8900	<950	<840	<840	<80	<8800	<890
Aroclor 1254		<17000	<17000	NA	<18000	<1900	<1700	<1700	<160	<18000	<1800
Aroclor 1260		2200(J)	2700(J)	NA	59000	2800	1200(J)	350(J)	1241	11000(J)	<1800
BNAs											
Bis(2ethylhexyl)phthalate		420(B)	430(B)								320(JB)
Revegetation Inorganics (mg/kg)											
Ammonia-N											27
Nitrate											7.5
Total Phosphorous											140
pH											5.3

02[IL]KM6120/1492/0

Key at end of table.

Table 5-5 (Cont.)

Parameter	Sample Number: Location:	90RRTS385SL G-133 SG	90RRTS386SL G-134 SG	90RRTS387SL G-135 SG	90RRTS388SL G-136 SG	90RRTS389SL G-137 SG	90RRTS390SL G-138 SG	90RRTS391SL G-139 SG	90RRTS392SL G-139 SG	90RRTS393SL G-139 SG	90RRTS394SL G-140 SG
PCBs											
Aroclor 1016		<900	<950	<18000	<560	<920	<880	<930	<94	<80	<1000
Aroclor 1221		<900	<950	<18000	<560	<920	<880	<930	<94	<80	<1000
Aroclor 1232		<900	<950	<18000	<560	<920	<880	<930	<94	<80	<1000
Aroclor 1242		<900	<950	<18000	<560	<920	<880	<930	<94	<80	<1000
Aroclor 1248		<900	<950	<18000	<560	<920	<880	<930	<94	<80	<1000
Aroclor 1254		<1800	<1900	<37000	<1100	<1800	<1800	<1900	<190	<160	<2100
Aroclor 1260		<1800	<1900	43000	<1100	530(J)	390(J)	540(J)	1100	1898	570(J)
BNAs											
Bis-(2ethylhexyl)phthalate		900(B)				420(JB)					
Benzyl Alcohol						110(J)					
Benzoic Acid						95(J)					

02[IL]KM6120/1492/0

Key at end of table.

Table 5-5 (Cont.)

Parameter	Sample Number: Location:	90RRTS395SL G-141 SG	90RRTS396SL G-142 SG	90RRTS397SL G-143 SG	90RRTS398SL G-144 SG	90RRTS399SL G-145 SG	90RRTS400SL G-146 SG	90RRTS401SL G-147 SG	90RRTS402SL G-148 SG	90RRTS403SL G-148 SG	90RRTS404SL G-148 SG
PCBs											
Aroclor 1016		<900	<950	<1200	<1800	<1900	<84	<87	<820	<820	<80
Aroclor 1221		<900	<950	<1200	<1800	<1900	<84	<87	<820	<820	<80
Aroclor 1232		<900	<950	<1200	<1800	<1900	<84	<87	<820	<820	<80
Aroclor 1242		<900	<950	<1200	<1800	<1900	<84	<87	<820	<820	<80
Aroclor 1248		<900	<950	<1200	<1800	<1900	<84	<87	<820	<820	<80
Aroclor 1254		<1800	<1900	<2500	<3500	<3700	<170	<170	<1600	<1600	<160
Aroclor 1260		760(J)	3500	<2500	<3500	<3700	<170	<170	<1600	<1600	<160
BNAs											
Fluoranthene					1300(J)	2500					
Pyrene					3200(J)	9900					
Chrysene					1300(J)	2700					
Bis(2ethylhexyl)phthalate				5800(B)	3500(B)						
Benzo(b)fluoranthene				2000(J)							
Benzo(K)fluoranthene					3400						

02[IL]KM6120/1492/0

Key at end of table.

Table 5-5 (Cont.)

Parameter	Sample Number: / Location:	90RRTS405SL G-149	90RRTS406SL G-150	90RRTS407SL G-151	90RRTS408SL G-152	90RRTS409SL G-153	90RRTS410SL G-154	90RRTS411SL G-155	90RRTS412SL Recovery Drum	90RRTS413SG G-156	90RRTS414SG G-157
		SG	SG	SG	SG	SG	SG	SG		S-1	S-2
PCBs											
Aroclor 1016		<840	<85	<93	<880	<99	<90	<850	<8000	<190	<1500
Aroclor 1221		<840	<85	<93	<880	<99	<90	<850	<8000	<190	<1500
Aroclor 1232		<840	<85	<93	<880	<99	<90	<850	<8000	<190	<1500
Aroclor 1242		<840	<85	<93	<880	<99	<90	<850	<8000	<190	<1500
Aroclor 1248		<840	<85	<93	<880	<99	<90	<850	<8000	<190	<1500
Aroclor 1254		<1700	<170	<190	<1800	<200	<180	<1700	<16000	<380	<3100
Aroclor 1260		<1700	<170	<190	<1800	97(J)	<180	3100	286400	<380	5600
BNAs											
4-Methylphenol										360(J)	65000
Naphthalene										40(J)	—
2-Methylnaphthalene									54(J)	8300	
Acenaphthene										540	—
Fluorene										510	2600(J)
Phenanthrene										3100	13000
Anthracene										910	—
Fluoranthene										3700	7100
Pyrene										3600	6700
Benzo(a)anthracene									2100	—	
Chrysene										2400	—
Benzo(k)Fluoranthene									2900	—	
Benzo(a)pyrene										1800	—
Indeno(1,2,3-cd)pyrene									1000	—	
Benzo(g,h,i)perylene									1100	—	
Dibenzofuran										170(J)	1100(J)

02[IL]KM6120/1492/0

Key at end of table.

Table 5-5 (Cont.)

Parameter / Sample Number:	90RRTS405SL	90RRTS406SL	90RRTS407SL	90RRTS408SL	90RRTS409SL	90RRTS410SL	90RRTS411SL	90RRTS412SL	90RRTS413SG	90RRTS414SG
	G-149	G-150	G-151	G-152	G-153	G-154	G-155	Recovery Drum	G-156	G-157
Location:	SG	SG	SG	SG	SG	SG	SG		S-1	S-2
VOAs										
Methylene Chloride								29(B)	7100(B)	
1,1-Dichloroethane								--	10000	
Chloroform									8(B)	62000(E)
1,2-Dichloroethane								--	2700	
1,1,1-Trichloroethane								--	32000	
Trichloroethene									--	250000(E)
Tetrachloroethene								9	2200	
Toluene									--	9500
Ethylbenzene									--	1500
M-Xylene									--	6300
O & P Xylene									--	5500
Inorganics (mg/kg)										
Antimony									<1.6	<2.5
Arsenic									5.3	4.2
Barium									46	320
Beryllium									1.2	1.8
Cadmium									5.4	7.5
Chromium									27	46
Copper									30	340
Lead									12	800
Mercury									0.093	5.9
Nickel									25	36
Selenium									<1.2	<1.8
Silver									<2.4	11
Thallium									<1.2	<1.8
Zinc									300	630
% Solids									85	52

02[IL]KM6120/1492/0

Key at end of table.

Table 5-5 (Cont.)

Parameter	Sample Number: 90RRTS415SG S-2	90RRTS416SG S-2	90RRTS417SG S-3
PCBs			
Aroclor 1016	<1500	<80	<2500
Aroclor 1221	<1500	<80	<2500
Aroclor 1232	<1500	<80	<2500
Aroclor 1242	<1500	<80	<2500
Aroclor 1248	<1500	<80	<2500
Aroclor 1254	<3100	<160	<5000
Aroclor 1260	4600	4183	5000
BNAs			
Phenanthrene			5900(J)
Fluoranthene			8800(J)
Pyrene			5900(J)
Benzo(a)anthracene			6100(J)
Chrysene			6900(J)
Bis(2ethylhexyl)phthalate			3300(JB)
Benzo(a)pyrene			5700(J)
VOAs			
Chloroethane	34		
Methylene Chloride	3100(BE)	9000(B)	110(B)
Acetone	840(E)		
Carbon Disulfide	270		
1,1-Dichloroethene	320	19320	550
1,1-Dichloroethane	8000(E)	19400	100
1,2-Dichloroethene(total)	810(E)		
Chloroform	11000(E)		640(BE)
1,2-Dichloroethane	1500(E)		36
1,1,1-Trichloroethane	11000(E)	35800	110
cis-1,3-Dichloropropene	46		
Trichloroethene	9900(E)	388800	5400(E)
Tetrachloroethene	730(E)		
1,1,2,2-Tetrachloroethane	130		
Toluene	3300(E)	9800(J)	520
Ethylbenzene	260		
M-Xylene	1300(E)		
O & P Xylene	1000(E)		
Total Xylenes		10600(J)	

02[IL]KM6120/1492/0

Key at end of table.

Table 5-5 (Cont.)

Parameter	Sample Number:	90RRTS415SG S-2	90RRTS416SG S-2	90RRTS417SG S-3
Inorganics (mg/kg)				
Antimony		3.8	<12	8.2
Arsenic		3.8	8.2	10
Barium		240	490	2700
Beryllium		<1.8	<1	<3.1
Cadmium		6.6	4.7	32
Chromium		34	45	82
Copper		340	194	1100
Lead		820	739	1200
Mercury		8.4	6.9	110
Nickel		32	44	36
Selenium		<1.7	<1	<3.5
Silver		<3.5	3.3	31
Thallium		<1.7	<2	<3.1
Zinc		760	555	2000
% Solids		52		32

02[IL]KM6120/1492/0

Key:

(B) = The material was deleted in the blanks.
(J) = The associate numerical value is an estimated quantity. Presence of the material is reliable.

Table 5-6

WIPE SAMPLING ANALYTICAL RESULTS
ROOSEVELT ROAD TRANSMITTER SITE
ANCHORAGE, ALASKA
CONTRACT NO. DACA85-88-D-0014
DELIVERY ORDER NO. 12
(RESULTS IN µg/kg, µg/100 cm^2)

Sample Number:	90RRTS01WS W-1	90RRTS02WS W-2	90RRTS03WS W-31	90RRTS04WS W-4	90RRTS05WS W-5	90RRTS06WS W-6	90RRTS07WS W-7	90RRTS08WS W-3	90RRTS09WS W-3	90RRTS10WS W-8
Parameter Location:	TA	TA	TA	TA	TA	TA	TA	TA	TA	TH
PCBs										
Aroclor 1016	<0.50	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.50	<0.10	<0.50
Aroclor 1221	<0.50	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.50	<0.10	<0.50
Aroclor 1232	<0.50	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.50	<0.10	<0.50
Aroclor 1242	<0.50	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.50	<0.10	<0.50
Aroclor 1248	<0.50	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.50	<0.10	<0.50
Aroclor 1254	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.10	<1.0
Aroclor 1260	1.9	5.4	1.2	4.1	<1.0	<1.0	<1.0	<1.0	<0.10	<1.0

02[IL]KM6120/1493/0

Table 5-6 (Cont.)

Parameter	Sample Number: Location:	90RRTS11WS W-9 TH	90RRTS12WS W-9 TH	90RRTS13WS W-9 TH	90RRTS14WS W-10 TH	90RRTS15WS W-11 TH	90RRTS16WS W-12 PH	90RRTS17WS W-13 PH	90RRTS18WS W-21-702 Blank	90RRTS19WS W-21-702 Blank
PCBs										
Aroclor 1016		<0.50	<0.50	<0.10	<0.50	<0.50	<0.50	<0.50	<0.50	<0.10
Aroclor 1221		<0.50	<0.50	<0.10	<0.50	<0.50	<0.50	<0.50	<0.50	<0.10
Aroclor 1232		<0.50	<0.50	<0.10	<0.50	<0.50	<0.50	<0.50	<0.50	<0.10
Aroclor 1242		<0.50	<0.50	<0.10	<0.50	<0.50	<0.50	<0.50	<0.50	<0.10
Aroclor 1248		<0.50	<0.50	<0.10	<0.50	<0.50	<0.50	<0.50	<0.50	<0.10
Aroclor 1254		<1.0	<1.0	<0.10	<1.0	<1.0	20	39	<1.0	<0.10
Aroclor 1260		<1.0	<1.0	1.45	<1.0	3.9(J)	<1.0	<1.0	<1.0	<0.10

02[IL]KM6120/1493/0

Table 5-6 (Cont.)

Parameter	Sample Number: / Location:	90RRTS262WS BW-1 Bunker	90RRTS266WS BW-2 Bunker	90RRTS268WS BW-3 Bunker	90RRTS270WS BW-5 Bunker	90RRTS271WS BBW-6 Bunker	90RRTS272WS BW-6 Bunker	90RRTS273WS BW-6 Bunker	90RRTS277WS BW-7 Bunker	90RRTS290WS BW-8 Bunker	90RRTS291WS BW-9 Bunker
PCBs											
Aroclor 1016		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.10	<0.50	<500	<5.0
Aroclor 1221		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.10	<0.50	<500	<5.0
Aroclor 1232		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.10	<0.50	<500	<5.0
Aroclor 1242		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.10	<0.50	<500	<5.0
Aroclor 1248		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.10	<0.50	<500	<5.0
Aroclor 1254		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.10	<1.0	<1000	<10.0
Aroclor 1260		9.9	2.6	1.0	2.0	8.1	8.4	25.10	1.6	200,000	410

02[IL]KM6120/1493/0

Table 5-6 (Cont.)

Parameter	Sample Number: Location:	90RRTS292WS BW-9 Bunker	90RRTS293WS BW-9 Bunker	90RRTS294WS BW-10 Bunker	90RRTS295WS BW-4 Bunker	90RRTS296WS BW-11 Bunker	90RRTS297WS BW-12 Bunker	90RRTS298WS BW-13 Bunker	90RRTS299WS BW-14 Bunker	90RRTS300WS BW-15 Bunker	90RRTS301WS BW-16 Bunker
PCBs											
Aroclor 1016		<5.0	<10.0	<500	<0.50	<0.50	<0.50	<5.0	<5.0	<0.50	<5.0
Aroclor 1221		<5.0	<10.0	<500	<0.50	<0.50	<0.50	<5.0	<5.0	<0.50	<5.0
Aroclor 1232		<5.0	<10.0	<500	<0.50	<0.50	<0.50	<5.0	<5.0	<0.50	<5.0
Aroclor 1242		<5.0	<10.0	<500	<0.50	<0.50	<0.50	<5.0	<5.0	<0.50	<5.0
Aroclor 1248		<5.0	<10.0	<500	<0.50	<0.50	<0.50	<5.0	<5.0	<0.50	<5.0
Aroclor 1254		<10.0	<10.0	<1000	<1.0	<1.0	<1.0	<10	<10	<1.0	<10
Aroclor 1260		630	1062	30,000	14	44	40	73	100	44	75

02[IL]KM6120/1493/0

Table 5-6 (Cont.)

Parameter	Sample Number: / Location:	90RRTS302WS BW-17 Bunker	90RRTS303WS BW-18 Bunker	90RRTS304WS BW-19 Bunker	90RRTS305WS BW-20 Bunker	90RRTS306WS BW-21 Bunker	90RRTS307WS BW-22 Bunker
PCBs							
Aroclor 1016		<5.0	<500	<50	<50	<40	<500
Aroclor 1221		<5.0	<500	<50	<50	<50	<500
Aroclor 1232		<5.0	<500	<50	<50	<50	<500
Aroclor 1242		<5.0	<500	<50	<50	<50	<500
Aroclor 1248		<5.0	<500	<50	<50	<50	<500
Aroclor 1254		<10	<1000	<100	<100	<100	<1000
Aroclor 1260		140	6300	4200	1700	540	25000

02[IL]KM6120/1493/0

Table 5-7

BOREHOLE SAMPLE ANALYTICAL RESULTS
ROOSEVELT ROAD TRANSMITTER SITE
ANCHORAGE, ALASKA
CONTRACT NO. DACA85-88-D-0014
DELIVERY ORDER NO. 12
(RESULTS IN µg/kg, ppb)

Parameter	Sample Number: / Location:	90RRTS36SL BH-1 0 - 1' TA	90RRTS37SL BH-1 4' - 6' TA	90RRTS38SL BH-1 10' - 12' TA	90RRTS39SL BH-1 10' - 12' TA	90RRTS40SL BH-1 10' - 12' TA	90RRTS41SL BH-1 14' - 16' TA	90RRTS42SL BH-1 19' - 21' TA	90RRTS43SL BH-1 24' - 26' TA	90RRTS44SL BH-2 0 - 3' TA	90RRTS45SL BH-2 3' - 5' TA
PCBs											
Aroclor 1016		<85	<84	<83	<82	<80	<87	<87	<84	<85	<86
Aroclor 1221		<85	<84	<83	<82	<80	<87	<87	<84	<85	<86
Aroclor 1232		<85	<84	<83	<82	<80	<87	<87	<84	<85	<86
Aroclor 1242		<85	<84	<83	<82	<80	<87	<87	<84	<85	<86
Aroclor 1248		<85	<84	<83	<82	<80	<87	<87	<84	<85	<86
Aroclor 1254		<170	<170	<170	<160	<160	<170	<170	<170	<170	<170
Aroclor 1260		<170	83(J)	<170	<160	<160	<170	<170	<170	<170	<170

02[IL]KM6120/1494/0

Key at end of table.

Table 5-7 (Cont.)

Parameter	90RRTS46SL BH-2 5' - 7' TA	90RRTS47SL BH-2 7' - 10' TA	90RRTS48SL BH-2 10' - 16' TA	90RRTS49SL BH-2 16' - 20' TA	90RRTS50SL BH-3 0 - 3' TA	90RRTS51SL BH-3 3' - 5' TA	90RRTS52SL BH-3 5' - 8' TA	90RRTS53Sl BH-3 5' - 8' TA	90RRTS54SL BH-3 5' - 8' TA
PCBs									
Aroclor 1016	<83	<84	<88	<83	<85	<88	<85	<80	<83
Aroclor 1221	<83	<84	<88	<83	<85	<88	<85	<80	<83
Aroclor 1232	<83	<84	<88	<83	<85	<88	<85	<80	<83
Aroclor 1242	<83	<84	<88	<83	<85	<88	<85	<80	<83
Aroclor 1248	<83	<84	<88	<83	<85	<88	<85	<80	<83
Aroclor 1254	<170	<170	<180	<170	<170	3600	2000	<160	1900
Aroclor 1260	180	1400	140(J)	100(J)	190(J)	3600	1800	5397	1800
BNAs									
1,2,4 Trichlorobenzene						500			

02[IL]KM6120/1494/0

Key at end of table.

Table 5-7 (Cont.)

Parameter	Sample Number: Location:	90RRTS55SL BH-3 8' - 11' TA	90RRTS56SL BH-4 0 - 2' TA	90RRTS57SL BH-4 2' - 4' TA	90RRTS58SL BH-4 2' - 4' TA	90RRTS59SL BH-4 2' - 4' TA	90RRTS60SL BH-4 4' - 6' TA	90RRTS61SL BH-4 6' - 11' TA	90RRTS62SL BH-5 0 - 2' TA	90RRTS63SL BH-5 2' - 4' TA
PCBs										
Aroclor 1016		<83	<86	<86	<85	<80	<86	<84	<100	<88
Aroclor 1221		<83	<86	<86	<85	<80	<86	<84	<100	<88
Aroclor 1232		<83	<86	<86	<85	<80	<86	<84	<100	<88
Aroclor 1242		<83	<86	<86	<85	<80	<86	<84	<100	<88
Aroclor 1248		<83	<86	<86	<85	<80	<86	<84	<100	<88
Aroclor 1254		<170	<170	<170	<170	<160	<170	<170	<210	<180
Aroclor 1260		160(J)	940	1100	1000	1425	840	200	270	330

02[IL]KM6120/1494/0

Key at end of table.

Table 5-7 (Cont.)

Parameter	Sample Number: / Location:	90RRTS64SL BH-6 0 - 2' TA	90RRTS65SL BH-6 2' - 4' TA	90RRTS66SL BH-6 4' - 6' TA	90RRTS67SL BH-6 4' - 6' TA	90RRTS68SL BH-6 4' - 6' TA	90RRTS69SL BH-6 6' - 10' TA	90RRTS70SL BH-6 10' - 15' TA	90RRTS71SL BH-6 15' - 20' TA	90RRTS72SL BH-6 20' - 29' TA
PCBs										
Aroclor 1016		<87	<85	<85	<86	<80	<83	<120	<84	<84
Aroclor 1221		<87	<85	<85	<86	<80	<83	<120	<84	<84
Aroclor 1232		<87	<85	<85	<86	<80	<83	<120	<84	<84
Aroclor 1242		<87	<85	<85	<86	<80	<83	<120	<84	<84
Aroclor 1248		<87	<85	<85	<86	<80	<83	<120	<84	<84
Aroclor 1254		<170	<170	<170	<170	<160	<170	<230	<170	<170
Aroclor 1260		1800	42(J)	150(J)	43(J)	199	<170	<230	<170	<170
BNAs										
1,2,4-Trichlorobenzene			110(J)							
Di-n-butylphthalate			11(J)							
Bis(2ethylhexyl)phthalate			350(JB)							

02(IL]KM6120/1494/0

Key at end of table.

Table 5-7 (Cont.)

Parameter	Sample Number: Location:	90RRTS73SL BH-7 0 - 2' TA	90RRTS74SL BH-7 4' - 6' TA	90RRTS75SL BH-7 8' - 10' TA	90RRTS76SL BH-7 10' - 16' TA	90RRTS77SL BH-7 10' - 16' TA	90RRTS78SL BH-7 10' - 16' TA	90RRTS79SL BH-7 16' - 21' TA	90RRTS80SL BH-8 0 - 2' TA	90RRTS81SL BH-8 0 - 2' TA
PCBs										
Aroclor 1016		<87	<8600	<850	<100	<86	<30	<85	<43,000	NA
Aroclor 1221		<87	<8600	<850	<100	<86	<30	<85	<43,000	NA
Aroclor 1232		<87	<8600	<850	<100	<86	<30	<85	<43,000	NA
Aroclor 1242		<87	<8600	<850	<100	<86	<30	<85	<43,000	NA
Aroclor 1248		<87	<8600	<850	<100	<86	<30	<85	<43,000	NA
Aroclor 1254		<170	<17,000	<1700	<200	<170	<30	<170	86,000	NA
Aroclor 1260		<170	22,000	1900	<200	<170	46.4	<170	1,900,000	NA
BNAs										
1,2,4-Trichlorobenzene			160							14,000(E)
Bis(2ethylhexyl)phthalate			190(JB)							190(JB)
1,4-Dichlorobenzene										22(J)
Hexachlorobenzene										35(J)

02(IL)KM6120/1494/0

Key at end of table.

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Table 5-7 (Cont.)

Parameter	Sample Number: Location:	90RRTS82SL BH-8 0 - 2' TA	90RRTS83SL BH-8 0 - 2' TA	90RRTS84SL BH-8 2' - 4' TA	90RRTS85SL BH-8 4' - 6' TA	90RRTS86SL BH-8 6' - 10' TA	90RRTS87SL BH-8 10' - 18' TA	90RRTS88SL BH-9 0 - 2' TA	90RRTS89SL BH-9 2' - 4' TA	90RRTS90SL BH-9 7' - 9' TA
PCBs										
Aroclor 1016				<43,000	<83	<85	<93	<8700	<42,000	<8400
Aroclor 1221				<43,000	<83	<85	<93	<8700	<42,000	<8400
Aroclor 1232				<43,000	<83	<85	<93	<8700	<42,000	<8400
Aroclor 1242				<43,000	<83	<85	<93	<8700	<42,000	<8400
Aroclor 1248				<43,000	<83	<85	<93	<8700	<42,000	<8400
Aroclor 1254				<87,000	<170	<170	<190	<17,000	<83,000	<17,000
Aroclor 1260				720,000	330	38(J)	32(J)	<17,000	450,000	<17,000
BNA										
1,2,4-Trichlorobenzene		5800(E)	22170						76,000(E)	
Bis(2ethylhexyl)phthalate		220(JB)								
1,2-Dichlorobenzene		110(J)	114(J)						850	
1,3-Dichlorobenzene									330(J)	
1,4-Dichlorobenzene		55(J)							270(J)	
Hexachlorobenzene									1100	
TICs										
Trichlorobenzene			6500							
Tetrachlorobenzene			13000							
Pentechlorobenzene			1500							
% Solids			94							

02[IL]KM6120/1494/0

Key at end of table.

Table 5-7 (Cont.)

Parameter	Sample Number: / Location:	90RRTS91SL BH-9 10' - 11' TA	90RRTS92SL BH-9 14' - 16' TA	90RRTS93SL BH-9 19' - 21' TA	90RRTS94SL BH-9 19' - 21' TA	90RRTS95SL BH-9 19' - 21' TA	90RRTS96SL BH-9 24' - 26' TA	90RRTS97SL BH-10 0 - 2' TA	90RRTS98SL BH-10 2' - 4' TA	90RRTS99SL BH-10 4' - 6' TA
PCBs										
Aroclor 1016		<8400	<830	<85	<85	<80	<84	<850	<8500	<850
Aroclor 1221		<8400	<830	<85	<85	<80	<84	<850	<8500	<850
Aroclor 1232		<8400	<830	<85	<85	<80	<84	<850	<8500	<850
Aroclor 1242		<8400	<830	<85	<85	<80	<84	<850	<8500	<850
Aroclor 1248		<8400	<830	<85	<85	<80	<84	<850	<8500	<850
Aroclor 1254		<17,000	<1700	<170	<170	<160	<170	<1700	<17000	<1700
Aroclor 1260		15,000(J)	980(J)	140(J)	110(J)	213	38(J)	7300	3100(J)	300(J)

02[IL]KM6120/1494/0

Key at end of table.

Table 5-7 (Cont.)

Parameter	Sample Number: / Location:	90RRTS100SL BH-10 9' - 11' TA	90RRTS101SL BH-10 14' - 16' TA	90RRTS102SL BH-10 19' - 21' TA	90RRTS103SL BH-10 22' - 23' TA	90RRTS104SL BH-10 29' - 30' TA	90RRTS105SL BH-11 0 - 2' TA	90RRTS106SL BH-11 3' - 4' TA	90RRTS107SL BH-11 4' - 6' TA
PCBs									
Aroclor 1016		<85	<8600	<8300	<8500	<8400	<83	<85	<84
Aroclor 1221		<85	<8600	<8300	<8500	<8400	<83	<85	<84
Aroclor 1232		<85	<8600	<8300	<8500	<8400	<83	<85	<84
Aroclor 1242		<85	<8600	<8300	<8500	<8400	<83	<85	<84
Aroclor 1248		<85	<8600	<8300	<8500	<8400	<83	<85	<84
Aroclor 1254		<170	<17,000	<17,000	<17,000	<17,000	<170	<170	<170
Aroclor 1260		<170	120,000(J)	170,000	510,000	120,000	39(J)	<170	160(J)
BNAs									
1,2,4-Trichlorobenzene		48(J)	850						
Hexachlorobenzene			490						
Bis(2ethylhexyl)phthalate		560(B)							

02[IL]KM6120/1494/0

Key at end of table.

Table 5-7 (Cont.)

Sample Number:	90RRTS108SL BH-11	90RRTS109SL BH-11	90RRTS110SL BH-11	90RRTS111SL BH-11	90RRTS112SL BH-11	90RRTS113SL BH-11	90RRTS114SL BH-11	90RRTS115SL BH-12	90RRTS116SL BH-12
Parameter Location:	7' - 9' TA	14' - 16' TA	19' - 21' TA	24' - 26' TA	24' - 26' TA	24' - 26' TA	28' - 30' TA	0 - 2' PH	2' - 4' PH
PCBs									
Aroclor 1016	<84	<87	<86	<83	<84	<80	<85	<980	<13,000
Aroclor 1221	<84	<87	<86	<83	<84	<80	<85	<980	<13,000
Aroclor 1232	<84	<87	<86	<83	<84	<80	<85	<980	<13,000
Aroclor 1242	<84	<87	<86	<83	<84	<80	<85	<980	<13,000
Aroclor 1248	<84	<87	<86	<83	<84	<80	<85	<980	<13,000
Aroclor 1254	<170	<170	<170	<170	<170	<160	<170	<2000	<26,000
Aroclor 1260	<170	43(J)	330	84(J)	140(J)	<160	120(J)	<2000	<26,000

02[IL]KM6120/1494/0

Key at end of table.

Table 5-7 (Cont.)

Parameter	Sample Number: / Location:	90RRTS117SL BH-12 4' - 6' PH	90RRTS118SL BH-13 0 - 4' PH	90RRTS119SL BH-13 1' - 4' PH	90RRTS120SL BH-13 4' - 6' PH	90RRTS121Sl BH-14 0 - 2' PH	90RRTS122SL BH-14 2' - 4' PH	90RRTS123Sl BH-14 4' - 6' PH	90RRTS124SL BH-15 0 - 2' PH	90RRTS125SL BH-15 4' - 6' PH
PCBs										
Aroclor 1016		<98	<92	<86	<83	<93	<81	<83	<980	<87
Aroclor 1221		<98	<92	<86	<83	<93	<81	<83	<980	<87
Aroclor 1232		<98	<92	<86	<83	<93	<81	<83	<980	<87
Aroclor 1242		<98	<92	<86	<83	<93	<81	<83	<980	<87
Aroclor 1248		<98	<92	<86	<83	<93	<81	<83	<980	<87
Aroclor 1254		<200	<180	<170	<170	<190	<160	<170	<2000	<170
Aroclor 1260		<200	<180	49(J)	<170	53(J)	<160	<170	1200(J)	74(J)

02[IL]KM6120/1494/0

Key at end of table.

Table 5-7 (Cont.)

Parameter	Sample Number: / Location:	90RRTS126SL BH-15 4' - 6' PH	90RRTS127SL BH-15 4' - 6' PH	90RRTS128SL BH-16 0 - 2' OTA	90RRTS129SL BH-16 2' - 4' OTA	90RRTS130SL BH-16 2' - 4' OTA	90RRTS131SL BH-16 2' - 4' OTA	90RRTS132SL BH-16 4' - 6' OTA	90RRTS133SL BH-16 8' - 10' OTA	90RRTS134SL BH-17 0 - 2' OTA
PCBs										
Aroclor 1016		<880	<80	<840	<1000	<1000	<800	<840	<83	<870
Aroclor 1221		<880	<80	<840	<1000	<1000	<800	<840	<83	<870
Aroclor 1232		<880	<80	<840	<1000	<1000	<800	<840	<83	<870
Aroclor 1242		<880	<80	<840	<1000	<1000	<800	<840	<83	<870
Aroclor 1248		<880	<80	<840	<1000	<1000	<800	<840	<83	<870
Aroclor 1254		<1800	<160	<1700	<2000	<2100	<1600	<1700	<170	<1700
Aroclor 1260		220(J)	<160	<1700	3200	4100	21,870	950(J)	<170	<1700

02[IL]KM6120/1494/0

Key at end of table.

Table 5-7 (Cont.)

Parameter / Sample Number: / Location:	90RRTS135SL BH-17 2' - 4' OTA	90RRTS136SL BH-17 4' - 6' OTA	90RRTS137SL BH-17 8' - 10' OTA	90RRTS138SL BH-18 0 - 2' OTA	90RRTS139SL BH-18 2' - 4' OTA	90RRTS140SL BH-18 4' - 6' OTA	90RRTS141SL BH-18 8' - 10' OTA	90RRTS142SL BH-19 0 - 2' OTA	90RRTS143SL BH-19 2' - 4' OTA
PCBs									
Aroclor 1016	<96	<86	<83	<1200	<850	<83	<83	<870	<92
Aroclor 1221	<96	<86	<83	<1200	<850	<83	<83	<870	<92
Aroclor 1232	<96	<86	<83	<1200	<850	<83	<83	<870	<92
Aroclor 1242	<96	<86	<83	<1200	<850	<83	<83	<870	<92
Aroclor 1248	<96	<86	<83	<1200	<850	<83	<83	<870	<92
Aroclor 1254	<190	<170	<170	<2500	<1700	<170	<170	<1700	<180
Aroclor 1260	170(J)	<170	<170	<2500	<1700	<170	<170	<1700	<180
BNAs									
Bis(2ethylhexyl)phthalate							170(JB)		
TPHs									
k-1 Kerosene							<52		
Gasoline							<52		
Diesel Fuel (as #2)							<52		
Jet Fuel (as Jct A)							<52		
Bunker Oil (as #6 Diesel)							<260		

02[IL]KM6120/1494/0

Key at end of table.

Table 5-7 (Cont.)

Parameter	Sample Number: / Location:	90RRTS144S1 BH-19 6' - 8' OTA	90RRTS145SL BH-19 8' - 10' OTA	90RRTS146SL BH-20 0 - 2' TH	90RRTS147SL BH-20 2' - 4' TH	90RRTS148SL BH-21 0 - 2' TH	90RRTS149SL BH-21 2' - 4' TH	90RRTS150SL BH-21 0 - 2' TH	90RRTS151SL BH-21 2' - 4' TH
PCBs									
Aroclor 1016		<83	<91	<850	<82	<850	<860	<860	<80
Aroclor 1221		<83	<91	<850	<82	<850	<860	<860	<80
Aroclor 1232		<83	<91	<850	<82	<850	<860	<860	<80
Aroclor 1242		<83	<91	<850	<82	<850	<860	<860	<80
Aroclor 1248		<83	<91	<850	<82	<850	<860	<860	<80
Aroclor 1254		<170	<180	<1700	<160	<1700	<1700	<1700	<160
Aroclor 1260		<170	<180	<1700	<160	<1700	<1700	<1700	<160
BNAs									
Bis(2ethylhexyl)phthalate						270(JB)	260(JB)		

02[IL]KM6120/1494/0

Key at end of table.

Table 5-7 (Cont.)

Parameter	Sample Number: Location:	90RRTS152SL BH-21 9' - 11' TH	90RRTS153SL BH-22 0 - 2' TH	90RRTS154SL BH-2 2' - 4' TH	90RRTS155SL BH-22 4' - 6' TH	90RRTS156SL BH-23 0 - 2' TH	90RRTS157SL BH-23 2' - 4' TH
PCBs							
Aroclor 1016		<82	<840	<840	<85	<830	<83
Aroclor 1221		<82	<840	<840	<85	<830	<83
Aroclor 1232		<82	<840	<840	<85	<830	<83
Aroclor 1242		<82	<840	<840	<85	<830	<83
Aroclor 1248		<82	<840	<840	<85	<830	<83
Aroclor 1254		<160	<1700	<1700	<170	<1700	<170
Aroclor 1260		<160	<1700	<1700	<170	<1700	<170

02[IL]KM6120/1494/0

Key:

(B) = The material was deleted in the blanks.

(J) = The associate numerical value is an estimated quantity. Presence of the material is reliable.

Table 5-8

RINSATE AND TRIP BLANK ANALYTICAL RESULTS
ROOSEVELT ROAD TRANSMITTER SITE
ANCHORAGE, ALASKA
CONTRACT NO. DACA85-88-D-0014
DELIVERY ORDER NO. 12
(RESULTS IN μg/kg, ppb)

Sample Number: / Location: / Parameter	W-21-702 18WS Matrix Blank	W-21-702 19WS Matrix Blank	90RRTS158WA Split-Spoon Rinsate	90RRTS335MI D-3 Hexane Rinsate	90RRTS336WA R-2 Spoon and Bowl Rinsate	90RRTS337WA R-2 Spoon and Bowl Rinsate	90RRTS338WA R-2 Spoon and Bowl Rinsate	90RRTS418WA Trip Blank	90RRTS419WA Trip Blank
PCBs									
Aroclor 1016	--	--	<0.71	NA	<0.71	<0.50	<0.50	NA	NA
Aroclor 1221	--	--	<0.71	NA	<0.71	<0.50	<0.50	NA	NA
Aroclor 1232	--	--	<0.71	NA	<0.71	<0.50	<0.50	NA	NA
Aroclor 1242	--	--	<0.71	NA	<0.71	<0.50	<0.50	NA	NA
Aroclor 1248	--	--	<0.71	NA	<0.71	<0.50	<0.50	NA	NA
Aroclor 1254	--	--	<1.4	NA	<1.4	<1.0	<1.0	NA	NA
Aroclor 1260	--	--	<1.4	NA	<1.4	<1.0	<1.0	NA	NA
BNAs									
Bis-(2ethylhexyl)phthalate	NA	NA	40(B)	NA	23(B)	NA	14(B)	NA	NA
VOAs									
Methylene Chloride	NA	NA	NA	NA	NA	NA	NA	18(B)	3(JB)
Chloroform	NA	NA	NA	NA	NA	NA	NA	45	--

02[IL]KM6120/1495/4

Key:

NA = Not analyzed for
-- = Not detected

Contaminant of Concern	Underground Bunker	Transmitter Annex	Original Transmitter Annex	Transformer Hut	Power Control Hut	Northeast Bunker Entrance	Site Grid	Cesspool Areas	Borehole Samples
VOCs (sampled for)	--	--	--	--	--	--	--	0 / ++	--
BNAs	0 / +	0 / +	0 / +	0 / +	--	--	0 / +	0 / +	0 / +
PCBs	0 / ++	0 / ++	0 / ++	0 / +	0 / +	0 / +	0 / +	0 / ++	0 / ++
Asbestos	0 / ++	0 / +	--	--	--	--	--	--	--
Dioxin	0 / ++	--	--	--	--	--	--	--	--
Metals	--	--	--	--	--	--	--	0 / ++	--

-- - Analysis not performed
0 - Samples analyzed for this set of targeted compounds
+ - Positive analytical result for a targeted analyte/compound in this group
++ - Positive analytical results for a targeted analyte/compound in this group at a value greater than a regulatory action level

Figure 5 - 1
SITE SAMPLING MATRIX
ROOSEVELT ROAD TRANSMITTER SITE
ANCHORAGE, ALASKA

6. BASELINE RISK ASSESSMENT

Asbestos, dioxin, VOA, BNA, PCB, and metal contaminants were identified at the Roosevelt Road Transmitter Site. The asbestos and dioxin contamination is confined inside the underground bunker, and, therefore, will not be subjected to environmental transport mechanisms. PCBs were detected in surface soil samples collected near the existing concrete foundations as well as in solid waste and wipe samples collected from inside the concrete bunker. Limited sampling was conducted for the VOA and BNA targeted compounds. Both VOA and BNA compounds were detected on site. Unfortunately, not enough samples were collected to determine the nature of the contamination (VOA) or its extent (VOA and BNA). VOA and BNA contamination was detected in soil samples collected from the cesspool area. BNAs were detected in surface and subsurface soils (borehole samples) as well. As a result, additional sampling is recommended to fill these data gaps (see Section 8).

This chapter describes the hazards presented by the principal contaminants present, PCBs, PCDDs, and PCDFs. Relevant information is presented on physical, chemical, and toxicological properties, likely release, fate and transport mechanisms, potential exposure pathways, potential receptors, and a qualitative discussion of potential health and environmental risks. The information presented in this section constitutes a preliminary human health hazard evaluation and is not intended as a quantitative baseline risk assessment.

6.1 WASTE CHARACTERIZATION

Contaminants are present in two general locations at the site, the underground bunker and on-site soils. The underground bunker contains PCBs, PCDDs, PCDFs, and some asbestos insulation. PCBs are present in concentrations ranging from 4 ppm to 410,000 ppm for waste samples and from 1 to 200,000 μg/100 cm^2 for wipe samples. Various PCDD and PCDF isomers were detected in two samples from the bunker. Using EPA toxicity equivalence factors (EPA 1990), a concentration equivalent to the most toxic isomer, TCDD was calculated to be 141 μg/kg for the ash sample (D-2) and 817 μg/kg for the pipe sample (D-1). The toxicity equivalence factor (TEF) is an interim science measure used by EPA to help characterize multiple PCDD and PCDF isomers. A conservative approach was employed in evaluating the data when the specific isomers were not identified; in those cases, the most toxic isomer TEF was used. See Appendix B for a listing of TEFs. No actual TCDD was detected and PCDFs accounted for most of the equivalent concentrations, as would be expected from the reported transformer fire that occurred in the bunker.

In terms of contaminants released to the environment, the site soils are the primary contaminated media. The soils contain PCBs released from transformer oils at the site. While the amount released is unknown, transformers typically contain 300 to 500 gallons of PCB dielectric fluid (EPA 1987). PCBs were detected in soils around the original transmitter annex, the transmitter annex, the northwest bunker entrance, power hut and transformer hut, ranging in concentration from below detection to 3,300 ppm. The primary PCB detected is Aroclor 1260. Appendix B presents background information on the environmental and toxicological properties of the primary contaminants of concern, PCBs, PCDDs, and PCDFs.

Limited sampling from the soil near the cesspool inlet pipe also indicates the presence of 388,800 μg/kg trichloroethene, 250,000 μg/kg tetrachloroethene, and 65,000 μg/kg 4-methylphenol, and lower concentrations of other volatile and inorganic contaminants. Sludge collected from the bottom of the cesspool also contained lesser amounts of these contaminants and 110 mg/kg mercury.

6.2 SOURCE AND RELEASE CHARACTERIZATION

During the site's active history, estimated from the 1940s to the 1960s, the structures on site housed PCB transformers of unknown number and description. Some transformers were vandalized for the copper contained inside, apparently releasing transformer oils. A 1978 clean-up using diesel fuel by Crowley Environmental Services involved some decontamination of the annex floor. PCB-contaminated debris inside the bunker included 126 gallons of oil from the vandalized transformers. A small fire is thought to have occurred in the bunker. Section 5 presents the extent of contamination observed throughout the site as a result of this investigation. A more detailed site history and possible on-site contamination is presented in Sections 2.3 and 2.4 of this report.

The detection of volatile organic and inorganic substances in cesspool sludge and soil indicates that these substances were disposed of into the facility sewage system and deposited into the cesspool at a total depth of at least 20 feet below ground surface. It is impossible to estimate from the data the volume and concentrations discharged.

6.3 FATE AND TRANSPORT OF CONTAMINANTS

As described in Appendix B, PCBs, PCDDs, and PCDFs are all heavy molecular weight compounds with general low water solubilities and high persistence that causes them to bind with organic matter in the surface soils. The surface soils contamination pattern is the result of transformer oil disposal and cleanup activities that may have been extended from foot and vehicle traffic, all of which are not well documented. Means of airborne release from soils include vaporization and fugitive dust emissions. Release to subsurface soils could occur by leaching, especially if dissolved in diesel fuel used for on-site cleanup. Groundwater near the site is present at 95 feet at Well B, located approximately 300 yards west of the bunker. However, these compounds do not migrate vertically to any great degree (Appendix B). Well B is sampled biannually as part of the existing basewide groundwater monitoring program; no positive PCB results have been reported. An additional potential release mechanism is release to surface water. However, the site is relatively flat and contains no surface water or apparent drainages. No surface water or sediment were sampled in this investigation.

Contaminants in the bunker are isolated from the environment and not subject to fate and transport mechanisms of the same type or scale as in soil. Given the construction materials and thickness, contaminant migration from the bunker is considered negligible and is not further considered. This section presents a brief overview of the probable fate and transport of the soil contaminants as observed in this study. Data are insufficient to fully reconstruct the waste quantities released over the years to the environment; however, some data and methods are available to estimate the environmental fate and transport of the current level of contamination. Since PCBs, PCDDs, and PCDFs behave very similarly in the environment, they will be discussed together.

6.3.1 Statement of Probable Fate and Transport

If left uncontrolled, the soil contaminants would very slowly be degraded through photolysis and biodegradation. Contaminants would also continue to migrate to the air and toward surface water by overland flow, fugitive dust emission, deposition, and resuspension. No defined drainages or water courses are near the site; hence, transport to surface water is not probable. Minor dispersion would include leaching downward through the soil profile and uptake of surface soil PCBs by terrestrial biota.

Actual data on photolysis and biodegradation for these compounds are limited. Although not found in site soils, the most persistent contaminant on this site is 2,3,7,8-tetrachloro dibenzodioxin (TCDD). Using TCDD as an indicator for the other contaminants, EPA (1985) has reported that photodecomposition is too slow to be detected in soils. Similarly, EPA's survey of the literature indicates that through biodegradation, volatilization, and leaching, the soil half-life of TCDD ranges from an initial 0.5 to 3 years, increasing to more than 10 years after 17 months. PCB soil half-lives are estimated to be less than TCDD, based on extent of chlorination.

The volatile organics released to the cesspool have moderately high water solubilities: 1,100 mg/l trichloroethene, 150 mg/l tetrachloroethene, and 24,000 mg/l 4-methylphenol; hence, they are likely to dissolve into water at these limits and be transported downward towards groundwater. Well B, a 95-foot-deep well located downgradient of the site, is sampled biannually as part of the basewide groundwater monitoring program and no positive results have been reported for any of the contaminants detected in the soil/sludge cesspool samples. In addition, the contaminants have relatively low organic carbon sorption coefficients and are not retarded significantly by sorption. Evidence suggests that these compounds may be subject to biodegradation under methanogenic conditions such as would be expected in a cesspool effluent environment.

6.3.2 Release Estimates

Two atmospheric transport mechanisms are volatilization and fugitive dust emissions. To make a preliminary estimate of these annual release mechanisms, E & E estimated that the area of soil sampled around the five structures is approximately 930 square meters. E & E applied an estimation procedure from EPA (1988) for Aroclor 1260, the prevailing contaminant, using 10 ppm as a representative soil concentration for the five structures. The average Aroclor 1260 concentrations for samples with detectable amounts ranged from 0.9 to 18.8 ppm around the five structures. An Aroclor 1260 emissions rate was estimated at 6×10^{-8} grams/day. This equates to 2.7×10^{-6} grams/day for the warmest daytime, three-month period during the summer. Volatilization rates are very temperature dependent; during the colder months volatilization approaches zero. It should be noted that Aroclor 1260 is among the least volatile of PCBs used in transformer oils. Other Aroclors with fewer chlorine substituents have diffusion rates four orders of magnitude greater. This may explain why Aroclor 1260 is the predominant PCB at the site today. Dioxin and furan isomers volatilize at an even slower rate than Aroclor 1260.

Fugitive dust emissions may also release PCBs bound to respirable particles (10 microns) from the site. Using an estimation method by Cowherd (1984), a respirable particulate emission rate of 126 grams/day was calculated. At 10 ppm PCB, this yields a daily PCB emission of 0.00126 grams per day, or 0.23 grams/year using a 6-month duration.

PCBs may also be subject to limited leaching transport. As described previously, the greater the chlorine substituents the greater its sorption onto soils and the lower the leaching rate in soils. Pal (1980) studied an unspecified PCB at a concentration of 1 ppm in a sandy loam and found that no detectable amounts leached beyond 30 centimeters below ground surface (bgs). However, if mixed with solvents such as diesel fuel, as was the case at the site, it is difficult to predict the rate of leaching and depth of contamination. The analytical results for the boreholes from this investigation showed detectable residues at the following maximum depths: 16 to 20 feet bgs at BH-2, 6 to 11 feet bgs at BH-4, 10 to 18 feet bgs at BH-8, 24 to 26 feet bgs at BH-9, 29 to 30 feet bgs at BH-10 (120,000 µg/kg Aroclor 1260), and 28 to 30 feet bgs at BH-11.

Aside from the BH-10 data, which display an unusually high concentration possibly associated with diesel fuel decontamination activities, the greatest concentration at the depths cited above is 200 µg/kg. These data suggest that some leaching has occurred at the site, and that further sampling is necessary during excavation to determine the extent of contamination.

The releases of volatile organic contaminants to the cesspool are impossible to estimate from the residues that were sampled. The medium of concern is groundwater since the contaminants were disposed of in the subsurface. Releases to air, surface soils, and surface water were probably negligible. Further sampling will be necessary to determine the extent of this contamination.

6.4 EXPOSURE SCENARIOS

In order to evaluate baseline health risks at the site, it is necessary to construct exposure scenarios that take into account current land use, human and environmental receptors, and potential exposure pathways. This section presents the current exposure scenario and rationale for its development.

6.4.1 Current Land Use Exposure Scenario

The Roosevelt Road Transmitter Site is currently owned by the United States Army as part of the Fort Richardson Army Base. No plans to sell or develop the site are known; nor does the general public have access to the site since it is fenced and posted as containing PCBs. However, the general area is used for military exercises and Army personnel have access to the site.

The primary contaminant sources are on-site soils around the transmitter platforms and the bunker. Inasmuch as the bunker is constructed of bombproof concrete walls, ceiling, and flooring, and its entrances are sealed, the bunker's interior is not considered to be a source of exposure to any receptors, for the purposes of the baseline risk assessment.

Unauthorized hunting on the site may occur despite signs posted on site that prohibit hunting. According to COE, small game hunting is allowed in certain areas of the base. Large game (moose) hunting depends on fish and wildlife authorities. In the past, the base and adjacent areas have sustained moose kills (COE 1990). The site lies within the Eagle River watershed; the Eagle River is located 1 mile to the north. However, there are no defined drainages from the site to the River. Eagle River drains to Knik Arm of Cook Inlet 2 miles west. Significant wetlands occur along Eagle River and at Eagle River Flats. Over 150 wetlands are located within 4 miles of the site according to the National Wetlands Inventory (USFWS 1990).

The City of Anchorage is located approximately 5 miles to the south and east of the site and utilizes surface water supplies upgradient of the site and groundwater from wells which produce from the aquifer approximately 300 feet below ground surface (Municipality of Anchorage 1990). The nearest municipal well is located approximately 5 miles southeast of the site. The nearest monitoring well, Well B, is located 300 yards west of the site and has a static water level of 96 feet. On the two sampling occasions in 1990, no PCBs were detected (CENPD 1990). Fort Richardson obtains its water from Elmendorf Air Force Base. Elmendorf Air Force Base utilizes surface water supplies upgradient of the site and two deep wells (300 feet); the nearest well is located approximately 3 miles southeast of the site. The direction of groundwater flow in the area is anticipated to be to the northwest.

6.4.2 Exposure Pathways

Based on information in Section 6.4.1, the potential exposure pathways are formulated in Table 6-1.

6.4.3 Exposure Levels

Normally, this portion of the baseline risk assessment is used to develop exposure estimates, (e.g., PCB intakes in mg/kg-day) for each pathway. However, since PCBs are the primary contaminant on the site, and the contaminated media are soil and surfaces, the EPA PCB Spill Cleanup Policy (SCP) (EPA 1987a) governs this situation. The SCP has already evaluated exposures and carcinogenic risks to workers and the general public and developed associated criteria, and as such is the applicable, relevant, and appropriate requirement (ARAR). However, the SCP is not intended to address other pathways such as hunting, fishing, or ingestion of groundwater. If more data on these pathways were available, exposure estimates would have been derived for this discussion.

The data are also insufficient to evaluate potential groundwater concentrations or exposure levels for the contaminants associated with the cesspool.

6.5 POTENTIAL RECEPTORS

This section briefly describes the potential pathway receptors presented in the previous section. By describing the potential receptors in more detail, the relative importance of each pathway can be better determined.

The military base hunting history was described previously. Sport game animals likely to be present in the area are moose, deer, and bears. According to Garret (USFWS 1990) no critical habitats or threatened nor do endangered species inhabit the site area.

Eagle River and Knik Arm sport fishery resources include king and silver salmon, Dolly Varden, and rainbow trout. In 1989, 1,028 anglers took 910 fish from the Eagle River east of the Glenn Highway. Eagle River is being enhanced as a chinook fishery and larger salmon runs are expected for 1990 (Department of Fish and Game 1990). The Eagle River Flats is a 2,500-acre tidal wetlands complex located in the northwest corner of Fort Richardson adjacent to Knik Arm. The Flats are located approximately 0.5 mile north of the site and have been used by Fort Richardson as a primary impact area for weapons training since World War II. Munitions of various types have been fired into the flats. Migratory bird die-offs have been observed since 1980. In 1989, the Army curtailed the use of the Flats as an impact area (E & E 1990). The Flats and adjacent wetlands support a variety of waterfowl and wetland predators. As described in Appendix B, mink are especially sensitive to toxic effects of PCBs.

Inhalation of PCBs on site is not expected to present a significant threat to sport game; however, Army personnel may be exposed to PCBs via inhalation. Army personnel were observed on site without protective clothing as Army fatigues are the standard clothing (COE 1990). Troop drills and maneuvers take place on the base during almost every week of the year.

Soil exposure consists of incidental soil ingestion and dermal contact with contaminated soils and surfaces. This is most likely a nonsignificant pathway for troops rotating in and out of maneuvers.

Ingestion of groundwater from the site appears an unlikely contaminant source, given the depth to groundwater, the direction of groundwater flow, and the locations of Anchorage water supply wells. No private domestic wells, municipal wells, or military supply wells are located within 3 miles of the site. The population of Anchorage using a blended water system is 211,000. The military population of Fort Richardson Army Base and Elmendorf Air Force Base using Elmendorf water is 5,300, while civilian employees and dependents total 10,690 (DEH 1989). No water supply wells are known to exist within 3 miles of the site. However, the extent of contamination in BH-10 causes this pathway to be included.

6.6 RISK CHARACTERIZATION

This section analyzes each pathway with respect to the contaminant concentrations present, likelihood of exposure, and comparison with ARARs. Actual risks are not calculated for the hunting, fishing, and groundwater pathways since little or no sampling data exist. Risks for the soil exposure and air inhalation pathways are not calculated since EPA PCB Spill Cleanup Policy (1986) has already evaluated these risks and established criteria. Potential ARARs applicable to each pathway are shown in Table 6-2.

6.6.1 Hunting

Sport game could become exposed by ingestion of contaminated soil during grazing, ingestion of contaminated forage by deposition of PCB-contaminated dust, by drinking from temporary rainwater and meltwater pools on site, and from inhalation. Given the small size of the site, the presence of a barbed-wire fence, and the Army's no hunting policy, the likelihood of significant exposure from this pathway is low. The most applicable ARAR is the FDA action level for PCBs in red meat of 3 ppm (FDA 1987).

6.6.2 Fishing

The potential for migration of PCBs to Eagle River was not investigated; however, given the lack of defined drainages, flat terrain, low average precipitation (37.4 cm per year), and distance to Eagle River, the likelihood of significant human or animal exposure from consumption of fish contaminated with PCBs is deemed unlikely. The most applicable ARAR is the Food and Drug Administration (FDA) action level for PCBs in fish of 2 ppm (FDA 1990).

6.6.3 Air Inhalation

Volatilization and particulate emissions from the site could contribute to human and animal exposure; however, the predominant PCB in this investigation is Aroclor 1260 which has among the lowest diffusion coefficient among PCBs and the low rated estimated release rates from volatilization and particulate emissions. Army personnel routinely enter the site and it is clearly posted as a restricted area. The most appropriate ARAR is the OSHA time-weighted average permissible exposure limit of 0.5 mg/m^3 for Aroclor 1254 (29 CFR 1910). For comparison purposes, EPA (1987) has estimated that persons located 0.6 mile or more from a spill site with soil PCB concentrations of 220 to 1,300 ppm would yield an excess lifetime inhalation cancer risk of 1×10^{-7}. No permanent residential or worker population exists within 0.6 mile.

6.6.4 Soil Exposure

Soil sample PCB concentrations range from undetected to a maximum of 3,300,000 µg/kg or 3,300 ppm Aroclor 1260, collected from near the transmitter annex. Aside from this one extreme value, the next highest concentration is 79 ppm, also collected near the transmitter annex. EPA SCP establishes cleanup criteria for PCBs based on the use of the facility where the leak occurred. The SCP used carcinogenic risks in determining its cleanup levels with a slope factor of 4 mg/kg per day. For outdoor electrical substations, as defined by CFR 761.123, the SCP requires soils to be cleaned up to a level less than 25 ppm to 50 ppm. However, the SCP states, "At such times as outdoor electrical substations are converted to another use, the spill site shall be cleaned up to the nonrestricted access requirements." These requirements specify 10 ppm provided that soil is excavated to a minimum depth of 10 inches. The SCP assumes both incidental soil ingestion and dermal contact exposure. According to the SCP, 25 ppm PCBs in soil are equivalent to an excess lifetime cancer risk of less than 1×10^{-7} to people on site who work more that 0.06 mile from the actual spill area.

6.6.5 Groundwater Exposure

The borehole data suggest that vertical leaching of PCBs has occurred to at least 30 feet at borehole 10 (130 ppm of Aroclor 1260 was detected at this depth). The cesspool data also indicate the likelihood of a release to subsurface soils and the potential for a release to groundwater for volatile organic compounds. The reported depth to groundwater in the area is 95 feet (Well B). Monitoring Well B, located 300 yards west of the bunker, was sampled twice during 1990. No PCBs or targeted compounds have yet been detected in Well B. The nearest municipal water supply well is located upgradient, 3 miles southeast of the site. The SCP does not specifically address groundwater contamination; however, data are insufficient to determine whether a release has occurred or might occur to groundwater. Well B is not ideally located for this purpose. However, an evaluation of groundwater use has not revealed any drinking water supply wells within 3 miles of the site and none downgradient of the site. Hence, there does not appear to be any human receptors potentially exposed to groundwater. The appropriate ARAR for PCBs in drinking water is the proposed maximum contaminant level (MCL) of 0.0005 mg/l (EPA 1989).

EPA SCP cleanup criteria for PCBs is based upon site access and ranges from 10 ppm to 25 ppm (EPA 1987). PCB concentrations detected on site exceeded these levels and therefore remediation must be implemented at the site. Section 7 details several remedial measures and evaluates them with respect to cost and feasibility.

Table 6-1

POTENTIAL EXPOSURE PATHWAYS

Intermediate Pathway	Exposure Receptor	Mode	Receptor
Hunting	Game species	Ingestion	Humans, predators
Fishing	Salmon, trout	Ingestion	Humans, otter, mink raptors
Air		Inhalation	Army personnel
Soil Exposure		Ingestion	Army personel
		Dermal	Army personnel
Ground water		Ingestion	Humans

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Table 6-2

POTENTIAL APPLICABLE, RELEVANT AND APPROPRIATE REQUIREMENTS PCBs, PCDDs, PCDFs

Standard or Criteria	PCBs	PCDD/PCDF
Carcingenic Potency Factors	4.0/(mg/kg/d) (EPA 1987) 7.7/(mg/kg/d) (IRIS 1990)	1.56×10^{-5}/(mg/kg/d) (EPA 1986)
Maximum Contaminant Levels Levels (MCL)	0.5 µg/l (proposed EPA 1989b)	--
Lifetime 10^{-6} Cancer Risk Concentration	0.005 µg/l (IRIS 1990)	2.2×10^{-7} µg/l (EPA 1987b)
Soil Contamination Action Levels	10 mg/kg (EPA 1987)	1 µg/kg (Kimbrough 1984)
Surfaces (Wipes)	10 to 100 µg/100 cm^2 (EPA 1987)	--
FDA Tolerances		
Red Meat	3 ppm (FDA 1987)	
Fish	2 ppm (EPA 1987)	25 pg/g (EPA 1987)

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7. ALTERNATIVE REMEDIAL MEASURES

The Roosevelt Road Transmitter Site was separated into two operable units which require remediation. The operable units include:

- o On-site soils; and
- o The underground bunker.

The overall objective of the remedial plan is to completely remove or otherwise isolate hazardous materials present at the Roosevelt Road Transmitter Site to eliminate or minimize possible exposure of the materials to humans or wildlife. Additional specific objectives for remediation of the on-site soils include:

- o Prevent PCB migration from the site by air and surface erosion; and
- o Cleanup of PCBs from soil which satisfies both EPA and Alaska department of environmental conservation cleanup requirements.

To accomplish these objectives, several alternatives were selected as potential remedial actions for both operable units and evaluated. The alternatives for remediation are as follows:

On-site Soil Operable Unit

- o No action;
- o Excavation of soil with off-site landfilling;
- o Excavation of contaminated soil with off-site incineration;
- o Excavation of contaminated soil with on-site incineration;

- Soil washing of contaminated soil;
- Excavation of soil with on-site landfilling;
- Bioremediation of contaminated soil; and
- Chemical treatment of contaminated soil (quicklime).

Underground Bunker Operable Unit

- No action; and
- Interior surface cleaning.

7.1 SUMMARY OF ALTERNATIVES

7.1.1 On-Site Soils Operable Unit

Alternative 1: No Action

The no action alternative is presented as a baseline for comparison to the other alternatives. As the title states, this alternative involves no remedial action and thus would leave the site in its present condition, doing nothing to contain or treat the PCB-containing soil at the site.

Alternative 2: Off-Site Landfilling

This alternative would involve the excavation of the PCB-contaminated soil on the site. The soil would be staged in a central location on the site and packaged in supersacks in preparation for shipping. The material would then be shipped to Seattle, Washington and then to Arlington, Oregon for disposal in a RCRA-permitted landfill owned and operated by Chemical Waste Management, Inc. The excavation would be backfilled with clean soil material, regraded, and revegetated.

Alternative 3: Off-Site Incineration

This alternative would involve the excavation of the PCB-contaminated soil on the site. The soil would be staged in a central location on the site and packaged in supersacks in preparation for shipping. The material would then be shipped to Seattle, Washington and transported to one of three incineration facilities operated by Chemwaste Management Inc. in Chicago, Illinois; Port Arthur, Texas; or

Kansas City, Missouri, where the material would be incinerated. The excavation would be backfilled with clean soil material, regraded, and revegetated.

Alternative 4: On-Site Incineration

This alternative would involve the shipping of a mobile incineration unit to Alaska from an undetermined location in the contiguous United States. The mobile incineration unit would be set up on site after the acquisition of the required operating permits by COE. The contaminated soil would be excavated and stockpiled adjacent to the incineration site in preparation for disposal. A test burn would be conducted to ensure that an adequate incineration of the contaminated soil is taking place and that the regulatory agency requirements on emissions are met. The stockpiled soil would then be incinerated and the resulting ash, upon meeting toxicity characteristic leaching procedure (TCLP) requirements, would be placed in the excavation prior to backfilling additional soil materials, regrading, and revegetation. If the resulting ash does not meet TCLP requirements it would be considered a RCRA waste requiring additional treatment and/or disposal at a secure landfill.

Alternative 5: Soil Washing

This alternative would involve excavation of the contaminated soil on the site. The soil would then be staged in a central location on the site in preparation for treatment. The soils would undergo pretreatment if necessary to improve pumpability, or physical or chemical composition to maximize effectiveness of the extraction process. The pretreated soil would be processed through a reaction vessel, dewatered, and separated. The treated soil, after achieving the cleanup goals, would be used as backfill for the excavation. The spent solvent, sludges, and still bottoms would be either sent to an approved landfill for disposal or incinerated depending upon the contaminant concentration.

Alternative 6: On-Site Landfilling

This alternative would involve the excavation of the PCB-contaminated soil on the site. The soil would be staged in a central location on the site and packaged in supersacks (a 6-mil polyethylene-lined sack which can contain a volume of approximately 0.75 cubic yards (cy) of soil). The filled sacks would then be transferred to the site's underground bunker for permanent storage. The bunker would be securely and permanently sealed. The excavation would be backfilled with clean soil, regraded, and revegetated.

Alternative 7: Bioremediation

This alternative would involve excavation of the PCB-contaminated soil on the site. The soil would be staged in a central location on the site in preparation for treatment. The soil would be transferred to treatment areas where conventional soil management practices would be used to enhance the microbial degradation of PCBs. The soils would remain in the treatment areas until acceptable PCB-concentration levels were achieved. The treated soil would then be used as backfill for the excavation.

Alternative 8: Chemical Treatment (Quicklime)

This alternative would involve excavation of the PCB-contaminated soil on the site. The soil would then be staged in a central location on the site in preparation for treatment. The soil would then be transferred to treatment areas and mixed with quicklime and other additives and allowed to react until PCB concentrations reached the cleanup goals. The treated soils would then be used as backfill for the excavation.

7.1.2 Underground Bunker Operable Unit

Alternative 1: No Action

The no action alternative is presented as a baseline for comparison to the other alternative. This alternative involves no remedial action and would leave this operable unit in its present condition, doing nothing to remove, contain, or treat the hazardous materials within the bunker.

Alternative 2: Interior Surface Cleaning

This alternative would involve removal and disposal of all PCB-contaminated debris and sludge and of all asbestos-containing material. Contaminated surfaces then would be solvent washed and rinsed. Concrete surfaces that do not meet cleanup goals after the solvent washing would be scraped to remove incremental amounts of concrete. This incremental concrete removal would continue until sampling indicated that the cleanup goals were achieved.

7.2 ANALYSIS OF REMEDIAL ALTERNATIVES

7.2.1 Prescreening of Alternatives

Each remedial action alternative was prescreened to determine the alternative's viability and to identify the alternatives that best warranted detailed evaluation. The alternatives were evaluated for the following parameters:

- o Utilization of proven technologies;
- o Technically feasible implementation;
- o Ability to meet Applicable, Relevant, and Appropriate Requirements (ARARs) (see Table 6-2); and
- o Ability to protect public health.

Tables 7-1 and 7-2 summarizes the prescreening of the identified remedial alternatives for the two operable units.

On-Site Soils Operable Unit

The only alternatives that met all of the identified prescreening requirements were:

- o On-site landfilling;
- o Off-site landfilling;
- o On-site incineration; and
- o Off-site incineration.

These four alternatives were deemed viable and were selected to undergo a detailed analysis.

The reasons for elimination of the other alternatives are summarized below:

Alternative 1: No Action

This alternative will not meet ARARs and will do nothing to prevent or minimize human or animal exposure to the hazardous materials identified on the site. Furthermore, it does nothing to prevent migration of the hazardous materials via air or groundwater. A detailed evaluation will be done, however, to provide a baseline for comparison.

Alternative 5: Soil Washing, Alternative 7: Bioremediation, and Alternative 8: Chemical Treatment (Quicklime)

Each of these alternatives depend on an unproven technology. Although each has demonstrated an ability to achieve some measure of success in the remediation of PCBs in soils, these successes have been mainly of laboratory scale under controlled conditions. Further bench and pilot scale studies would be required to determine their applicability to the Roosevelt Road Transmitter Site conditions.

Bioremediation will not be applicable to this site because of the temperature control needed to assure a stable environment for the microbes. Alaskan surface temperatures would not provide the needed stability to support the microbial degradation process.

Underground Bunker Operable Unit

Alternative 1: No Action

This alternative will not meet the prescreening requirement of meeting all ARARs. However, the bunker may be suitable as an on-site storage facility. All appropriate permits and conditions must be met to achieve storage facility status. This alternative would be viable under these conditions and warrants detailed evaluation.

Alternative 2: Interior Surface Cleaning

This alternative meets all prescreening requirements and warrants detailed evaluation.

7.2.2 Detailed Analysis of Alternatives

Each selected alternative was rigorously evaluated to determine the best approach for remediation of the site. Each alternative was evaluated for the following:

- o Utilization of proven technologies;
- o Applicability of the technologies to site conditions;
- o Ability of alternative to reduce risk from contaminants present;
- o Ability to achieve compliance with ARARs and regulatory cleanup levels;
- o Ability to facilitate remediation without creating a greater hazard as a result of the remediation; and
- o Cost.

A summary of the detailed evaluation is provided in Table 7-3 for the on-site soil operable unit. The Costs Summary for the On-Site Soil Operable Unit is provided in Table 7-4. A summary of the detailed evaluation for the Underground Bunker Operable Unit is provided in Table 7-5. The Costs Summary for the Underground Bunker Operable Unit is provided in Table 7-6.

Technical Analysis

This alternative has no remedial action requirements and thus it constitutes the present condition. The contamination would remain in place.

Environmental Analysis

The no action alternative would not decrease the potential for contaminant migration from the site via surface erosion, direct contact, or groundwater transport. It would be prudent and necessary to fence the site to remove it from military and other land use; however, the regulatory agencies impose more stringent requirements (cleanup).

Institutional Analysis

Implementation of this alternative would do nothing to decrease the concentration of contamination at the site to the required PCB cleanup level of 10 ppm. Therefore, based strictly on an institutional analysis, this alternative is not viable.

Alternative 2: Off-Site Landfilling

Technical Analysis

Implementation of this analysis is very sound from a technical standpoint. There are numerous landfills in the United States approved to accept PCB-contaminated soils. The nearest landfill to the Alaska location is operated by Chem Security Systems, Inc., a fully permitted landfill in Arlington, Oregon.

Standard construction equipment and transportation methods can be employed. Excavation techniques and soil containment procedures, and consistent with industry standards can easily be implemented assuming seasonal conditions are taken into consideration. Soil sampling and analysis would be required during excavation to ensure that cleanup goals were met.

Potential problems associated with this alternative are that the concrete pads and the bunker may interfere with excavation activities and that there could be a release of materials due to an accident during transport.

Environmental Analysis

This alternative would remove PCB-contaminated soils (greater than 10 ppm) from the site and replace them with clean fill (less than 1 ppm in accordance with EPA Spill Cleanup Policy). Some residual contamination would remain (areas at greater than 10 ppm). these areas would be covered with clean soil to further reduce environmental risks.

Public Health Analysis

This alternative would reduce all risks to human health to regulatory levels for unrestricted access areas (40 CFR 761.125). Residual soil contamination (less than 10 ppm) will be further minimized by covering with clean soil (less than 1 ppm).

Institutional Analysis

This alternative would eliminate all materials that have levels of PCB contamination at 10 ppm or greater from the site. This remediation would thus satisfy State of Alaska and EPA cleanup requirements.

Cost Estimate

The estimated cost for this alternative is $1,069,865. The cost breakdown of costs is presented in Table 7-4. The detailed estimates are provided in Appendix E.

Sensitivity Analysis

Cleanup Levels. Cleanup levels of 10 ppm and 25 ppm were analyzed to determine the sensitivity of the remedial alternative to this type of change. A variance of the cleanup level directly affects the amount of PCB-contaminated soil that would be generated during the remediation of the site. Isocontours based on the laboratory results were plotted for the respective cleanup levels and were used as the basis for calculating volume estimates of PCB-contaminated soil. The depth of excavation required to remediate the site at a cleanup level of 10 ppm was estimated at 30 feet below existing grade. It is assumed that the change in total depth of the excavation is small when based on a variance in the selected cleanup criteria. The narrow, vertical migration of the contaminant plume will require approximately the same lateral extent of excavation regardless of the selected cleanup criteria. Therefore, the total volume of soil to be excavated is assumed to remain constant. thus the change in cleanup levels directly affects transportation and disposal costs. Mobilization and demobilization costs, excavation and backfill costs, and laboratory analysis costs remain relatively unaffected since they are largely dependent on the size of the overall excavation. The results of the sensitivity analysis are summarized in Table 7-7.

Quantity. Changes in the quantity of PCB-contaminated soil were analyzed to determine the sensitivity of the remedial alternative to a change in the total volume of soil to be excavated. It is assumed that a linear relationship exists between the volume of PCB-contaminated soil and the total volume of soil to be excavated.

Changes in the quantity of generated soil directly affect excavation and backfill costs, transportation and disposal costs, and laboratory costs. Mobilization and demobilization costs are not affected since the equipment and manpower required for this task are not influenced by a moderate change in the size of the total excavation. The results are listed in Table 7-8.

Alternative 3: Off-Site Incineration

Technical Analysis

Incineration of PCBs is a widely used method of destruction. The organic matter in the soil matrix is burned at an extremely high temperature while a resultant product of ash is obtained. There are three incinerators currently in operation in the State of Alaska but none of these are permitted to accept waste from other sources than the site on which they are in operation. Also, the corporations owning these sites would not permit the incinerator companies to contract for additional wastes. The incinerators that are located in the contiguous United States closest to Alaska that are fully permitted and capable of handling the wastes are in Chicago, Illinois; El Dorado, Arkansas; Deer Park, Texas; and Port Arthur, Texas.

Standard construction equipment and transportation methods can be employed. Excavation techniques and soil containment procedures, consistent with industry standards, can be used but cold weather conditions should be taken into consideration.

Potential problems associated with this alternative are that there may be a release of PCB contamination due to an accident during transport.

Environmental Analysis

This alternative would remove contaminated soils (greater than 10 ppm) from the site and replace them with clean fill (less than 1 ppm in accordance with EPA Spill Cleanup Policy. Some residual contamination would remain, (areas of less than 10 ppm). These areas would be covered with clean soil to further reduce environmental risks.

Public Health Analysis

This alternative would reduce all risks to human health to regulatory levels for unrestricted access areas (40 CFR 761.125). Residual soil contamination (less than 10 ppm) will be further minimized by covering with clean soil (less than 1 ppm).

Institutional Analysis

This alternative would eliminate materials containing PCBs at levels in excess of 10 ppm or greater from the site. This alternative would thus satisfy the State of Alaska and the EPA cleanup requirements.

Cost Estimate

The estimated cost of this alternative is $4,553,865. The cost breakdown of costs is provided in Table 7-4. A detailed estimate is provided in Appendix E.

Sensitivity Analysis

Cleanup Levels. Cleanup levels of 10 ppm and 25 ppm were analyzed to determine the sensitivity of the remedial alternative to this type of change. A variance of the cleanup level directly affects the amount of PCB-contaminated soil that would be generated during the remediation of the site. Isocontours based on the laboratory results were plotted for the respective cleanup levels and were used as the basis for calculating volume estimates of PCB-contaminated soil. The depth of excavation required to remediate the site at a cleanup level of 10 ppm is estimated at 30 feet below existing grade. It is assumed that the change in total depth of the excavation is small when based on a variance in the selected cleanup criteria. The narrow, vertical migration of the contaminant plume will require approximately the same lateral extent of excavation regardless of the selected cleanup criteria. Therefore, the total volume of soil to be excavated is assumed to remain constant. Thus, the change in cleanup criteria directly affects transportation and disposal costs. Mobilization and demobilization costs, excavation and backfill costs, and laboratory analysis costs remain relatively unaffected since these items are largely dependent on the size of the overall excavation. The results of the sensitivity analysis are shown in Table 7-7.

Quantity. Changes in the quantity of PCB-contaminated soil were analyzed to determine the sensitivity of the remedial alternative to a change in the total volume of soil to be excavated. It is assumed that a linear relationship exists between the volume of PCB-contaminated soil and the total volume of soil to be excavated.

Changes in the quantity of soil generated directly affect excavation and backfill costs, transportation and disposal costs, and laboratory costs. Mobilization and demobilization costs are not affected since the equipment and manpower required for this task are not influenced by a moderate change in the size of the total excavation. The results are listed in Table 7-8.

Alternative 4: On-Site Incineration

Technical Analysis

This alternative would require that a mobile incinerator thermal destruction unit (TDU) be mobilized on site. There are several different types of TDUs all of which operate under the same basic theory as follows: soils are heated until the PCBs are volatilized. The volatilized PCBs are then further heated until the PCBs are destroyed and are transformed to their elemental components.

Most TDUs, such as rotary kilns and infrared-heated primary units, volatilize PCBs in a relatively low operating temperature primary unit. The actual destruction of PCBs occurs in a higher operating temperature secondary unit. There are some TDUs, such as fluidized bed and circulating bed combustors, that destroyed PCBs in the same unit in which they are volatilized.

On-site thermal destruction is a proven technology that has been successfully used on remediating many sites contaminated with PCBs. The capacity of TDUs can vary greatly. Some prior-scale models have a maximum throughput of approximately 0.5 tons/hour. An average range of throughputs for the average site existing unit is approximately 6 to 8 tons/hour. However, at least one larger unit can reportedly accept up to 30 tons/hour. Even the smallest units must be transported in several tractor trailer beds. An average size unit would require about 20 trailer beds.

Much of the equipment to be transported is pollution control equipment. Gaseous effluent from the TDU must be scrubbed, pH adjusted, and cooled. Additionally, the effluent must be monitored to help ensure adequate combustion efficiency and minimal hydrocarbon release.

TDUs require a source of clean water for quenching gases and ash, a disposal area for liquid effluent and ash, and a source of power for heat. Natural gas is the usual source although fuel oil can be used and electricity is needed for the infrared type. Electricity is also needed for motors and the control system on all the TDUs.

TDUs that incinerate PCBs at concentrations greater than 5 ppm are regulated under the Toxic Substance Control Act (TSCA). TDUs must demonstrate, through a trial burn, that the destruction removal efficiency (DRE) is greater that 99.9999% and that insignificant amounts of products of incomplete combustion (PICs) (e.g., dioxins and dibenzofurans) are generated. Ash is usually specified to contain 2 ppm PCB per TSCA guidance.

Environmental Analysis

This alternative would remove and destroy all PCB contamination above 10 ppm and would therefore eliminate all significant threats to the environment.

Public Health Analysis

This alternative would remove and destroy all PCB contamination above 10 ppm and would therefore eliminate all significant threats to public health. the required trial burn and continuous emission monitoring will minimize public health threats while the TDU is operating.

Institutional Analysis

This alternative is in accordance with all ARARs. The cleanup level is in accordance with State of Alaska policy and is consistent with EPA policy for spills.

The required air permit for operation of the TDU has been controversial at other sites within the United States and can require a significant period of time to be obtained.

Cost Estimate

The estimated cost for this alternative is $4,463,881. The breakdown of costs is provided in Table 7-4. The detailed estimate is provided in Appendix E.

Sensitivity Analysis

Cleanup Levels. Cleanup levels of 10 ppm and 25 ppm were analyzed to determine the sensitivity of the remedial alternative to this type of change. A variance of the cleanup level directly affects the amount of PCB-contaminated soil that would be generated during the remediation of the site. Isocontours based on the laboratory results were plotted for the respective cleanup levels and were used as the basis for calculating volume estimates of PCB-contaminated soil. The depth of excavation required to remediate the site at a cleanup level of 10 ppm is estimated at 30 feet below existing grade. It is assumed that the change in the total depth of the excavation is small in relation to a variance in the cleanup level. The narrow, vertical migration of the contaminant plume will require approximately the same lateral extent of excavation regardless of the selected cleanup criteria. Therefore, the total volume of soil to be excavated is assumed to remain constant.

A variation in the selected cleanup criteria directly affects the cost associated with disposal; however, the change in the disposal cost is minimal in relation to the total cost for this remedial alternative. Mobilization and demobilization costs, excavation and backfill costs, laboratory analysis costs, and the cost for conducting a test burn are not affected. The results of the sensitivity analysis are summarized in Table 7-7.

Quantity. Changes in the quantity of PCB-contaminated soil were analyzed to determine the sensitivity of this remedial alternative to a change in the total volume of soil to be excavated. It is assumed that a linear relationship exists between the volume of PCB-contaminated soil and the total volume of soil to be excavated.

Variations in the quantity of soil generated has a direct affect on the excavation and backfill cost, disposal cost, and laboratory analysis cost since these items are dependent on both the size of the total excavation and the amount of contaminated soil to be disposed of. Mobilization and demobilization costs and test burn costs are not affected since the equipment and manpower required for these tasks are not influenced by a moderate change in the size of the total excavation. The results are listed in Table 7-8.

Alternative 6: On-Site Landfilling

Technical Analysis

This alternative would entail burying the contaminated material on site, within the bombproof bunker. The soil would be excavated as in all of the other alternatives and then transferred to the bunker.

Standard construction equipment would be utilized for the excavation, transfer, and backfilling.

Periodic monitoring of the soil and possibly the groundwater around the bunker would ensure integrity and the bunker would be securely and permanently closed.

Environmental Analysis

This alternative would remove PCB-contaminated soils (greater than 10 ppm) from the site and replace with clean fill (less than 1 ppm) in accordance with EPA Spill Cleanup Policy. Some residual contamination would remain (areas at less than 10 ppm). These areas would be covered with clean soil to further reduce environmental risks.

Public Health Analysis

This alternative would reduce all risks to human health to regulatory levels for unrestricted access areas (40 CFR 761.125). Residual soil contamination (less than 10 ppm) will be further minimized by covering with clean soil (less than 1 ppm).

Institutional Analysis

This alternative may be problematic because the contaminated material is neither destroyed nor removed from the site. The greatest costs would include obtaining a RCRA permit, operating a disposal facility, and obtaining a closure permit.

Cost Estimate

The estimated cost for this alternative is $963,512. The breakdown of costs is provided in Table 7-4.

Sensitivity Analysis

Cleanup Levels. Cleanup levels of 10 ppm and 25 ppm were analyzed to determine the sensitivity of the remedial alternative to this type of change. A variance of the cleanup level directly affects the amount of PCB-contaminated soil that would be generated during the remediation of the site. Isocontours based on the laboratory results were plotted for the respective cleanup levels and were used as the basis for calculating volume estimates of PCB-contaminated soil. The depth of excavation required to remediate the site at a cleanup level of 10 ppm is estimated at 30 feet below existing grade. It is assumed that the change in the total depth of the excavation is small in relation to a variance in the cleanup level. The narrow, vertical migration of the contaminant plume will require approximately the same lateral extent of excavation regardless of the selected cleanup criteria. Therefore, the total volume of soil to be excavated is assumed to remain constant.

A variation in the selected cleanup criteria has virtually no effect on the total cost for this remedial alternative. This is due to the total size of the excavation is the determining factor in the final cost of the remediation. The results of the sensitivity analysis are summarized in Table 7-7.

Quantity. Changes in the quantity of PCB-contaminated soil were analyzed to determine the sensitivity of this remedial alternative to a change in the total volume of soil to be excavated. It is assumed that a linear relationship exists between the volume of PCB-contaminated soil and the total volume of soil to be excavated.

Variations in the quantity of soil generated have a direct effect on the excavation and backfill cost, and laboratory analysis cost since these items are dependent on the size of the total excavation. Mobilization and demobilization costs, and costs associated with permitting and monitoring are not affected since the equipment and manpower required for these tasks are not influenced by a moderate change in the size of the total excavation. The results are listed in Table 7-8.

7.3 UNDERGROUND BUNKER OPERABLE UNIT

Alternative 1: No Action

Technical Analysis. This alternative has no remedial action requirements and thus it constitutes the present condition. The contaminants would remain in place.

Installation of a series of monitoring wells to determine if contaminants have entered the groundwater is recommended.

Environmental Analysis. The no action alternative would not decrease the potential for contaminant migration from the site via direct contact or possibly groundwater transport. It would be necessary to permanently secure the site.

Institutional Analysis. Implementation of this alternative would do nothing to decrease the concentration of contaminants at the site to regulatory cleanup levels. Therefore, based strictly on an institutional analysis, this alternative is not viable. At minimum, the site would have to be permitted as a storage facility.

Alternative 2: Interior Surface Cleaning

Technical Analysis. The remediation of the underground bunker is divided into three phases. The initial phase consists of the demolition, removal, and disposal of the miscellaneous debris inside the bunker. The second phase consists of the removal and disposal of PCB sludge followed by a solvent wash of all contaminated areas. The final phase consists of the removal and disposal of all concrete where PCBs have migrated at concentrations greater than 10 ppm.

The implementation of this alternative would involve the use of standard construction techniques, however, they would be hindered by the health and safety issues associated with the unique working environment of the bunker. Lighting, ventilation, and communication systems would be required to conduct all work in a safe and efficient manner.

Standard transportation and disposal methods would be employed for all debris, asbestos, sludge, used solvent, and contaminated water generated during the remediation.

Environmental Analysis. This alternative would remove all PCB contaminants from inside the bunker, including contaminants that have migrated into the concrete floor and walls. All PCBs (greater than 10 ppm) would be removed in accordance with EPA Spill Cleanup Policy; thus, all significant threats to the environment would be eliminated.

Public Health Analysis. This alternative would remove and destroy all PCB contamination above 10 ppm as well as the asbestos and dioxin contamination known to exist inside the bunker and would therefore eliminate all significant threats to public health.

Institutional Analysis. This alternative would remove all PCB contamination above 10 ppm as well as the asbestos and dioxin contamination known to exist inside the bunker. Thus, all regulatory agency requirements would be satisfied.

Cost Estimate. The estimated cost for this alternative is $775,366. The breakdown of costs is presented in Table 7-4.

Table 7-1

**— REMEDIAL ALTERNATIVE PRESCREENING MATRIX
ON-SITE SOIL OPERABLE UNIT**

Requirement	Alternative							
	1. No Action	2. Off-Site Landfilling	3. Off-Site Incineration	4. On-Site Incineration	5. Soil Washing	6. On-Site Landfilling	7. Bioremediation	8. Chemical Treatment (Quicklime)
Proven Technology	--	Y	Y	Y	N	Y	N	N
Technically Feasible	Y	Y	Y	Y	Y	Y	N	Y
Meets ARARs	N	Y	Y	Y	U	Y	U	U
Protects Public Health	N	Y	Y	Y	U	Y	U	U

02[IL]KM6120/1480/5

Key:

-- = Not applicable.
N = No, does not meet requirement.
U = Undetermined.
Y = Yes, does meet requirement.

Table 7-2

**REMEDIAL ALTERNATIVE PRESCREENING MATRIX
UNDERGROUND BUNKER OPERABLE UNIT**

Requirement	Alternative	
	1. No Action	2. Interior Surface Cleaning
Proven Technology	--	Y
Technically Feasible	Y	Y
Meets ARARs	N	Y
Protects Public Health	N	Y

02[IL]KM6120/1481/32

Key:

-- = Not applicable.
N = No, does not meet requirement.
Y = Yes, does meet requirement.

Table 7-3

DETAILED EVALUATION COMPARISON MATRIX
ON-SITE SOIL OPERABLE UNIT

Remedial Alternative	Technologies: Soil Excavation	Pre-treatment	Land-filling	Incin-eration	Back-filling	On-Site Storage	Environmental Protection: Air Borne Contam-ination	Surface Water Borne Contam-ination	Ground-water Borne Contam-ination	Surface Erosion Contam-ination	Residual Contam-ination	Trans-portation Accidents
1. No Action	N	N	N	N	N	Y	L	M	L	M	Y	N
2. Off-Site Landfilling	Y	N	Y	N	Y	Y[1]	L[1]	N	L	N	Y	L
3. Off-Site Inciner-ation	Y	Y[3]	Y[4]	Y	Y	N	L[1]	N	L	N	Y	L
4. On-Site Incinera-tion	Y	Y[3]	Y[4]	Y	Y	Y[1]	L[1]	N	L	N	Y	N
6. On-Site Landfilling	Y	N	Y	N	Y	Y[1]	L[1]	N	L	N	Y	N

02[IL]KM6120/1482/0

Key at end of table.

Table 7-3 (Cont.)

Remedial Alternative	Public Health Protection						Regulatory Compliance				
	Eliminates Source	Eliminates >10 ppm Soils	Limits Access to >10 ppm Soils	Treats Residuals	Limits Access to Residuals	Eliminates Residuals	Meets ARARs	Eliminates >25 ppm Soils	Eliminates >10 ppm Soils	Permitted Storage	Permitted Burning
1. No Action	N	N	N	N	N	N	N	N	N	N	N
2. Off-Site Landfilling	Y	Y	--	N	Y	N	Y	Y	Y	Y	N
3. Off-Site Inciner-ation	Y	Y	--	N	Y	N	Y	Y	Y	Y	Y
4. On-Site Incinera-ation	Y	Y	--	N	Y	N	Y	Y	Y	Y	N[2]
6. On-Site Landfilling	Y	N	Y	N	Y	N	Y	N	N	N[2]	N

02[IL]KM6120/1482/0

Key:

L = Low probability.
M = Medium probability.
N = No.
Y = Yes.
-- = Not Applicable.

[1]During Excavation
[2]Permit not applied for yet.
[3]If necessary to increase British Thermal Unit (Btu) content, remove metals or other contaminants.
[4]Of residual ash.

Table 7-4

DETAILED EVALUATION COST (DOLLARS) COMPARISON MATRIX ON-SITE SOIL OPERABLE UNIT

Remedial Alternative	Mobilization/ Demobilization	Excavation/ Backfill	Inciner-ation	Material Shipping	Compliance Sampling Analytical	Compliance Sampling Shipping	Regulatory Permitting
PCB Soil Remediatiation							
1. No Action	—	—	—	—	—	—	—
2. Off-Site Landfilling	10,314	252,864	NA	224,000	72,500	2,700	NA
3. Off-Site Incineration	10,314	252,864	2,240,000	224,000	72,500	2,700	NA
4. On-Site Incineration	1,710,141	218,663	118,000	NA	72,500	2,700	625,000**
6. On-Site Landfilling	6,590	294,477	NA	NA	NA	NA	150,000

02[IL]KM6120/1486/8

Key at end of table.

OUA 0000577

Table 7-4 (Cont.)

Remedial Alternative	Monitoring Well Installation	Disposal	Site Restoration	Contingency (+/- 25%)	Construction Estimate	Engineering Design (+/- 15%)	Construction Management (+/- 15%)	Total Estimate
1. No Action	--	--	--	--	--	--	--	--
2. Off-Site Landfilling	--	96,000	NA	164,595	822,973	123,446	123,446	1,069,865
3. Off-Site Incineration	--	NA	NA	700,595	3,502,973	525,446	525,446	4,553,865
4. On-Site Incineration	--	NA	NA	686,751	3,433,755	515,063	515,063	4,463,881
6. On-Site Landfilling	37,500	181,352*	350	167,568	837,836	125,675	125,675	963,512

02[IL]KM6120/1486/8

*Present worth of annual operating costs and placement of contaminated material in bunker.
**Test burn cost.

Table 7-5

DETAILED EVALUATION COMPARISON MATRIX
UNDERGROUND BUNKER OPERABLE UNIT

	Technologies				Environmental Protection				
Remedial Alternative	Debris Removal	Surface Washing	Surface Demolition	Landfilling	Airborne Contamination	Surface Water Contamination	Groundwater Contamination	Surface Erosion Contamination	Residual Contamination
1. No Action	N	N	N	N	L	L	L	L	Y
2. Interior Surface Cleaning	Y	Y	Y[2]	Y	L	N	N	N	N

02[IL]KM6120/1484/23

Key at end of table.

Table 7-5 (Cont.)

Remedial Alternative	Public Health Protection: Eliminates Service	Public Health Protection: Isolates Residuals	Public Health Protection: Limits Access	Regulatory Compliance: Meets ARARs	Regulatory Compliance: Meets Cleanup Goals	Regulatory Compliance: Permitted Storage
1. No Action	N	N	Y	N	N	N[1]
2. Interior Surface Cleaning	Y	--	--	Y	Y	--

02[IL]KM6120/1484/23

Key:

L = Low probability
N = No
Y = Yes
-- = Not applicable

[1] Permit not applied for yet
[2] Where necessary

Table 7-6

DETAILED EVALUATION COST (DOLLARS) COMPARISON MATRIX UNDERGROUND BUNKER OPERABLE UNIT

Remedial Alternative	Monitoring Well Installation	Disposal	Site Restoration	Contingency (+/- 25%)	Construction Estimate	Engineering Design (+/- 15%)	Construction Management (+/- 15%)	Total Estimate
Underground Bunker Remediation								
1. Monitor Site	TBD	NA	NA	TBD	TBD	TBD	TBD	TBD
2. Bunker Remediation	—	477,148	NA	119,287	596,435	89,465	89,465	775,366

02(IL)KM6120/1487/8

TBD = To be determined.

Table 7-7

CLEANUP LEVEL SENSITIVITY ANALYSIS
ON-SITE SOIL OPERABLE UNIT

Remedial Alternative	Cleanup Level (ppm)	Volume of PCB Contaminated Soil (cy)	Remediation Cost*	$/cy
On-Site Landfilling	25	185	653,484	3,532
Off-Site Landfilling	25	185	471,623	2,549
On-Site Incinerating	25	185	2,678,204	14,476
Off-Site Incinerating	25	185	1,463,533	7,911
On-Site Landfilling	10	400	670,296	1,676
Off-Site Landfilling	10	400	658,387	1,646
On-Site Incinerating	10	400	2,747,004	6,868
Off-Site Incinerating	10	400	2,802,383	7,006

02[IL]KM6120/1483/25

*Does not include contingency, engineering design, or construction management costs.

Table 7-8

**SOIL QUANTITY SENSITIVITY ANALYSIS
ON-SITE SOIL OPERABLE UNIT**

Remedial Alternative	Volume of PCB Contaminated Soil (cy)	Total Volume to be Excavated (cy)	Remediation Cost* ($)	$/cy
On-Site Landfilling	334	2,000	612,296	1,833
Off-Site Landfilling	334	2,000	549,194	1,644
On-Site Incinerating	334	2,000	2,676,679	8,014
Off-Site Incinerating	334	2,000	2,315,883	6,934
On-Site Landfilling	400	2,400	670,296	1,676
Off-Site Landfilling	400	2,400	658,378	1,646
On-Site Incinerating	400	2,400	2,747,004	6,868
Off-Site Incinerating	400	2,400	2,802,383	7,006
On-Site Landfilling	500	3,000	733,361	1,467
Off-Site Landfilling	500	3,000	801,358	1,603
On-Site Incinerating	500	3,000	3,833,879	7,668
Off-Site Incinerating	500	3,000	3,481,383	6,963

02[IL]KM6120/1485/17

*Does not include contingency, engineering design, or construction management costs.

8. RECOMMENDATIONS

Of the eight remedial alternatives to remove PCB-contamination considered and evaluated in Section 7, Remedial Alternatives: the No Action Alternative, the Off-Site Landfilling Alternative, the Off-Site Incineration Alternative, the On-Site Soil Washing Alternative, the On-Site Landfilling Alternative; Bioremediation Alternative; and the Chemical Treatment Alternative; the recommended alternative is Number 2: Off-Site Landfilling.

Both on-site soil washing and on-site landfilling were deemed not feasible and were screened from consideration. On-site soil washing would require an extensive pilot scale study prior to effective implementation. In order to determine the procedure's effectiveness, a large amount of contaminated material is necessary. This factor coupled with the high mobilization costs deems this option not feasible. The on-site landfill was screened from consideration due to long-term liability created as a result of this option. Periodic soil and groundwater monitoring would be required to ensure the integrity of the bunker. In addition, the process of obtaining a RCRA permit would be both costly and time-consuming.

The three alternatives considered as feasible options are Off-Site Landfilling, Off-Site Incineration, and On-Site Incineration. Alternative Number 2: Off-Site Landfilling is approximately one-third the cost of the remaining alternatives and was E & E's choice based upon economic considerations.

each of the above three alternatives involves remediation of the underground bunker. this activity would consist of demolition, removal and disposal of debris (including asbestos and dioxin contamination), removal and disposal of PCB sludges, and scarification and disposal of PCB-contaminated concrete.

Various combinations of remedial alternatives; for example, the off-site landfilling of contaminated soil coupled with securing the bunker until better remedial options for PCB-contaminated concrete cleanup options are available, cannot be assessed without input from the appropriate regulatory agencies.

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APPENDIX A

BOREHOLE LOGS

DEPARTMENT OF THE ARMY NORTH PACIFIC DIVISION U.S. ARMY ENGINEER DISTIRCT, ALASKA EXPLORATION LOG	PROJECT: Roosevelt Road LOCATION COORD N. E. DRILLING AGENCY OTHER COE Alaska District		SHEET 1 OF 1
HOLE NO. FIELD BH-1 HOLE NO. PERMANENT	NAME OF DRILLER Mitchell		WEATHER Partly cloudy, calm, 55°-60°
TYPE OF HOLE TEST PIT ___ AUGER HOLE X CHURN DRILL ___	DEPTH TO	DEPTH DRILLED 26.0′	TOTAL DEPTH OF HOLE 26.0′

SIZE AND TYPE OF BIT 8" hollowstem auger	DATUM FOR ELEVATION SHOWN MSL	TYPE OF EQUIPMENT Acker 5000

TOTAL NO. OF SAMPLES 6	TYPE OF SAMPLES Split-spoon	DEPTH TO GROUNDWATER Not Encountered	DATE HOLE STARTED 5/30/90	DATE HOLE COMPLETED 5/30/90

ELEVATION TOP OF HOLE	INSPECTOR R. Architzel	CHIEF SOILS SECTION	CHIEF GEOTECHNICAL BRANCH

DEPTH IN FEET	% WATER	SAMPLE	SOIL LEGEND	CLASSIFICATION	MAX SIZE	DESCRIPTION AND REMARKS
				Concrete Pad		
		36SL	SM	Silty sand with gravel	2"	Moderate brown, subrounded, HNu=bkg.
5		37SL		Silty sand with gravel		Moderate brown, subrounded, HNu=bkg.
10		38, 39 40SL	SW	Well graded sand with gravel	0.5"	Brown, subrounded, HNu=bkg.
			SM	Silty sand with gravel	2"	Brown, angular to subrounded, HNu=bkg.
15		41SL	ML	Sandy silt		Brown, HNu=bkg., moist 14′-15′, wet at 18′ [perched water table], trace subrounded gravel (max. size 2").
20		42SL	ML	Silt with gravel	0.5"	Brownish gray, subrounded, dry at 19′, HNu=bkg.
25		43SL	SM	Silty sand with gravel	2"	Brown, subrounded to angular, dry, HNu=bkg.
30						Bottom of hole 26.0′ (auger refusal) Bkg.=Background

DEPARTMENT OF THE ARMY NORTH PACIFIC DIVISION U.S. ARMY ENGINEER DISTIRCT, ALASKA EXPLORATION LOG	PROJECT: Roosevelt Road	SHEET 1 OF 1
HOLE NO. FIELD BH-2 / HOLE NO. PERMANENT	LOCATION COORD N. E. DRILLING AGENCY OTHER COE Alaska District NAME OF DRILLER Mitchell	WEATHER Clear, 55-60°
TYPE OF HOLE: TEST PIT ___ AUGER HOLE X CHURN DRILL ___	DEPTH TO	DEPTH DRILLED 25.0′ / TOTAL DEPTH OF HOLE 25.0′
SIZE AND TYPE OF BIT: 8" hollowstem auger	DATUM FOR ELEVATION SHOWN: ___ MSL ___	TYPE OF EQUIPMENT: Acker 5000
TOTAL NO. OF SAMPLES: 6 / TYPE OF SAMPLES: Split-spoon	DEPTH TO GROUNDWATER: Not Encountered	DATE HOLE STARTED 5/31/90 / DATE HOLE COMPLETED 5/31/90
ELEVATION TOP OF HOLE / INSPECTOR R. Architzel	CHIEF SOILS SECTION	CHIEF GEOTECHNICAL BRANCH

DEPTH IN FEET	% WATER	SAMPLE	SOIL LEGEND	CLASSIFICATION	MAX SIZE	DESCRIPTION AND REMARKS
				Concrete Pad		
		44SL	SM	Silty sand with gravel	2"	brown, subrounded, top 3" = moist, piece of charcoal fragment at 5′, HNu = bkg.
5		45SL		Silty sand with gravel		brown, subrounded, top 3"= moist, piece of charcoal fragment at 5′, HNu = 5.0ppm.
		46SL		(Same as above)		brown, subrounded, top 3"=moist, piece of charcoal fragment at 5′, HNu=bkg.
10		47SL	SW	Well graded sand with gravel	3"	brown, subrounded, HNu=4.8ppm.
15		48SL	SM	Silty sand		brown, crumbly, trace fragments of charcoal, dry, HNu = bkg.
20		49SL	ML	Sandy silt with gravel	2"	grayish olive, subrounded, HNu=bkg., moist.
		--	GM	[Cuttings: silty gravel with sand]	3"	Subrounded, moist, HNu=bkg., Drilling difficult. Representative sample not recovered.
25						
30						Bottom of hole 25.0′ (Auger refusal) Bkg. = Background

DEPARTMENT OF THE ARMY NORTH PACIFIC DIVISION U.S. ARMY ENGINEER DISTIRCT, ALASKA EXPLORATION LOG	PROJECT: Roosevelt Road LOCATION COORD N. E. DRILLING AGENCY OTHER COE Alaska District	SHEET 1 OF 1
HOLE NO. FIELD BH-3 HOLE NO. PERMANENT	NAME OF DRILLER Mitchell	WEATHER Overcast, 50°F
TYPE OF HOLE TEST PIT ___ AUGER HOLE X CHURN DRILL ___	DEPTH TO	DEPTH DRILLED 13.5' / TOTAL DEPTH OF HOLE 13.5'

SIZE AND TYPE OF BIT	DATUM FOR ELEVATION SHOWN	TYPE OF EQUIPMENT
8" hollowstem auger	___ MSL ___	Acker 5000

TOTAL NO. OF SAMPLES	TYPE OF SAMPLES	DEPTH TO GROUNDWATER	DATE HOLE STARTED	DATE HOLE COMPLETED
4	Split-spoon	Not encountered	6/01/90	6/01/90

ELEVATION TOP OF HOLE	INSPECTOR	CHIEF SOILS SECTION	CHIEF GEOTECHNICAL BRANCH
	R. Architzel		

DEPTH IN FEET	% WATER	SAMPLE	SOIL LEGEND	CLASSIFICATION	MAX SIZE	DESCRIPTION AND REMARKS
				Concrete Pad		
		50SL	SM	Silty sand with gravel	2"	Dark yellowish brown, subrounded HNu = bkg., moist at 3'
5		51,52, 53SL		(Same as above)		(Same as above), HNu = 18 ppm.
		54SL	SW	Well-graded sand		dark greenish gray subrounded to subangular gravels, cobble fragments, trace hard, brittle orange stringers, HNu=1.0ppm, dry.
10		55SL	SP	Poorly-graded sand with gravel	2"	light olive gray, subrounded, trace silt, HNu=1.0ppm, moist.
15						Bottom of hole 13.5' (Auger refusal)
20						
25						
30						

DEPARTMENT OF THE ARMY NORTH PACIFIC DIVISION U.S. ARMY ENGINEER DISTIRCT, ALASKA EXPLORATION LOG	PROJECT: Roosevelt Road	SHEET 1 OF 1
	LOCATION COORD N. E.	
	DRILLING AGENCY OTHER COE Alaska District	
HOLE NO. FIELD BH-4 HOLE NO. PERMANENT	NAME OF DRILLER ·Mitchell	WEATHER Partly sunny, 55-60°

TYPE OF HOLE	DEPTH TO	DEPTH DRILLED	TOTAL DEPTH OF HOLE
TEST PIT ___ AUGER HOLE X CHURN DRILL ___		13.5′	13.5′

SIZE AND TYPE OF BIT	DATUM FOR ELEVATION SHOWN	TYPE OF EQUIPMENT
8" hollowstem auger	___ MSL ___	Acker 5000

TOTAL NO. OF SAMPLES	TYPE OF SAMPLES	DEPTH TO GROUNDWATER	DATE HOLE STARTED	DATE HOLE COMPLETED
4	Split-spoon	Not encountered	6/01/90	6/01/90

ELEVATION TOP OF HOLE	INSPECTOR	CHIEF SOILS SECTION	CHIEF GEOTECHNICAL BRANCH
	R. Architzel		

DEPTH IN FEET	% WATER	SAMPLE	SOIL LEGEND	CLASSIFICATION	MAX SIZE	DESCRIPTION AND REMARKS
				Concrete Pad		
		56SL	SM	Silty sand with gravel	2"	brown to dark yellowish brown, subrounded, cobble fragments, HNu=1.4ppm.
5		57,58, 59SL		Silty sand with gravel		brown to dark yellowish brown, subrounded, cobble fragments, HNu=2.0ppm.
		60SL		Silty sand with gravel		brown to dark yellowish brown, subrounded, cobble fragments, HNu=1.4ppm.
10		61SL	SW	Well-graded sand with gravel	3"	dark yellowish brown, subrounded cobble fragments, HNu=1.6ppm.
15						Bottom of hole 13.5′ (Auger refusal)
20						
25						
30						

DEPARTMENT OF THE ARMY NORTH PACIFIC DIVISION U.S. ARMY ENGINEER DISTIRCT, ALASKA EXPLORATION LOG	PROJECT: Roosevelt Road	SHEET 1 OF 1
	LOCATION COORD N. E.	
	DRILLING AGENCY OTHER COE Alaska District	
HOLE NO. FIELD BH-5 / HOLE NO. PERMANENT	NAME OF DRILLER Mitchell	WEATHER Overcast, 55-60°

TYPE OF HOLE	DEPTH TO	DEPTH DRILLED	TOTAL DEPTH OF HOLE
TEST PIT ___ AUGER HOLE X CHURN DRILL ___		8.0′	8.0′

SIZE AND TYPE OF BIT	DATUM FOR ELEVATION SHOWN	TYPE OF EQUIPMENT
8" hollowstem auger	___ MSL ___	Acker 5000

TOTAL NO. OF SAMPLES	TYPE OF SAMPLES	DEPTH TO GROUNDWATER	DATE HOLE STARTED	DATE HOLE COMPLETED
2	Split-spoon	Not encountered	6/02/90	6/02/90

ELEVATION TOP OF HOLE	INSPECTOR	CHIEF SOILS SECTION	CHIEF GEOTECHNICAL BRANCH
	R. Architzel		

DEPTH IN FEET	% WATER	SAMPLE	SOIL LEGEND	CLASSIFICATION	MAX SIZE	DESCRIPTION AND REMARKS
		62SL	SM	Silty sand with gravel	2"	dark yellowish brown, subrounded cobble fragments, organics in top 2", HNu=1.0ppm.
5		63SL		Silty sand with gravel		(Same as above), HNu=1.8ppm.
		--				Representative sample not recovered; split-spoon hit refusal at 4′4".
				Concrete fragments		Drilling very difficult.
10						Bottom of hole 8.0′ (Drill head sheared off at 8.0′)
15						
20						
25						
30						

DEPARTMENT OF THE ARMY NORTH PACIFIC DIVISION U.S. ARMY ENGINEER DISTIRCT, ALASKA EXPLORATION LOG	PROJECT: Roosevelt Road	SHEET 1 OF 1
HOLE NO. FIELD BH-6	LOCATION COORD N. E.	
HOLE NO. PERMANENT	DRILLING AGENCY OTHER COE Alaska District	
	NAME OF DRILLER Mitchell	WEATHER Overcast, 55-60°
TYPE OF HOLE: TEST PIT ___ AUGER HOLE X CHURN DRILL ___	DEPTH TO	DEPTH DRILLED 28.0' / TOTAL DEPTH OF HOLE 29.0'

SIZE AND TYPE OF BIT	DATUM FOR ELEVATION SHOWN	TYPE OF EQUIPMENT
8" hollowstem auger	___ MSL ___________	Acker 5000

TOTAL NO. OF SAMPLES	TYPE OF SAMPLES	DEPTH TO GROUNDWATER	DATE HOLE STARTED	DATE HOLE COMPLETED
7	Split-spoon	Not encountered	6/02/90	6/02/90

ELEVATION TOP OF HOLE	INSPECTOR	CHIEF SOILS SECTION	CHIEF GEOTECHNICAL BRANCH
	R. Architzel		

DEPTH IN FEET	% WATER	SAMPLE	SOIL LEGEND	CLASSIFICATION	MAX SIZE	DESCRIPTION AND REMARKS
				Concrete Pad		
		64SL	SM	Silty sand with gravel	3"	Dark yellowish brown, subrounded cobble fragments, HNu=bkg.
		65SL		Silty sand with gravel		Dark yellowish brown, subrounded cobble fragments, HNu=bkg.
5		66,67, 68SL		Silty sand with gravel		Dark yellowish brown, subrounded cobble fragments, HNu=bkg.
10		69SL	SW	Well-graded sand with gravel	1"	Dark Yellowish brown, subrounded trace silt, moist, HNu=bkg.
15		70SL	MH	Elastic silt		Moderate brown, moist, very soft trace subrounded gravel (max. size=3'), HNu=bkg., smells septic.
20		71SL	SW	Well-graded sand with gravel	2"	light olive gray to grayish olive, subrounded, trace silt, moist, HNu=6.7ppm.
25						Representative sample not recovered. Drilling difficult.
		72SL		Well-graded sand with gravel.	2"	light olive gray, subrounded, trace silt, HNu=1.8ppm
				Bkg.=Background		Bottom of hole 29.0'

DEPARTMENT OF THE ARMY NORTH PACIFIC DIVISION U.S. ARMY ENGINEER DISTIRCT, ALASKA EXPLORATION LOG	PROJECT: Roosevelt Road	SHEET 1 OF 1
	LOCATION COORD N.	E.
	DRILLING AGENCY OTHER	COE Alaska District
HOLE NO. FIELD BH-7 / HOLE NO. PERMANENT	NAME OF DRILLER Mitchell	WEATHER Clear, 60-70°

TYPE OF HOLE	DEPTH TO	DEPTH DRILLED	TOTAL DEPTH OF HOLE
TEST PIT ___ AUGER HOLE X CHURN DRILL ___		21.0′	21.0′

SIZE AND TYPE OF BIT	DATUM FOR ELEVATION SHOWN	TYPE OF EQUIPMENT
8" hollowstem auger	___ MSL ___	Acker 5000

TOTAL NO. OF SAMPLES	TYPE OF SAMPLES	DEPTH TO GROUNDWATER	DATE HOLE STARTED	DATE HOLE COMPLETED
5	Split-spoon	Not encountered	6/ 4/90	6/ 4/90

ELEVATION TOP OF HOLE	INSPECTOR	CHIEF SOILS SECTION	CHIEF GEOTECHNICAL BRANCH
	Sienkiewicz		

DEPTH IN FEET	% WATER	SAMPLE	SOIL LEGEND	CLASSIFICATION	MAX SIZE	DESCRIPTION AND REMARKS
				Concrete Pad		
		73SL	ML	Sandy silt with gravel	2"	dark bround, rounded to sub-rounded cobbles, HNU=bkg, moist.
5		74SL		[Cuttings = dark brown sandy silt with gravel]		Representative sample not recovered.
10		75SL	SM	Silty sand with gravel	3"	Red-brown to grey-brown angular to subrounded cobbles, HNU=bkg, slightly moist.
15		76,77, 78SL		Silty sand with gravel	2"	Grey brown, subrounded, HNU=bkg, moist.
20		79SL	SP	Poorly-graded sand		Dark brown, angular, trace silt, HNU=bkg, very moist.
			ML	Sandy silt with gravel	2"	Grey cobbles.
						Bottom of hole 21.0′ (Auger refusal) Bkg.=Background
25						
30						

DEPARTMENT OF THE ARMY NORTH PACIFIC DIVISION U.S. ARMY ENGINEER DISTRICT, ALASKA EXPLORATION LOG	PROJECT: Roosevelt Road	SHEET 1 OF 1
HOLE NO. FIELD BH-8 / HOLE NO. PERMANENT	LOCATION COORD N. E. DRILLING AGENCY OTHER COE Alaska District NAME OF DRILLER Mitchell	WEATHER
TYPE OF HOLE: TEST PIT ___ AUGER HOLE X CHURN DRILL ___	DEPTH TO / DEPTH DRILLED 19.0′	TOTAL DEPTH OF HOLE 19.0′
SIZE AND TYPE OF BIT 8" hollowstem auger	DATUM FOR ELEVATION SHOWN ___ MSL ___	TYPE OF EQUIPMENT Acker 5000

TOTAL NO. OF SAMPLES	TYPE OF SAMPLES	DEPTH TO GROUNDWATER	DATE HOLE STARTED	DATE HOLE COMPLETED
5	Split-spoon	Not encountered	6/ 5/90	6/ 5/90

ELEVATION TOP OF HOLE	INSPECTOR	CHIEF SOILS SECTION	CHIEF GEOTECHNICAL BRANCH
	Sienkiewicz		

DEPTH IN FEET	% WATER	SAMPLE	SOIL LEGEND	CLASSIFICATION	MAX SIZE	DESCRIPTION AND REMARKS
				Concrete Pad		
		80,81, 82,83SL	SP	Poorly-graded sand		Dark brown, trace silt,1" sub-rounded cobble, HNU=5ppm,moist.
		84SL		Poorly-graded sand		2-3′: HNU=10ppm; 3-4′: HNU=5ppm; Sweet acrid odor, moist.
5		85SL	SM	Silty sand with gravel	3"	Brown to tan,subrounded cobbles, HNU=0.6ppm, slightly moist.
10		86SL		Silty sand with gravel	3"	Brown to tan,subrounded,slightly moist, HNU=bkg.
15		--				Representative sample not recovered(split-spoon hit refusal).
		87SL	ML	Top 5"=Sandy Silt	1"	Olive brown, trace angular gravel, slightly moist.
			SM	Silty sand with gravel	4"	Brown-olive,subrounded, semi-dry
20						Bottom of hole 19.0′ (Auger refusal) Bkg.=Background
25						
30						

DEPARTMENT OF THE ARMY NORTH PACIFIC DIVISION U.S. ARMY ENGINEER DISTIRCT, ALASKA EXPLORATION LOG	PROJECT: Roosevelt Road	SHEET 1 OF 1
	LOCATION COORD N. E.	
	DRILLING AGENCY OTHER COE Alaska District	
HOLE NO. FIELD BH-9 / HOLE NO. PERMANENT	NAME OF DRILLER Mitchell	WEATHER

TYPE OF HOLE	DEPTH TO	DEPTH DRILLED	TOTAL DEPTH OF HOLE
TEST PIT ___ AUGER HOLE X CHURN DRILL ___		24.0'	25.5'

SIZE AND TYPE OF BIT	DATUM FOR ELEVATION SHOWN	TYPE OF EQUIPMENT
8" hollowstem auger	___ MSL ______	Acker 5000

TOTAL NO. OF SAMPLES	TYPE OF SAMPLES	DEPTH TO GROUNDWATER	DATE HOLE STARTED	DATE HOLE COMPLETED
7	Split-spoon	Not encountered	6/ 5/90	6/ 5/90

ELEVATION TOP OF HOLE	INSPECTOR	CHIEF SOILS SECTION	CHIEF GEOTECHNICAL BRANCH
	Sienkiewicz		

DEPTH IN FEET	% WATER	SAMPLE	SOIL LEGEND	CLASSIFICATION	MAX SIZE	DESCRIPTION AND REMARKS
				Concrete Pad		
		88SL	SM	Silty sand with gravel	1"	Brown, subrounded, moist, HNU=1.0ppm, slight sweet acrid odor.
5		89SL		Silty sand with gravel	1"	Dark brown, HNU=22ppm, slight sweet acrid odor.
		90SL		Silty sand with gravel	1"	Grey-brown, subrounded, slightly moist, HNU=4ppm.
10		91SL		Silty sand with gravel	1"	Brown, moist, HNU=20ppm
15		92SL	GM	Silty gravel	3"	Brown, moist, HNU=1.0ppm
20		93,94, 95SL	SM	Silty sand with gravel	5"	Grey-brown, trace olive-grey clay matrix, slightly moist, HNU=3ppm.
25		96SL		Silty sand with gravel	2"	Brown, angular, moist, HNU=bkg.
						Bottom of hole 25.5' (Split-spoon refusal) Bkg.=Background
30						

DEPARTMENT OF THE ARMY NORTH PACIFIC DIVISION U.S. ARMY ENGINEER DISTRICT, ALASKA EXPLORATION LOG	PROJECT: Roosevelt Road	SHEET 1 OF 1
	LOCATION COORD N. E.	
	DRILLING AGENCY OTHER COE Alaska District	
HOLE NO. FIELD BH-10 / HOLE NO. PERMANENT	NAME OF DRILLER Mitchell	WEATHER

TYPE OF HOLE	DEPTH TO	DEPTH DRILLED	TOTAL DEPTH OF HOLE
TEST PIT ___ AUGER HOLE X CHURN DRILL ___		29.0'	30.6'

SIZE AND TYPE OF BIT	DATUM FOR ELEVATION SHOWN	TYPE OF EQUIPMENT
8" hollowstem auger	___ MSL ___________	Acker 5000

TOTAL NO. OF SAMPLES	TYPE OF SAMPLES	DEPTH TO GROUNDWATER	DATE HOLE STARTED	DATE HOLE COMPLETED
8	Split-spoon	Not encountered	6/ 6/90	6/ 6/90

ELEVATION TOP OF HOLE	INSPECTOR	CHIEF SOILS SECTION	CHIEF GEOTECHNICAL BRANCH
	Sienkiewicz		

DEPTH IN FEET	% WATER	SAMPLE	SOIL LEGEND	CLASSIFICATION	MAX SIZE	DESCRIPTION AND REMARKS
		97SL	SM	Silty sand		Brown, trace 2" angular gravel, dry, HNU=5ppm.
		98SL	SM	Silty sand with gravel	2"	Brown, moist to slightly moist, HNU=bkg.
5		99SL		Silty sand with gravel	2"	Brown, moist to slightly moist, HNU=5ppm.
10		100SL		Silty sand with gravel	2"	Brown, wet, HNU=3ppm, sample loose and uncompacted.
15		101SL		Silty sand with gravel	12"	Brown, wet, subrounded gravel, HNU=5ppm, slight sweet acrid odor.
20		--		(no sample)		representative sample not recovered. Split-spoon = sweet acrid odor.
		102SL		Silty sand with gravel		Gray-brown, wet, subrounded gravel, HNU=5ppm, sweet acrid odor.
25		103SL	SM	Silty sand		Olive-gray, slightly moist, trace 1" subrounded gravel, HNU=12ppm.
30		104SL	SM	Silty sand with gravel	2"	Green-gray, slightly moist, HNU=11ppm.
						Bottom of hole: 30.6 Bkg.=Background

DEPARTMENT OF THE ARMY NORTH PACIFIC DIVISION U.S. ARMY ENGINEER DISTIRCT, ALASKA EXPLORATION LOG	PROJECT: Roosevelt Road LOCATION COORD N. E. DRILLING AGENCY OTHER COE Alaska District	SHEET 1 OF 1
HOLE NO. FIELD BH-11 HOLE NO. PERMANENT	NAME OF DRILLER Mitchell	WEATHER

TYPE OF HOLE	DEPTH TO	DEPTH DRILLED	TOTAL DEPTH OF HOLE
TEST PIT ___ AUGER HOLE X CHURN DRILL ___		28.0′	28.8′

SIZE AND TYPE OF BIT	DATUM FOR ELEVATION SHOWN	TYPE OF EQUIPMENT
8" hollowstem auger	___ MSL ___	Acker 5000

TOTAL NO. OF SAMPLES	TYPE OF SAMPLES	DEPTH TO GROUNDWATER	DATE HOLE STARTED	DATE HOLE COMPLETED
8	Split-spoon	Not encountered	6/ 8/90	6/ 8/90

ELEVATION TOP OF HOLE	INSPECTOR	CHIEF SOILS SECTION	CHIEF GEOTECHNICAL BRANCH
	Sienkiewicz		

DEPTH IN FEET	% WATER	SAMPLE	SOIL LEGEND	CLASSIFICATION	MAX SIZE	DESCRIPTION AND REMARKS
		105SL	ML	Sandy silt with gravel	2"	Brown, subrounded, dry, HNU=bkg.
		106SL	SP	Poorly-graded sand.		Dark brown, trace 2" gravel, slightly moist, HNU=bkg.
5		107SL	SM	Silty sand		Dark brown, trace 2"gravel, moist, HNU=bkg.
		108SL		Silty sand with gravel	1"	Brown, subrounded, moist, HNU=bkg.
10						
15		109SL	SM	Silty sand		Yellow brown, trace subrounded 1"gravel, moist, HNU=bkg.
20		110SL	SM	Silty sand with gravel	2"	Brown, wet, HNU=bkg.
25		111,112 113SL		Silty sand with gravel	1"	Red brown, wet, HNU=1.0ppm.
		114SL		Silty sand with gravel	1"	Brown-olive-gray, moist, HNU=bkg trace brown-gray clay matrix.
30						Bottom of hole 28.8′ (Split-spoon hit refusal) Bkg.-Background.

DEPARTMENT OF THE ARMY NORTH PACIFIC DIVISION U.S. ARMY ENGINEER DISTRICT, ALASKA EXPLORATION LOG	PROJECT: Roosevelt Road LOCATION COORD N. E. DRILLING AGENCY OTHER COE Alaska District		SHEET 1 OF 1
HOLE NO. FIELD BH-12 HOLE NO. PERMANENT	NAME OF DRILLER Mitchell		WEATHER
TYPE OF HOLE TEST PIT ___ AUGER HOLE X CHURN DRILL ___	DEPTH TO	DEPTH DRILLED 4.0'	TOTAL DEPTH OF HOLE 6.0'

SIZE AND TYPE OF BIT 8" hollowstem auger	DATUM FOR ELEVATION SHOWN ___ MSL ___	TYPE OF EQUIPMENT Acker 5000

TOTAL NO. OF SAMPLES 3	TYPE OF SAMPLES Split-spoon	DEPTH TO GROUNDWATER Not encountered	DATE HOLE STARTED 6/ 8/90	DATE HOLE COMPLETED 6/ 8/90

ELEVATION TOP OF HOLE	INSPECTOR Sienkiewicz	CHIEF SOILS SECTION	CHIEF GEOTECHNICAL BRANCH

DEPTH IN FEET	% WATER	SAMPLE	SOIL LEGEND	CLASSIFICATION	MAX SIZE	DESCRIPTION AND REMARKS
		115SL	ML	Sandy silt with gravel	3/4"	Red-brown, some organic topsoil, slightly moist, HNU=0.5ppm.
		116SL	ML	Silt		Brown mottled gray-olive, trace gravel, compacted, HNU=0.5ppm
5		117SL	GM	Silty gravel		Yellow brown, trace organics, HNU=0.5ppm.
						Bottom of hole 6.0'
10						
15						
20						
25						
30				Frozen		

DEPARTMENT OF THE ARMY NORTH PACIFIC DIVISION U.S. ARMY ENGINEER DISTRICT, ALASKA EXPLORATION LOG	PROJECT: Roosevelt Road — SHEET 1 OF 1 LOCATION COORD N. E. DRILLING AGENCY OTHER COE Alaska District
HOLE NO. FIELD BH-13 — HOLE NO. PERMANENT	NAME OF DRILLER Mitchell — WEATHER

TYPE OF HOLE	DEPTH TO	DEPTH DRILLED	TOTAL DEPTH OF HOLE
TEST PIT ___ AUGER HOLE X CHURN DRILL ___			5.5′

SIZE AND TYPE OF BIT	DATUM FOR ELEVATION SHOWN	TYPE OF EQUIPMENT
8" hollowstem auger	___ MSL ________	Acker 5000

TOTAL NO. OF SAMPLES	TYPE OF SAMPLES	DEPTH TO GROUNDWATER	DATE HOLE STARTED	DATE HOLE COMPLETED
3	Split-spoon	Not encountered	6/ 8/90	6/ 8/90

ELEVATION TOP OF HOLE	INSPECTOR	CHIEF SOILS SECTION	CHIEF GEOTECHNICAL BRANCH
	Sienkiewicz		

DEPTH IN FEET	% WATER	SAMPLE	SOIL LEGEND	CLASSIFICATION	MAX SIZE	DESCRIPTION AND REMARKS
		118SL	OL/OH	Top 4": Organic soil and detritus, some ceramic debris.		HNU=bkg.
		119SL	ML	Silt.		Yellow-brown to gray-brown, moist, HNU=12.0ppm.
5		120SL	SM	At 4′9": Silty sand with gravel	1"	Yellow-brown to olive-brown, dry to slightly moist, rock fragments.
10						Bottom of hole 5.5′ Bkg.=background
15						
20						
25						
30						

DEPARTMENT OF THE ARMY NORTH PACIFIC DIVISION U.S. ARMY ENGINEER DISTIRCT, ALASKA EXPLORATION LOG	PROJECT: Roosevelt Road	SHEET 1 OF 1
	LOCATION COORD N.	E.
	DRILLING AGENCY OTHER	COE Alaska District
HOLE NO. FIELD BH-14 / HOLE NO. PERMANENT	NAME OF DRILLER Mitchell	WEATHER

TYPE OF HOLE	DEPTH TO	DEPTH DRILLED	TOTAL DEPTH OF HOLE
TEST PIT ___ AUGER HOLE X CHURN DRILL ___		4.0′	6.0′

SIZE AND TYPE OF BIT	DATUM FOR ELEVATION SHOWN	TYPE OF EQUIPMENT
8" hollowstem auger	___ MSL ___	Acker 5000

TOTAL NO. OF SAMPLES	TYPE OF SAMPLES	DEPTH TO GROUNDWATER	DATE HOLE STARTED	DATE HOLE COMPLETED
3	Split-spoon	Not encountered	6/ 8/90	6/ 8/90

ELEVATION TOP OF HOLE	INSPECTOR	CHIEF SOILS SECTION	CHIEF GEOTECHNICAL BRANCH
	Sienkiewicz		

DEPTH IN FEET	% WATER	SAMPLE	SOIL LEGEND	CLASSIFICATION	MAX SIZE	DESCRIPTION AND REMARKS
		121SL	OL/OH	Organic soil		Roots and organics.
			ML	Sandy silt		Brown, trace 1"gravel and rock fragments, HNU=bkg.
		122SL		Pulverized grano-diorite		HNU=bkg.
5		123SL	SM	Silty sand with gravel	3/4"	Yellow-brown, rock fragments, HNU=bkg.
						Bottom of hole 6.0′ Bkg.=background
10						
15						
20						
25						
30						

DEPARTMENT OF THE ARMY NORTH PACIFIC DIVISION U.S. ARMY ENGINEER DISTIRCT, ALASKA EXPLORATION LOG	PROJECT: Roosevelt Road LOCATION COORD N. E. DRILLING AGENCY OTHER COE Alaska District	SHEET 1 OF 1
HOLE NO. FIELD BH-15 HOLE NO. PERMANENT	NAME OF DRILLER Mitchell	WEATHER

TYPE OF HOLE	DEPTH TO	DEPTH DRILLED	TOTAL DEPTH OF HOLE
TEST PIT ___ AUGER HOLE X CHURN DRILL ___			6.0'

SIZE AND TYPE OF BIT	DATUM FOR ELEVATION SHOWN	TYPE OF EQUIPMENT
8" hollowstem auger	___ MSL ___	Acker 5000

TOTAL NO. OF SAMPLES	TYPE OF SAMPLES	DEPTH TO GROUNDWATER	DATE HOLE STARTED	DATE HOLE COMPLETED
2	Split-spoon	Not encountered	6/ 8/90	6/ 8/90

ELEVATION TOP OF HOLE	INSPECTOR	CHIEF SOILS SECTION	CHIEF GEOTECHNICAL BRANCH
	Sienkiewicz		

DEPTH IN FEET	% WATER	SAMPLE	SOIL LEGEND	CLASSIFICATION	MAX SIZE	DESCRIPTION AND REMARKS
		124SL				HNU=Bkg.
		--				No recovery
5		125,126 127SL				HNU=4ppm.
						Bottom of hole 6.0' BKg.=Background
10						
15						
20						
25						
30						

DEPARTMENT OF THE ARMY NORTH PACIFIC DIVISION U.S. ARMY ENGINEER DISTIRCT, ALASKA EXPLORATION LOG	PROJECT: Roosevelt Road	SHEET 1 OF 1
	LOCATION COORD N. E.	
	DRILLING AGENCY OTHER COE Alaska District	
HOLE NO. FIELD BH-16 HOLE NO. PERMANENT	NAME OF DRILLER Mitchell	WEATHER

TYPE OF HOLE	DEPTH TO	DEPTH DRILLED	TOTAL DEPTH OF HOLE
TEST PIT ___ AUGER HOLE X CHURN DRILL ___		8.0'	10.0'

SIZE AND TYPE OF BIT	DATUM FOR ELEVATION SHOWN	TYPE OF EQUIPMENT
8" hollowstem auger	___ MSL ___	Acker 5000

TOTAL NO. OF SAMPLES	TYPE OF SAMPLES	DEPTH TO GROUNDWATER	DATE HOLE STARTED	DATE HOLE COMPLETED
4	Split-spoon	Not encountered	6/ 8/90	6/ 8/90

ELEVATION TOP OF HOLE	INSPECTOR	CHIEF SOILS SECTION	CHIEF GEOTECHNICAL BRANCH
	R. Architzel		

DEPTH IN FEET	% WATER	SAMPLE	SOIL LEGEND	CLASSIFICATION	MAX SIZE	DESCRIPTION AND REMARKS
		128SL	ML	Sandy silt with gravel	1"	Reddish-brown, subrounded, dry, HNU=bkg.
		129,130 131SL	ML	At 2'10"=Silt		Brown, moist, compacted, trace subrounded 1"gravel, HNU=7ppm.
5		132SL	SM	Silty sand with gravel	2"	Reddish-brown, subrounded, oily odor, HNU=17ppm.
10		133SL		Silty sand with gravel		(Same as above), slight oily odor, HNU=2ppm.
						Bottom of hole 10.0' Bkg.=Background
15						
20						
25						
30						

DEPARTMENT OF THE ARMY NORTH PACIFIC DIVISION U.S. ARMY ENGINEER DISTIRCT, ALASKA EXPLORATION LOG	PROJECT: Roosevelt Road LOCATION COORD N. E. DRILLING AGENCY OTHER COE Alaska District	SHEET 1 OF 1
HOLE NO. FIELD BH-17 HOLE NO. PERMANENT	NAME OF DRILLER Mitchell	WEATHER
TYPE OF HOLE: TEST PIT ___ AUGER HOLE X CHURN DRILL ___	DEPTH TO	DEPTH DRILLED 8.0′ / TOTAL DEPTH OF HOLE 10.0′
SIZE AND TYPE OF BIT 8" hollowstem auger	DATUM FOR ELEVATION SHOWN ___ MSL ___	TYPE OF EQUIPMENT Acker 5000
TOTAL NO. OF SAMPLES 4 / TYPE OF SAMPLES Split-spoon	DEPTH TO GROUNDWATER Not encountered	DATE HOLE STARTED 6/ 8/90 / DATE HOLE COMPLETED 6/ 8/90
ELEVATION TOP OF HOLE / INSPECTOR Sienkiewicz	CHIEF SOILS SECTION	CHIEF GEOTECHNICAL BRANCH

DEPTH IN FEET	% WATER	SAMPLE	SOIL LEGEND	CLASSIFICATION	MAX SIZE	DESCRIPTION AND REMARKS
		134SL	ML	Sandy silt		Top 2"=organic soil; brown, slightly moist, trace 1"gravel, HNU=30ppm
		135SL	SM	Silty sand with gravel	1"	Brown, subrounded slightly moist
			ML	Silt		Mottled brown-gray, compacted, trace sand, HNU=2ppm.
5		136SL	ML	Silty sand with gravel		Gray-brown, dry, HNU=3ppm.
10		137SL		Silty sand with gravel	2"	Yellow-brown, angular to sub-rounded, moist, HNU=17ppm.
						Bottom of hole 10.0′
15						
20						
25						
30						

DEPARTMENT OF THE ARMY NORTH PACIFIC DIVISION U.S. ARMY ENGINEER DISTIRCT, ALASKA EXPLORATION LOG	PROJECT: Roosevelt Road LOCATION COORD N. E. DRILLING AGENCY OTHER COE Alaska District	SHEET 1 OF 1
HOLE NO. FIELD BH-18 HOLE NO. PERMANENT	NAME OF DRILLER Mitchell	WEATHER

TYPE OF HOLE	DEPTH TO	DEPTH DRILLED	TOTAL DEPTH OF HOLE
TEST PIT ___ AUGER HOLE X CHURN DRILL ___		8.0'	10.0'

SIZE AND TYPE OF BIT	DATUM FOR ELEVATION SHOWN	TYPE OF EQUIPMENT
8" hollowstem auger	___ MSL ___	Acker 5000

TOTAL NO. OF SAMPLES	TYPE OF SAMPLES	DEPTH TO GROUNDWATER	DATE HOLE STARTED	DATE HOLE COMPLETED
4	Split-spoon	Not encountered	6/ 8/90	6/ 8/90

ELEVATION TOP OF HOLE	INSPECTOR	CHIEF SOILS SECTION	CHIEF GEOTECHNICAL BRANCH
	Sienkiewicz		

DEPTH IN FEET	% WATER	SAMPLE	SOIL LEGEND	CLASSIFICATION	MAX SIZE	DESCRIPTION AND REMARKS
		138SL	ML	Silt		Brown, dry, trace 1"gravel and organics, HNU=bkg.
		139SL	SP	At 3'1": Poorly graded sand		Tan-brown 3" section of severed electrical cable, HNU=55ppm.
5		140SL	GP-GM	Poorly-graded gravel with silt and sand	2"	Yellow-brown, 1" section of severed electrical cable, HNU=Bkg.
		141SL	ML	At 8'3": silt		Dark brown, moist, compacted HNU=50ppm.
10			SM	At 8'6": silty sand with gravel		Yellow-brown, moist
						Bottom of hole 10.0' Bkg.=background
15						
20						
25						
30						

DEPARTMENT OF THE ARMY NORTH PACIFIC DIVISION U.S. ARMY ENGINEER DISTIRCT, ALASKA EXPLORATION LOG	PROJECT: Roosevelt Road — SHEET 1 OF 1 LOCATION COORD N. E. DRILLING AGENCY OTHER COE Alaska District
HOLE NO. FIELD BH-19 — HOLE NO. PERMANENT	NAME OF DRILLER Mitchell — WEATHER

TYPE OF HOLE	DEPTH TO	DEPTH DRILLED	TOTAL DEPTH OF HOLE
TEST PIT ___ AUGER HOLE X CHURN DRILL ___		8.0′	10.0′

SIZE AND TYPE OF BIT	DATUM FOR ELEVATION SHOWN	TYPE OF EQUIPMENT
8" hollowstem auger	___ MSL ________	Acker 5000

TOTAL NO. OF SAMPLES	TYPE OF SAMPLES	DEPTH TO GROUNDWATER	DATE HOLE STARTED	DATE HOLE COMPLETED
4	Split-spoon	Not encountered	6/ 8/90	6/ 8/90

ELEVATION TOP OF HOLE	INSPECTOR	CHIEF SOILS SECTION	CHIEF GEOTECHNICAL BRANCH
	Sienkiewicz		

DEPTH IN FEET	% WATER	SAMPLE	SOIL LEGEND	CLASSIFICATION	MAX SIZE	DESCRIPTION AND REMARKS
		142SL	ML	Silt with gravel	1"	Top 2"=stained organic soil; brown, trace sand, HNU=bkg.
		143SL	ML	Sandy silt		Yellow-brown, dry at top to very moist at bottom, trace 2′sub-rounded gravel, HNU=5ppm.
5		--		(no sample)		Representative sample not recovered.
		144SL	SM	Silty sand with gravel	1"	Dark yellowish brown, wet at top to moist at bottom, angular, HNU=9ppm.
10		145SL	ML	Silt		Tan-brown, moist, trace sub-rounded 1" gravel and very coarse sand, HNU=Bkg.
15						Bottom of hole 10.0′ Bkg.=Background
20						
25						
30						

DEPARTMENT OF THE ARMY NORTH PACIFIC DIVISION U.S. ARMY ENGINEER DISTIRCT, ALASKA EXPLORATION LOG	PROJECT: Roosevelt Road LOCATION COORD N. E. DRILLING AGENCY OTHER COE Alaska District	SHEET 1 OF 1
HOLE NO. FIELD BH-20 HOLE NO. PERMANENT	NAME OF DRILLER Mitchell	WEATHER

TYPE OF HOLE	DEPTH TO	DEPTH DRILLED	TOTAL DEPTH OF HOLE
TEST PIT ___ AUGER HOLE X CHURN DRILL ___		4.0′	6.0′

SIZE AND TYPE OF BIT	DATUM FOR ELEVATION SHOWN	TYPE OF EQUIPMENT
8" hollowstem auger	___ MSL ___	Acker 5000

TOTAL NO. OF SAMPLES	TYPE OF SAMPLES	DEPTH TO GROUNDWATER	DATE HOLE STARTED	DATE HOLE COMPLETED
2	Split-spoon	Not encountered	6/ 8/90	6/ 8/90

ELEVATION TOP OF HOLE	INSPECTOR	CHIEF SOILS SECTION	CHIEF GEOTECHNICAL BRANCH
	Sienkiewicz		

DEPTH IN FEET	% WATER	SAMPLE	SOIL LEGEND	CLASSIFICATION	MAX SIZE	DESCRIPTION AND REMARKS
		146SL	ML	Sandy silt with gravel	3"	Yellow-brown, HNU=30ppm
		147SL	SM	Silty sand		Yellow-brown, trace 2"gravel dry HNU=6ppm.
5		--		No sample		Representative sample not recovered.
						Bottom of hole 6.0′
10						
15						
20						
25						
30						

DEPARTMENT OF THE ARMY NORTH PACIFIC DIVISION U.S. ARMY ENGINEER DISTIRCT, ALASKA EXPLORATION LOG	PROJECT: Roosevelt Road	SHEET 1 OF 1
HOLE NO. FIELD BH-21 / HOLE NO. PERMANENT	LOCATION COORD N. E. DRILLING AGENCY OTHER COE Alaska District NAME OF DRILLER Mitchell	WEATHER

TYPE OF HOLE	DEPTH TO	DEPTH DRILLED	TOTAL DEPTH OF HOLE
TEST PIT ___ AUGER HOLE X CHURN DRILL ___		8.0'	10.0'

SIZE AND TYPE OF BIT	DATUM FOR ELEVATION SHOWN	TYPE OF EQUIPMENT
8" hollowstem auger	___ MSL ___	Acker 5000

TOTAL NO. OF SAMPLES	TYPE OF SAMPLES	DEPTH TO GROUNDWATER	DATE HOLE STARTED	DATE HOLE COMPLETED
3	Split-spoon	Not encountered	6/ 8/90	6/ 8/90

ELEVATION TOP OF HOLE	INSPECTOR	CHIEF SOILS SECTION	CHIEF GEOTECHNICAL BRANCH
	Sienkiewicz		

DEPTH IN FEET	% WATER	SAMPLE	SOIL LEGEND	CLASSIFICATION	MAX SIZE	DESCRIPTION AND REMARKS
		148SL	SM	Silty sand with gravel	1"	Dark yellow-brown, oily with oily odor. (No product visible)
		149,150 151SL		Silty sand with gravel	1"	Brown oily with oily odor. (No product visible)
5		--				Representative sample not recovered.
10		152SL		Silty sand with gravel	1"	Brown oily with oily odor, slightly moist.
						Bottom of hole 10.0'
						HNu not functioning for BH-21.
15						
20						
25						
30						

DEPARTMENT OF THE ARMY NORTH PACIFIC DIVISION U.S. ARMY ENGINEER DISTIRCT, ALASKA EXPLORATION LOG	PROJECT: Roosevelt Road LOCATION COORD N. E. DRILLING AGENCY OTHER COE Alaska District	SHEET 1 OF 1
HOLE NO. FIELD BH-22 HOLE NO. PERMANENT	NAME OF DRILLER Mitchell	WEATHER

TYPE OF HOLE TEST PIT ___ AUGER HOLE X CHURN DRILL ___	DEPTH TO	DEPTH DRILLED 4.0'	TOTAL DEPTH OF HOLE 6.0'

SIZE AND TYPE OF BIT 8" hollowstem auger	DATUM FOR ELEVATION SHOWN ___ MSL ___	TYPE OF EQUIPMENT Acker 5000

TOTAL NO. OF SAMPLES 3	TYPE OF SAMPLES Split-spoon	DEPTH TO GROUNDWATER Not encountered	DATE HOLE STARTED 6/ 8/90	DATE HOLE COMPLETED 6/ 8/90

ELEVATION TOP OF HOLE	INSPECTOR Sienkievicz	CHIEF SOILS SECTION	CHIEF GEOTECHNICAL BRANCH

DEPTH IN FEET	% WATER	SAMPLE	SOIL LEGEND	CLASSIFICATION	MAX SIZE	DESCRIPTION AND REMARKS
		153SL	ML	Sandy silt		Yellow-brown, dry, trace 1" gravel.
		154SL		Sandy silt		(Same as above), no odor.
5		155SL	SM	Silty sand		Yellow-brown, slightly moist, trace 1" gravel, no odor.
						Bottom of hole 6.0' HNU not functioning.
10						
15						
20						
25						
30						

DEPARTMENT OF THE ARMY NORTH PACIFIC DIVISION U.S. ARMY ENGINEER DISTIRCT, ALASKA EXPLORATION LOG	PROJECT: Roosevelt Road	SHEET 1 OF 1
HOLE NO. FIELD BH-23 / HOLE NO. PERMANENT	LOCATION COORD N. E.	
	DRILLING AGENCY OTHER	COE Alaska District
	NAME OF DRILLER Mitchell	WEATHER

TYPE OF HOLE	DEPTH TO	DEPTH DRILLED	TOTAL DEPTH OF HOLE
TEST PIT ___ AUGER HOLE X CHURN DRILL ___		4.0'	6.0'

SIZE AND TYPE OF BIT	DATUM FOR ELEVATION SHOWN	TYPE OF EQUIPMENT
8" hollowstem auger	___ MSL ______	Acker 5000

TOTAL NO. OF SAMPLES	TYPE OF SAMPLES	DEPTH TO GROUNDWATER	DATE HOLE STARTED	DATE HOLE COMPLETED
2	Split-spoon	Not encountered	6/ 8/90	6/ 8/90

ELEVATION TOP OF HOLE	INSPECTOR	CHIEF SOILS SECTION	CHIEF GEOTECHNICAL BRANCH
	Sienkiewicz		

DEPTH IN FEET	% WATER	SAMPLE	SOIL LEGEND	CLASSIFICATION	MAX SIZE	DESCRIPTION AND REMARKS
		156SL	ML	Sandy silt		Brown, dry, trace 1" gravel, no odor.
		157SL	SM	Silty sand with gravel	1"	Dark brown, slightly moist, no odor.
5		--				Representative sample not recovered.
						Bottom of hole 6.0' HNU not functioning.
10						
15						
20						
25						
30						

DEPARTMENT OF THE ARMY NORTH PACIFIC DIVISION U.S. ARMY ENGINEER DISTIRCT, ALASKA EXPLORATION LOG	PROJECT: Roosevelt Road	SHEET 1 OF 1
	LOCATION COORD N. E.	
	DRILLING AGENCY OTHER COE Alaska District	
HOLE NO. FIELD BH-13 HOLE NO. PERMANENT	NAME OF DRILLER Mitchell	WEATHER

TYPE OF HOLE	DEPTH TO	DEPTH DRILLED	TOTAL DEPTH OF HOLE
TEST PIT ___ AUGER HOLE X CHURN DRILL ___			5.5′

SIZE AND TYPE OF BIT	DATUM FOR ELEVATION SHOWN	TYPE OF EQUIPMENT
8" hollowstem auger	___ MSL ________	Acker 5000

TOTAL NO. OF SAMPLES	TYPE OF SAMPLES	DEPTH TO GROUNDWATER	DATE HOLE STARTED	DATE HOLE COMPLETED
3	Split-spoon	Not encountered	6/ 8/90	6/ 8/90

ELEVATION TOP OF HOLE	INSPECTOR	CHIEF SOILS SECTION	CHIEF GEOTECHNICAL BRANCH
	Sienkievicz		

DEPTH IN FEET	% WATER	SAMPLE	SOIL LEGEND	CLASSIFICATION	MAX SIZE	DESCRIPTION AND REMARKS
		118SL	OL/OH	Top 4": Organic soil and detritus, some ceramic debris.		HNU=bkg.
		119SL	ML	Silt.		Yellow-brown to gray-brown, moist, HNU=12.0ppm.
5		120SL	SM	At 4′9": Silty sand with gravel	1"	Yellow-brown to olive-brown, dry to slightly moist, rock fragments.
10						Bottom of hole 5.5′ Bkg.=background
15						
20						
25						
30						

DEPARTMENT OF THE ARMY
NORTH PACIFIC DIVISION
U.S. ARMY ENGINEER DISTRICT, ALASKA
EXPLORATION LOG

PROJECT: Roosevelt Road | SHEET 1 OF 1
LOCATION COORD N. E.
DRILLING AGENCY OTHER COE Alaska District
NAME OF DRILLER Mitchell | WEATHER

HOLE NO. FIELD BH-14 | HOLE NO. PERMANENT

TYPE OF HOLE: TEST PIT ___ AUGER HOLE X CHURN DRILL ___
DEPTH TO
DEPTH DRILLED 4.0'
TOTAL DEPTH OF HOLE 6.0'

SIZE AND TYPE OF BIT	DATUM FOR ELEVATION SHOWN	TYPE OF EQUIPMENT
8" hollowstem auger	___ MSL ___	Acker 5000

TOTAL NO. OF SAMPLES	TYPE OF SAMPLES	DEPTH TO GROUNDWATER	DATE HOLE STARTED	DATE HOLE COMPLETED
3	Split-spoon	Not encountered	6/ 8/90	6/ 8/90

ELEVATION TOP OF HOLE	INSPECTOR	CHIEF SOILS SECTION	CHIEF GEOTECHNICAL BRANCH
	Sienkiewicz		

DEPTH IN FEET	% WATER	SAMPLE	SOIL LEGEND	CLASSIFICATION	MAX SIZE	DESCRIPTION AND REMARKS
		121SL	OL/OH	Organic soil		Roots and organics.
			ML	Sandy silt		Brown, trace 1"gravel and rock fragments, HNU=bkg.
		122SL		Pulverized grano-diorite		HNU=bkg.
5		123SL	SM	Silty sand with gravel	3/4"	Yellow-brown, rock fragments, HNU=bkg.
						Bottom of hole 6.0' Bkg.=background
10						
15						
20						
25						
30						

DEPARTMENT OF THE ARMY NORTH PACIFIC DIVISION U.S. ARMY ENGINEER DISTIRCT, ALASKA EXPLORATION LOG	PROJECT: Roosevelt Road LOCATION COORD N. E. DRILLING AGENCY OTHER COE Alaska District	SHEET 1 OF 1
HOLE NO. FIELD BH-15 HOLE NO. PERMANENT	NAME OF DRILLER Mitchell	WEATHER
TYPE OF HOLE TEST PIT ___ AUGER HOLE X CHURN DRILL ___	DEPTH TO	DEPTH DRILLED / TOTAL DEPTH OF HOLE 6.0'

SIZE AND TYPE OF BIT	DATUM FOR ELEVATION SHOWN	TYPE OF EQUIPMENT
8" hollowstem auger	MSL	Acker 5000

TOTAL NO. OF SAMPLES	TYPE OF SAMPLES	DEPTH TO GROUNDWATER	DATE HOLE STARTED	DATE HOLE COMPLETED
2	Split-spoon	Not encountered	6/ 8/90	6/ 8/90

ELEVATION TOP OF HOLE	INSPECTOR	CHIEF SOILS SECTION	CHIEF GEOTECHNICAL BRANCH
	Sienkiewicz		

DEPTH IN FEET	% WATER	SAMPLE	SOIL LEGEND	CLASSIFICATION	MAX SIZE	DESCRIPTION AND REMARKS
		124SL				HNU=Bkg.
		--				No recovery
5		125,126 127SL				HNU=4ppm.
						Bottom of hole 6.0' BKg.=Background
10						
15						
20						
25						
30						

DEPARTMENT OF THE ARMY NORTH PACIFIC DIVISION U.S. ARMY ENGINEER DISTIRCT, ALASKA EXPLORATION LOG	PROJECT: Roosevelt Road — SHEET 1 OF 1 LOCATION COORD N. E. DRILLING AGENCY OTHER COE Alaska District
HOLE NO. FIELD BH-16 — HOLE NO. PERMANENT	NAME OF DRILLER Mitchell — WEATHER

TYPE OF HOLE	DEPTH TO	DEPTH DRILLED	TOTAL DEPTH OF HOLE
TEST PIT ___ AUGER HOLE X CHURN DRILL ___		8.0′	10.0′

SIZE AND TYPE OF BIT	DATUM FOR ELEVATION SHOWN	TYPE OF EQUIPMENT
8" hollowstem auger	___ MSL ______	Acker 5000

TOTAL NO. OF SAMPLES	TYPE OF SAMPLES	DEPTH TO GROUNDWATER	DATE HOLE STARTED	DATE HOLE COMPLETED
4	Split-spoon	Not encountered	6/ 8/90	6/ 8/90

ELEVATION TOP OF HOLE	INSPECTOR	CHIEF SOILS SECTION	CHIEF GEOTECHNICAL BRANCH
	R. Architzel		

DEPTH IN FEET	% WATER	SAMPLE	SOIL LEGEND	CLASSIFICATION	MAX SIZE	DESCRIPTION AND REMARKS
		128SL	ML	Sandy silt with gravel	1"	Reddish-brown, subrounded, dry, HNU=bkg.
		129,130 131SL	ML	At 2′10"=Silt		Brown, moist, compacted, trace subrounded 1"gravel, HNU=7ppm.
5		132SL	SM	Silty sand with gravel	2"	Reddish-brown, subrounded, oily odor, HNU=17ppm.
		133SL		Silty sand with gravel		(Same as above), slight oily odor, HNU=2ppm.
10						Bottom of hole 10.0′ Bkg.=Background
15						
20						
25						
30						

DEPARTMENT OF THE ARMY NORTH PACIFIC DIVISION U.S. ARMY ENGINEER DISTIRCT, ALASKA EXPLORATION LOG HOLE NO. FIELD BH-17 HOLE NO. PERMANENT	PROJECT: Roosevelt Road LOCATION COORD N. E. DRILLING AGENCY OTHER COE Alaska District NAME OF DRILLER Mitchell	SHEET 1 OF 1 WEATHER

TYPE OF HOLE	DEPTH TO	DEPTH DRILLED	TOTAL DEPTH OF HOLE
TEST PIT ___ AUGER HOLE X CHURN DRILL ___		8.0′	10.0′

SIZE AND TYPE OF BIT	DATUM FOR ELEVATION SHOWN	TYPE OF EQUIPMENT
8" hollowstem auger	___ MSL ___	Acker 5000

TOTAL NO. OF SAMPLES	TYPE OF SAMPLES	DEPTH TO GROUNDWATER	DATE HOLE STARTED	DATE HOLE COMPLETED
4	Split-spoon	Not encountered	6/ 8/90	6/ 8/90

ELEVATION TOP OF HOLE	INSPECTOR	CHIEF SOILS SECTION	CHIEF GEOTECHNICAL BRANCH
	Sienkiewicz		

DEPTH IN FEET	% WATER	SAMPLE	SOIL LEGEND	CLASSIFICATION	MAX SIZE	DESCRIPTION AND REMARKS
		134SL	ML	Sandy silt		Top 2"=organic soil; brown, slightly moist, trace 1"gravel,
		135SL	SM	Silty sand with gravel	1"	HNU=30ppm
			ML	Silt		Brown, subrounded slightly moist
5		136SL	ML	Silty sand with gravel		Mottled brown-gray, compacted, trace sand, HNU=2ppm.
						Gray-brown, dry, HNU=3ppm.
10		137SL		Silty sand with gravel	2"	Yellow-brown, angular to sub-rounded, moist, HNU=17ppm.
						Bottom of hole 10.0′
15						
20						
25						
30						

DEPARTMENT OF THE ARMY NORTH PACIFIC DIVISION U.S. ARMY ENGINEER DISTIRCT, ALASKA EXPLORATION LOG	PROJECT: Roosevelt Road		SHEET 1 OF 1
	LOCATION COORD N.	E.	
	DRILLING AGENCY OTHER	COE Alaska District	
HOLE NO. FIELD BH-18 / HOLE NO. PERMANENT	NAME OF DRILLER Mitchell	WEATHER	

TYPE OF HOLE TEST PIT ___ AUGER HOLE X CHURN DRILL ___	DEPTH TO	DEPTH DRILLED 8.0′	TOTAL DEPTH OF HOLE 10.0′

SIZE AND TYPE OF BIT 8" hollowstem auger	DATUM FOR ELEVATION SHOWN ___ MSL ________	TYPE OF EQUIPMENT Acker 5000

TOTAL NO. OF SAMPLES 4	TYPE OF SAMPLES Split-spoon	DEPTH TO GROUNDWATER Not encountered	DATE HOLE STARTED 6/ 8/90	DATE HOLE COMPLETED 6/ 8/90

ELEVATION TOP OF HOLE	INSPECTOR Sienkiewicz	CHIEF SOILS SECTION	CHIEF GEOTECHNICAL BRANCH

DEPTH IN FEET	% WATER	SAMPLE	SOIL LEGEND	CLASSIFICATION	MAX SIZE	DESCRIPTION AND REMARKS
		138SL	ML	Silt		Brown, dry, trace 1"gravel and organics, HNU=bkg.
		139SL	SP	At 3′1": Poorly graded sand		Tan-brown 3" section of severed electrical cable, HNU=55ppm.
5		140SL	GP-GM	Poorly-graded gravel with silt and sand	2"	Yellow-brown, 1" section of severed electrical cable, HNU=Bkg.
		141SL	ML	At 8′3": silt		Dark brown, moist, compacted HNU=50ppm.
10			SM	At 8′6": silty sand with gravel		Yellow-brown, moist
						Bottom of hole 10.0′ Bkg.=background
15						
20						
25						
30						

DEPARTMENT OF THE ARMY NORTH PACIFIC DIVISION U.S. ARMY ENGINEER DISTIRCT, ALASKA EXPLORATION LOG	PROJECT: Roosevelt Road LOCATION COORD N. E. DRILLING AGENCY OTHER	SHEET 1 OF 1 COE Alaska District	
HOLE NO. FIELD BH-19 HOLE NO. PERMANENT	NAME OF DRILLER Mitchell	WEATHER	
TYPE OF HOLE TEST PIT ___ AUGER HOLE X CHURN DRILL ___	DEPTH TO	DEPTH DRILLED 8.0'	TOTAL DEPTH OF HOLE 10.0'
SIZE AND TYPE OF BIT 8" hollowstem auger	DATUM FOR ELEVATION SHOWN ___ MSL ___	TYPE OF EQUIPMENT Acker 5000	
TOTAL NO. OF SAMPLES 4	TYPE OF SAMPLES Split-spoon	DEPTH TO GROUNDWATER Not encountered	DATE HOLE STARTED 6/ 8/90 DATE HOLE COMPLETED 6/ 8/90
ELEVATION TOP OF HOLE	INSPECTOR Sienkiewicz	CHIEF SOILS SECTION	CHIEF GEOTECHNICAL BRANCH

DEPTH IN FEET	% WATER	SAMPLE	SOIL LEGEND	CLASSIFICATION	MAX SIZE	DESCRIPTION AND REMARKS
		142SL	ML	Silt with gravel	1"	Top 2"=stained organic soil; brown, trace sand, HNU=bkg.
		143SL	ML	Sandy silt		Yellow-brown, dry at top to very moist at bottom, trace 2'sub-rounded gravel, HNU=5ppm.
5		--		(no sample)		Representative sample not recovered.
		144SL	SM	Silty sand with gravel	1"	Dark yellowish brown, wet at top to moist at bottom, angular, HNU=9ppm.
10		145SL	ML	Silt		Tan-brown, moist, trace sub-rounded 1" gravel and very coarse sand, HNU=Bkg.
						Bottom of hole 10.0' Bkg.=Background
15						
20						
25						
30						

DEPARTMENT OF THE ARMY NORTH PACIFIC DIVISION U.S. ARMY ENGINEER DISTIRCT, ALASKA EXPLORATION LOG	PROJECT: Roosevelt Road	SHEET 1 OF 1
	LOCATION COORD N. E.	
	DRILLING AGENCY OTHER COE Alaska District	
HOLE NO. FIELD BH-20 / HOLE NO. PERMANENT	NAME OF DRILLER Mitchell	WEATHER

TYPE OF HOLE	DEPTH TO	DEPTH DRILLED	TOTAL DEPTH OF HOLE
TEST PIT ___ AUGER HOLE X CHURN DRILL ___		4.0′	6.0′

SIZE AND TYPE OF BIT	DATUM FOR ELEVATION SHOWN	TYPE OF EQUIPMENT
8" hollowstem auger	___ MSL ___________	Acker 5000

TOTAL NO. OF SAMPLES	TYPE OF SAMPLES	DEPTH TO GROUNDWATER	DATE HOLE STARTED	DATE HOLE COMPLETED
2	Split-spoon	Not encountered	6/ 8/90	6/ 8/90

ELEVATION TOP OF HOLE	INSPECTOR	CHIEF SOILS SECTION	CHIEF GEOTECHNICAL BRANCH
	Sienkiewicz		

DEPTH IN FEET	% WATER	SAMPLE	SOIL LEGEND	CLASSIFICATION	MAX SIZE	DESCRIPTION AND REMARKS
		146SL	ML	Sandy silt with gravel	3"	Yellow-brown,HNU=30ppm
		147SL	SM	Silty sand		Yellow-brown, trace 2"gravel dry HNU=6ppm.
5		--		No sample		Representative sample not recovered.
						Bottom of hole 6.0′
10						
15						
20						
25						
30						

DEPARTMENT OF THE ARMY NORTH PACIFIC DIVISION U.S. ARMY ENGINEER DISTIRCT, ALASKA EXPLORATION LOG	PROJECT: Roosevelt Road	SHEET 1 OF 1
HOLE NO. FIELD BH-21	LOCATION COORD N. E.	
HOLE NO. PERMANENT	DRILLING AGENCY OTHER COE Alaska District	
	NAME OF DRILLER Mitchell	WEATHER

TYPE OF HOLE	DEPTH TO	DEPTH DRILLED	TOTAL DEPTH OF HOLE
TEST PIT ___ AUGER HOLE X CHURN DRILL ___		8.0′	10.0′

SIZE AND TYPE OF BIT	DATUM FOR ELEVATION SHOWN	TYPE OF EQUIPMENT
8" hollowstem auger	___ MSL ___	Acker 5000

TOTAL NO. OF SAMPLES	TYPE OF SAMPLES	DEPTH TO GROUNDWATER	DATE HOLE STARTED	DATE HOLE COMPLETED
3	Split-spoon	Not encountered	6/ 8/90	6/ 8/90

ELEVATION TOP OF HOLE	INSPECTOR	CHIEF SOILS SECTION	CHIEF GEOTECHNICAL BRANCH
	Sienkievicz		

DEPTH IN FEET	% WATER	SAMPLE	SOIL LEGEND	CLASSIFICATION	MAX SIZE	DESCRIPTION AND REMARKS
		148SL	SM	Silty sand with gravel	1"	Dark yellow-brown, oily with oily odor. (No product visible)
		149,150 151SL		Silty sand with gravel	1"	Brown oily with oily odor. (No product visible)
5		--				Representative sample not recovered.
		152SL		Silty sand with gravel	1"	Brown oily with oily odor, slightly moist.
10						Bottom of hole 10.0′
						HNu not functioning for BH-21.
15						
20						
25						
30						

DEPARTMENT OF THE ARMY NORTH PACIFIC DIVISION U.S. ARMY ENGINEER DISTRICT, ALASKA EXPLORATION LOG	PROJECT: Roosevelt Road	SHEET 1 OF 1
	LOCATION COORD N. E.	
	DRILLING AGENCY OTHER	COE Alaska District
HOLE NO. FIELD BH-22 / HOLE NO. PERMANENT	NAME OF DRILLER Mitchell	WEATHER

TYPE OF HOLE	DEPTH TO	DEPTH DRILLED	TOTAL DEPTH OF HOLE
TEST PIT ___ AUGER HOLE X CHURN DRILL ___		4.0'	6.0'

SIZE AND TYPE OF BIT	DATUM FOR ELEVATION SHOWN	TYPE OF EQUIPMENT
8" hollowstem auger	___ MSL ________	Acker 5000

TOTAL NO. OF SAMPLES	TYPE OF SAMPLES	DEPTH TO GROUNDWATER	DATE HOLE STARTED	DATE HOLE COMPLETED
3	Split-spoon	Not encountered	6/ 8/90	6/ 8/90

ELEVATION TOP OF HOLE	INSPECTOR	CHIEF SOILS SECTION	CHIEF GEOTECHNICAL BRANCH
	Sienkiewicz		

DEPTH IN FEET	% WATER	SAMPLE	SOIL LEGEND	CLASSIFICATION	MAX SIZE	DESCRIPTION AND REMARKS
		153SL	ML	Sandy silt		Yellow-brown, dry, trace 1" gravel.
		154SL		Sandy silt		(Same as above), no odor.
5		155SL	SM	Silty sand		Yellow-brown, slightly moist, trace 1" gravel, no odor.
						Bottom of hole 6.0' HNU not functioning.
10						
15						
20						
25						
30						

DEPARTMENT OF THE ARMY NORTH PACIFIC DIVISION U.S. ARMY ENGINEER DISTRICT, ALASKA EXPLORATION LOG	PROJECT: Roosevelt Road LOCATION COORD N. E. DRILLING AGENCY OTHER COE Alaska District	SHEET 1 OF 1
HOLE NO. FIELD BH-23 / HOLE NO. PERMANENT	NAME OF DRILLER Mitchell	WEATHER

TYPE OF HOLE	DEPTH TO	DEPTH DRILLED	TOTAL DEPTH OF HOLE
TEST PIT ___ AUGER HOLE X CHURN DRILL ___		4.0'	6.0'

SIZE AND TYPE OF BIT	DATUM FOR ELEVATION SHOWN	TYPE OF EQUIPMENT
8" hollowstem auger	___ MSL ___	Acker 5000

TOTAL NO. OF SAMPLES	TYPE OF SAMPLES	DEPTH TO GROUNDWATER	DATE HOLE STARTED	DATE HOLE COMPLETED
2	Split-spoon	Not encountered	6/ 8/90	6/ 8/90

ELEVATION TOP OF HOLE	INSPECTOR	CHIEF SOILS SECTION	CHIEF GEOTECHNICAL BRANCH
	Sienkiewicz		

DEPTH IN FEET	% WATER	SAMPLE	SOIL LEGEND	CLASSIFICATION	MAX SIZE	DESCRIPTION AND REMARKS
		156SL	ML	Sandy silt		Brown, dry, trace 1" gravel, no odor.
		157SL	SM	Silty sand with gravel	1"	Dark brown, slightly moist, no odor.
5		--				Representative sample not recovered.
						Bottom of hole 6.0' HNU not functioning.
10						
15						
20						
25						
30						

APPENDIX B

PHYSICAL, CHEMICAL, AND TOXICOLOGICAL PROPERTIES
PCBs, PCDDs, PCDFs

Polychlorinated Biphenyls (PCBs)

Physical and Chemical Properties

The following information has been compiled from EPA (1985). The most useful compilation of the physical and chemical properties which result in the dispersal of PCBs into the environment to cause potential danger to human health are briefly summarized below.

The widespread distribution of PCBs in the environment suggests that the major route by which PCBs are transported from their sources is through the atmosphere in the form of volatilized vapor and adsorption on particulate matter. Soil contaminated with PCBs will exert vapor pressure for volatilization. The vapor pressure above the soil with concentrations of PCBs at saturation or greater concentrations will be the same as saturation vapor pressure. Below the saturation point, the vapor pressure of PCBs on soil will be less than the saturation vapor pressure, and is called the partial pressure or true vapor pressure of PCBs.

Experimental data suggest that PCBs are strongly adsorbed on earth materials, including soil. PCBs adsorbed on soil, or present in mixture with soil, may be subject to ingestion if the contaminated sites are accessible to children or adults. Bioaccumulation into animal tissues, especially adipose, is another important property of PCBs. Since bioaccumulation of PCBs includes not only the terrestrial food chain but also the aquatic biota, the bioaccumulation factor is also an important physical parameter when there is a possibility of considerable transport of these compounds into water because of their solubilities.

The need exists to compile the chemical and physical properties for aroclors, although those for individual chlorobiphenyl compounds can be derived from existing data. There are a number of congeners for each of the Aroclors. Thus, the properties listed for an aroclor represent an average over the various species which constitute the mixture. The observation that environmental samples contain more of chlorobiphenyls with a high number of chlorines than is characteristic of freshly manufactured Aroclors has often been attributable to possible metabolism and volatilization of lower chlorine species coupled with enhanced sorption of species with more chlorine.

The properties and parameters for a chemical commonly needed in estimating the environmental fate and transport are vapor pressure, solubility in water, soil-water partition coefficient, and bioaccumulation factors. These properties are shown in Table 1 along with some other properties.

The more common types of Aroclors are shown in Table 2. These compounds range from oily liquids to white crystals and hard transparent resins, and generally have similar chemical and biological characteristics.

The vapor pressures of PCBs and their solubilities in water are low, and tend to decrease as the number of chlorine substitutions on the phenyl rings increase. Aroclors are soluble in most aliphatic and aromatic solvents, and are highly resistant to the action of strong alkali or acids, or high temperatures. PCBs have been shown to adsorb relatively rapidly and strongly to various materials such as soil, wood, plastic, glass, etc.

Partition coefficients indicating a measure of partitioning under equilibrium conditions between PCBs at the interfaces of air-soil, air-water, water-soil media are important parameters in exposure analysis. Experimental data are scarce. Data for the distribution between air and water in the form of Henry's law constant and water and soil, exist for some selected aroclors. Experimental data measuring the distribution of PCBs between air and soil are nonexistent. Estimates of air-soil partition coefficient based on Henry's law constant and soil-water partition coefficient can be calculated using one of several empirical relationships.

An EPA report presents kinetic data obtained from biodegradation experiments using water-soluble Aroclor 1242. The rate constants are presented for biphenyl compounds with up to the three chlorine substitutions present in Aroclor 1242. The data clearly show that many of the chlorinated biphenyls with four chlorine substitutions do not biodegrade after 48 hours of degradation run. Inferring from the compositions of Aroclors 1242 and 1254 as given in Table 1, it is conceivable that Aroclor 1242 may biodegrade to some extent because it contains a substantial amount of chlorinated biphenyls with two and three chlorine substitutions. It appears that biodegradation of Aroclor

1254 would be insignificant or may not occur because most biphenyl components have four or more substituted chlorine atoms.

PCBs have several properties which make them toxic in the environment. The high bioaccumulation factor indicates that they can significantly bioaccumulate and concentrate in the fatty tissues of all organisms. For example, the pcb concentration in resident fish is often many times higher than that in the surrounding water. PCBs are chemically stable compounds that are able to persist in the environment for long periods. Impurities in commercial PCBs could amplify the PCB problem because of their similarity in chemical structure and toxicity.

Non-Carcinogenic Toxicological Properties

This section briefly summarizes the non-cancer toxicological properties of PCBs. To date, EPA has not established a chronic reference dose (RFD) for non-cancer effects related to PCB intake. significant rodent chronic feeding bioassays have been performed by Kimbrough (1972), Bruckner (1974), Zinkl (1977), and Koller (1977) for various PCB formulations. In general, physiologic changes include liver changes, such as increased relative liver weight, liver enzyme induction, increased urinary proporphyrin and liver lipid content. lowest adverse effect levels (LOAEL) or no adverse effect levels (NOEL) were: 5 parts per million (ppm) Aroclor 1242 for Sprague-Dawley rats (Bruckner 1974); 10 ppm Aroclor 1254 for CD rats (Zinkl 1977); 3.75 ppm Aroclor 1254 for Balb/C mice (Koller 1977).

Other animal studies have used mink and various monkey species in chronic feeding studies. Both are more sensitive to pcb toxicity than are rats and mice. Bleavins (1980) exposed pastel mink to Aroclors 1016 and 1242. Due to high dose regimens and significant mortality, the apparent LOAEL was less than 5 ppm. Aulerich and Ringer (1977) exposed mink to four Aroclors and the NOEL was 2 ppm. Barsotti (1981) exposed rhesus monkeys to Aroclor 1016. At 1 ppm, infants showed a significantly lower birth weight. Nursing exacerbated symptoms of PCB toxicity. The NOEL for this study was 0.25 ppm.

Several studies of humans occupationally exposed to PCBs have been reported, but exposure levels are not well characterized. In a well-studied PCB poisoning (Yusho) event that occurred in 1968 in Japan, approximately 1,000 people consumed rice oil contaminated with PCBs. The average estimated PCB exposure was 2 grams; approximately 5 ppm of PCDF were also present. Symptoms included: premature delivery, reduced birth weight and height, hyperpigmentation of the skin and mucous membranes, precocious dental eruption and decreased calcification of the cranium. By 1979, 31 deaths had occurred among Yusho patients, 11 (35.4%) from malignant neoplasms (Urabe 1979). Since PCDFs were present, it is difficult to attribute all symptoms to PCBs only.

Carcinogenic Properties

PCBs are classified by EPA as B2, probable human carcinogens based on the production of hepatocellular carcinomas in three strains of rats and two strains of mice and inadequate but suggestive evidence of excess risk of liver cancer in humans by ingestion and inhalation or dermal contact.

Animal studies have yielded "sufficient" evidence of carcinogenicity with commercial PCB preparations. The carcinogenicity "slope factor" is based on the norback and weltman (1985) study of Sprague-Dawley rats fed 100 ppm Aroclor 1260 for 16 months which resulted in a 91% and 4% incidence of hepatocellular carcinomas among female and male rats, respectively. Another important study by Kimbrough (1979) produced hepatocellular carcinomas in 14% of female sherman rats when 100 ppm Aroclor 1260 was administered over 630 days. Studies have yielded positive results for other PCB isomers/formulations.

Polychlorinated Dibenzodioxins (PCDDs) and Polychlorinated Dibenzofurans (PCDFs)

Physical and Chemical Properties

PCDDs are a class of chlorinated aromatic hydrocarbons in which two chlorinated benzene rings are linked by a pair of oxygen atoms. PCDFs are a class of chlorinated aromatics in which two benzene rings are fused to each other by a central furan ring. Figure 1 depicts the generalized chemical structures of PCDDs and PCDFs, as well as the specific structure for 2,3,7,8-TCDD, the chemical which is currently regarded as presenting the highest potential human health risks.

There are 75 different PCDD isomers and 135 PCDF isomers. Table 1 breaks down the number of PCDD and PCDF isomers by chlorinated substituent class. Table 2 summarizes the abbreviations used in this document for individual PCDD and PCDF isomers.

Neither PCDDs nor PCDFs are or have been deliberately produced or released to the environment. Rather, they are unwanted trace contaminants in chlorinated phenols, polychlorinated biphenyls, and 2,4,5-trichlorophenoxyacetic acid formulations, and are also produced by a variety of combustion sources. Because of the high toxicity of some of the pcdd and pcdf congeners, risk assessment of potential human exposure to these contaminants in site-related media usually is driven by the concentrations of these chemicals in their respective media.

Physico-chemical properties are important determinants of the environmental transport rates and fate processes directly affecting the exposure potential for humans or environmental receptors. In the absence of physico-chemical property data for most of the isomers, this section will use the properties of 2,3,7,8-TCDD to evaluate PCDD and PCDF isomers.

Table 3 presents certain estimated physico-chemical properties of 2,3,7,8-TCDD. as presented in the table, PCDDs and PCDFs are characterized by extremely low vapor pressures, high log octanol-water coefficients (log K_{ow}s), high organic-carbon water partition coefficients (K_{oc}s), and extremely low water solubilities. Based upon criteria set by mckay and leinonen (1975), these isomers would be regarded as having moderate Henry's law constants.

Currently, the literature does not indicate significant chemical or biological degradation of PCDDs or PCDFs in air, soil, sediment, groundwater, or surface water. Whether photochemical reactions are important transformation processes in any ambient media is uncertain.

In the absence of non-aqueous phase organic liquids in the soils, which would dramatically increase transport and alter cross-media partitioning, the data indicate that PCDDs and PCDFs are persistent and subject to extremely slow rates of intramedia and/or intermedia transport. The high K_{oc}s indicate that pcdds and pcdfs will be strongly adsorbed to soils. The low water solubilities and high K_{oc}s indicate that rates of transport from the unsaturated zone soils to the water table via rain infiltration would be extremely low. For the same reasons, transport of PCDDs or PCDFs to groundwater will be strongly retarded relative to water flow due to strong sorption to soil particulate. The low vapor pressure indicates that volatilization from soils would occur at extremely low rates. Finally, low rates of physical or biological degradation indicate that PCDDs and PCDFs would be highly persistent in soils and groundwater.

The low water solubilities, high K_{oc}s, and moderate Henry's law constant indicate that both partitioning from surface water to air and sediments and sorption to sediments are important fate processes. Due to low rates of biodegradation and high K_{oc}s, PCDDs and PCDFs should be highly persistent in sediments.

Toxicological Properties: PCDDs

Certain PCDDs have been tested extensively for toxicity in animals. Of the PCDDs tested, 2,3,7,8-TCDD, 1,2,3,7,8-PeCDD, and two HxCDD isomers were discovered to be highly toxic following acute exposure (EPA 1985). All animal species that were administered high levels of these compounds developed weight loss and thymic atrophy (reduction in thymus size, which can result in decreased resistance to disease). Liver damage, edema, hair loss, and immune suppression (which can also result in decreased ability to respond to disease) were also observed in some species. Chronic cancer bioassays have been performed for only 2,3,7,8-TCDD and a mixture of the two HxCDD isomers. In these studies, the primary non-neoplastic lesion was a fatty and necrotic liver damage.

In those species tested, the fetus was highly sensitive to the toxic effects of 2,3,7,8-TCDD (EPA 1985). In rats, evidence of fetotoxicity included hemorrhage, edema, and kidney abnormalities. In mice, the predominant lesions were cleft palates and kidney abnormalities. USEPA has reported a 1 µg/kg dose of TCDD in mice as the lowest dose in animals resulting in important adverse effects on the fetus (EPA 1985).

Based upon animal carcinogenicity bioassays, EPA has categorized TCDD and a mixture of the two HxCDD isomers in group B2 (sufficient data in animals, insufficient data in humans) representing probable human carcinogens (EPA 1985). EPA regards the TCDD-related epidemiological studies performed to date as insufficient, on a statistical basis, for directly evaluating the carcinogenicity for humans. There have been no epidemiological studies concerned solely with the carcinogenicity of HxCDD for humans. As estimated by their Carcinogenic Potency Factors (CPFs) TCDD and HxCDD are two of the most potent carcinogens evaluated by EPA. Their CPFs were originally estimated to be 1.56×10^5 and 6.2×10^3 $(mg/kg/day)^{-1}$, respectively (EPA 1985), however, EPA's office of research and development recently reviewed the carcinogenic potency estimate for 2,3,7,8-TCDD and in a draft document (EPA 1988a) recommended revising its estimated potency downward to 1.0×10^4 $(mg/kg/day)^{-1}$. If this recommendation is accepted, it would have the effect of raising the various standards and criteria for dioxins by a factor of about 16.

Toxicological Properties: PCDFs

Some of the many PCDFs are extremely toxic to animals and man; to date, 2,3,7,8-TCDF and 2,3,4,7,8-PCDF appear to be the most toxic. Rodent studies indicate that 2,3,7,8-TCDF, 2,3,4,7,8-PCDF, and 1,2,3,4,7,8-HxCDF are teratogenic in mice, resulting in cleft palates and kidney damage (EPA 1986; Birnbaum et al. 1987a,b). Additionally, severe adverse effects have been reported in humans who consumed PCB- and PCDF-contaminated cooking and rice oil in Japan and China. Effects noted in exposed individuals included retarded growth, liver dysfunction, acneform eruptions, and skin pigmentation. Nine babies born to exposed mothers had grayish dark pigmentation of the skin, gums, and nails, and the majority also had unusual discharges from the eyes.

EPA Interim Procedures for Estimating TEFs of PCDD and PCDF Mixtures

There is neither a valid bioassay for evaluating the toxicity of complex mixtures of PCDDs and PCDFs nor complete sets of toxicological data for each constituent PCDD or PCDF congener (EPA 1987a). Consequently, as an interim science policy measure, EPA has developed a procedure for estimating the toxic risks of these mixtures using the distributions and concentrations of individual isomers and/or of isomers with the same number of chlorine substituents, as well as the estimated relative toxicity of these compounds. These procedures generate

2,3,7,8-TCDD toxicity equivalence factors (TEFs) of complex mixtures based on isomer-specific data. Table 4 presents the EPA-recommended TEFs.

Human Health Risks Associated With Exposure to Environmental PCDDs and PCDFs Contamination

As discussed in the previous section, the current practice in evaluating the health effects of PCDDs and PCDFs is to first convert PCDD and PCDF concentrations and estimated exposures to 2,3,7,8-TCDD equivalents and then evaluate the risks in those terms. Estimated exposure levels and associated health risks arising from 20 hypothetical environmental exposure scenarios involving 2,3,7,8-TCDD have recently been published in draft form by EPA (1988b). Fifteen of the scenarios involved surface soil or a landfill containing TCDD and five involved TCDD released to the environment as a result of municipal solid waste incineration. For the soil contamination scenarios, the greatest estimated risks were associated with consumption of dairy products, beef and fish produced or caught in the immediate vicinity of the contaminated area. Other than food consumption, the greatest estimated risks were associated with childhood soil consumption, resulting from hand-to-mouth transfer, and lifetime dermal soil contact. Inhalation of vapors and contaminated dust and consumption of contaminated drinking water were generally estimated to pose lesser risks. The actual estimated risk levels depended on the details of the individual scenarios. In the scenarios with assumed soil 2,3,7,8-TCDD concentrations of 1 ppb, the estimated carcinogenic risks associated with consumption of food produced or caught near the site ranged from about 10^{-6} (one in a million) to 10^{-2} (one in a hundred) while non-food related risks ranged from about 10^{-8} (one in one hundred million) to 10^{-4} (one in ten thousand). Regulatory agencies have regarded risks ranging from 10^{-7} to 10^{-4} as acceptable, depending on the specific circumstances, and EPA (1988c) has adopted a risk level of 10^{-6} (one in a million) as a "point of departure" for choosing acceptable risk levels for hazardous waste sites.

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TABLE 1

NUMBER OF PCDD AND PCDF ISOMERS
ACCORDING TO TOTAL CHLORINE SUBSTITUENTS

CHLORINE SUBSTITUENTS	1	2	3	4	5	6	7	8	TOTAL
PCDDs	2	10	14	22	14	10	2	1	75
PCDFs	4	16	28	38	28	16	4	1	135

TABLE 2

ABBREVIATIONS USED FOR INDIVIDUAL PCDD AND PCDF ISOMERS*

	PCDD Isomer	PCDF Isomer
Tetrachloro	TCDD	TCDF
Pentachloro	PeCDD	PeCDF
Hexachloro	HxCDD	HxCDF
Octachloro	OCDD	OCDF

* When describing individual isomers, the chlorine substitution pattern will precede the isomer designation. For example; 2,3,7,8-tetrachlorodibenzodioxin is abbreviated as 2,3,7,8-TCDD.

TABLE 3

ESTIMATED PHYSICO-CHEMICAL PROPERTIES OF TCDD

Parameter	Value
Water Solubility	0.2 µg/l at 25°C
Vapor Pressure	1.7×10^{-6} mm Hg at 25°C
Henry's Law Constant	3.6×10^{-3} atm-m^3/mol
K_{oc}*	3,300,000
log K_{ow}**	6.7
BCF***	10,000

* Soil organic carbon-water partition coefficient.
** Logarithm of octanol-water partition coefficient.
*** Aquatic bioconcentration factor.

Source: USEPA 1986, 1988a.

TABLE 4

TEFs
For PCDDs and PCDFs

COMPOUND	TEF
PCDDs	
Mono- through tri-CCDs	0
2,3,7,8-TCDD	1
Other TCDDs	0
2,3,7,8-PeCDDs	0.5
Other PeCDDs	0
2,3,7,8-HxCDDs	0.1
Other HxCDDs	0
2,3,7,8-HpCDDs	0.01
Other HpCDDs	0
OCDD	0.001
PCDFs	
Mono- through tri-PCDFs	0
2,3,7,8-TCDFs	0.1
Other TCDFs	0
2,3,7,8-PeCDFs	0.05
2,3,4,7,8-PeCDFS	0.5
Other PeCDFs	0
2,3,7,8-HxCDFs	0.1
Other HxCDFs	0
2,3,7,8-HpCDFs	0.01
Other HpCDFs	0
OCDF	0.001

Source: USEPA (1990).

TABLE 5

STANDARDS AND CRITERIA RELEVANT TO
PCBs, PCDDs and PCDFs

Standard or Criteria	PCB	PCD/PCDF	Reference
Carcinogenic Potency Factors (CPFs)			
2,3,7,8-TCDD		1.56×10^5 (mg/kg/day)$^{-1}$	USEPA 1986
Two HexCDD isomers		6.2×10^3 (mg/kg/day)$^{-1}$	USEPA 1986
Safe Drinking Water Act (MCLs or MCLGs)		None established	
Drinking Water Health Advisories			USEPA 1987b
One Day		0.001 µg/L	
Ten Days		0.0001 µg/L	
Longer Term Child (10 Kg)		0.00001 µg/L	
Adult (70 Kg)		0.000035 µg/L	
Lifetime 10^{-6} Cancer Risk Concentration		2.2×10^7 µg/L	
Soil Contamination "Action Levels"			
Residential Area Sol Concentration Above Which Remedial Measures Should Be Considered		1 µg/kg	Centers for Disease Control (CDC) in Kimbrough, et al. 1984
Surfaces (Wipes)			

APPENDIX B REFERENCES

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APPENDIX C

COMPARISON OF HNu READINGS TO PCB ANALYTICAL RESULTS

Table C-1

COMPARISON OF HNu READINGS ABOVE BACKGROUND TO THEIR PCB ANALYTICAL RESULT

Borehole	Depth (feet)	HNu Reading (above background) (ppm)	Aroclor 1260 PCB Result (mg/kg, ppb)
BH-2	5 - 7	5.0	180
BH-2	7 - 10	4.8	1400
BH-3	5 - 8	18	800, 5397, 1800
BH-3	8 - 11	1.0	160
BH-4	0 - 2	1.4	940
BH-4	2 - 4	2.0	1100, 1000, 1425
BH-4	4 - 6	1.4	840
BH-4	6 - 11	1.6	200
BH-5	0 - 2	1.0	270
BH-5	2 - 4	1.8	330
BH-6	15 - 20	6.7	<170
BH-6	20 - 29	1.8	<170
BH-8	0 - 2	5.0	1,900,000
BH-8	2 - 4	10	720,000
BH-8	4 - 6	0.6	330
BH-9	0 - 2	1.0	<17,000
BH-9	2 - 4	22	450,000
BH-9	7 - 9	4	<17,000
BH-9	10 - 11	20	15,000
BH-9	14 - 16	1.0	980
BH-9	19 - 21	3	140, 110, 213
BH-10	0 - 2	5	7300
BH-10	4 - 6	5	300
BH-10	9 - 11	3	<170
BH-10	14 - 16	5	120,000
BH-10	19 - 21	5	170,000
BH-10	22 - 23	12	510,000
BH-10	29 - 30	11	120,000
BH-11	24 - 26	1.0	84, 140, <160
BH-12	0 - 2	0.5	<2000

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Table C-1 (Cont.)

Borehole	Depth (feet)	HNu Reading (above background) (ppm)	Aroclor 1260 PCB result (mg/kg, ppb)
BH-12	2 - 4	0.5	<26,000
BH-12	4 - 6	0.5	<200
BH-13	1 - 4	12	49
BH-15	4 - 6	4	74, 220, <160
BH-16	2 - 4	7	3200, 4100, 21,870
BH-16	4 - 6	17	950
BH-16	8 - 10	2	<170
BH-17	0 - 2	30	<1700
BH-17	2 - 4	2	170
BH-17	4 - 6	3	<170
BH-17	8 - 10	17	<170
BH-18	2 - 4	55	<1700
BH-18	8 - 10	50	<170
BH-19	2 - 4	5	<180
BH-19	6 - 8	9	<170
BH-20	0 - 2	30	<1700
BH-20	2 - 4	6	<160

02[IL]KM6120/1459/23

APPENDIX D

DATA VALIDATION REPORT

DEPARTMENT OF THE ARMY
NORTH PACIFIC DIVISION MATERIALS LABORATORY
CORPS OF ENGINEERS
1491 N.W. GRAHAM AVENUE
TROUTDALE, OREGON 97060-9503

September 24, 1990

Ecology and Environment, Inc.
Attn: Lynn Fischer
1057 W. Fireweed
Suite 102
Anchorage, Alaska 99503

Dear Madam:

Enclosed are reports of quality assurance data for the ROOSEVELT ROAD TRANSMITTER SITE project sampled by Ecology and Environment, Inc., on May 22-31 and June 1-26, 1990. Included are:

a. Chemical Quality Assurance Report.

b. Reports from Southwest Laboratory of Oklahoma, Inc., dated July 12 and August 3-19, 1990.

c. Analytical report from Corps of Engineers-North Pacific Division Laboratory, dated July 31, 1990.

d. Addendum to analytical reports of project data previously submitted by ARDL, Inc.

e. Chain of Custody and Cooler Receipt forms.

f. Diskettes with all reported data.

The enclosed data completes all analysis requested to date for this site.

Please contact Dr. Ajmal Ilias or Ms. Pamela Swann at (503)665-4166 if you have any questions.

Sincerely,

Timothy J. Seeman

For James A. Paxton, Director
CENPD Materials Laboratory

Enclosures

Copy Furnished:

North Pacific Division Engineering/Geotechnical Branch

CENPD-EN-G-L (90-HM-107b)

24 Sep 90

CHEMICAL QUALITY ASSURANCE REPORT

ROOSEVELT ROAD TRANSMITTER SITE

1. SUMMARY:

a. All project data are acceptable except for one set of dioxin/furans and metal data:

1) Dioxin/furans Data of Soil/Sludge: The confirmation of congeners is acceptable but quantitations are questionable. Caution should be taken when used for site evaluation.

2) Metals Data: Cadmium, chromium, copper, lead, silver, thallium and zinc data are questionable due to low matrix spike recoveries for all these analytes and a high relative percent difference in laboratory duplicate results for cadmium and zinc.

b. All project and QA data agree except for data in Tables XV, XXVI, XXVII-2 and XXX. The data disagreements in these tables are due,in part,to non-identical samples and the project laboratories dioxin/furan and metals internal QA data.

2. BACKGROUND: The samples were collected on May 22-24 and 29-31 and June 1, 2, 4-8, 11-15, 18,19, 25 and 26, 1990. They were received by the analytical laboratories on May 24, 25 and 31 and June 1, 4-9, 12-14, 16, 18-21, 27 and 28, 1990.

3. OBJECTIVES:

a. Two hundred eighty-one soils samples, including 29 blind duplicates, 36 hexane wipes, including four blind duplicates, eleven tar samples, including two blind duplicates, five asbestos samples, including one blind duplicate and three sludge samples, including one blind duplicate, were collected from various subsites around the site to determine the extent of chemical contamination.

b. Thirty-eight quality assurance (QA) samples, one pair of trip blanks, three rinsates and one pair of hexane wipe blanks were submitted to evaluated the sampler's technique and the project laboratory's data.

4. PROJECT ORGANIZATION:

a. The samples were collected by North Pacific Division-Alaska District staff.

b. The project samples were analyzed by ARDL, Inc., Mt. Vernon, Illinois. Dioxin/furan samples were sub-contracted to Chemwest Analytical Laboratories, Sacramento, California. Asbestos samples were analyzed by Walker and Ward, Inc., Evansville, Indiana.

c. The QA samples were analyzed by Southwest Laboratory of Oklahoma, Broken Arrow, Oklahoma and North Pacific Division Materials Laboratory, Troutdale, Oregon.

5. ANALYTICAL REFERENCES:

Number	Title	Date
a. SW-846,Third Edition	Test Methods for Evaluating Solid Waste	11/86
b. EPA-600/4-79-020	Methods for Chemical Analysis of Water and Wastes	3/83
c. EPA-600/4-82-057	Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater	7/82
d. CENPD-EN-G-L Proposed Modified Method 8015	Fuel Quantification and Identification	1989
1) Method D-3328-78	Annual Book of ASTM Standards, Part 31	1980
2) Method D-2600	Annual Book of ASTM Standards, Part 24	1980
e. ASTM Method D-2487-83	Soils Classification for Engineering Purposes	10/83

6. EVALUATION OF THE PROJECT LABORATORY'S DATA:

a. Surrogates: One surrogate was used in PCB, three in volatile organics (VOC) and dioxin analyses and six in semi-volatile organics (BNA) analyses.

1) PCB's: Approximately three hundred surrogate recoveries were reported in nineteen sets of ARDL reports. Surrogate recoveries in ARDL report numbers 690, 695,696, 699, 702 and 709 through 713, 715, 720 and 728 were within advisory limits and are acceptable. Most of the surrogates in report numbers 707, 714, 716 and 719 were diluted out due to high dilutions applied to the extracts, which is acceptable. The surrogate

recoveries in report number 691 of wipe samples ranged from 141 through 259-percent, which is higher than advisory limits. Since targeted PCB's were found in only three samples, the data of six out of nine samples were not affected. In these three samples, the data are also acceptable, as dibutyl chlorendate (surrogate) was masked by the presence of PCB's 1254 and 1260; therefore, higher recoveries were found. Nine out of nineteen surrogate recoveries in ARDL report number 717 were outside the advisory limits. Of these nine out-of-control recoveries, two were in MS and MSD; therefore, data were not directly affected. High recoveries in four soil samples were due to the masking of PCB-1260 and were calculated high. The surrogate recovery in one water sample, -337WA, was above advisory limits; since no PCB's were found in this sample, data were not affected. Data of the remaining two soil samples are questionable due to surrogate recoveries below advisory limits. PCB's may not have been detected in these two samples if present in small quantities.

2) VOC's: VOC results are given in ARDL report number 728. All surrogates were within EPA QC limits and acceptable.

3) BNA's: BNA data are given in 12 out of 19 ARDL reports. All surrogate recoveries are within QC limits and acceptable.

4) Dioxin/Furans: Dioxin/furan results are given in ARDL reports 711 and 714. Soils/sludge results are given in report 714. Two out of three surrogates in sample 90RRTS279 and one out of three in -275 and its duplicate -274 were above the upper QC limits; therefore, data are questionable. For a detailed explanation, see Chemwest Analytical Laboratories, Inc. addendum. Surrogate recoveries of one water sample, given in report 717, are within QC limits and acceptable.

b. Matrix Spike (MS) and Matrix Spike Duplicate (MSD):

1) PBC's: Wipe sample results are in reports 690 and 691. MS and MSD were not done with these batches. Reported laboratory control sample recoveries were within QC limits and acceptable. MS and MSD in ARDL reports 696, 709, 713, 717 and 728 were within QC limits and are acceptable. MS and MSD in ARDL reports 695, 699, 710, 714, 715, 716 and 719 were above 200%, due to a high initial concentration of PCB-1260. The samples were spiked with about 350 ppb of PCB-1254, which was below the initial concentration of PCB-1260 in the samples; therefore, 1254 peaks were masked by 1260 peaks and higher recoveries resulted. High MS and MSD recoveries in these sets did not affect the data. MS and MSD recoveries in ARDL reports 702 and 707 could not be calculated due to the dilution required for analysis and the interfering presence of Aroclor-1260 in the spiked sample matrix. MS and MSD recoveries in ARDL reports 711 and 712 are high. The chromatograms of samples 196SL and 244SL showed a PCB like pattern in the retention time envelope for the spiking compound, PCB-1254, thus contributing to the high percent recoveries. Samples 210SL and 254SL contained PCB-1260 in the sample matrix, which interfered in the calculation of the spiked compound and also contributed to the high percentage recoveries for these samples.

2) VOC's, BNA's and Dioxin/Furans: MS and MSD in one set of VOC and 12 sets of BNA's were within QC limits except for three sets (646, 702 and 714), where one or two out of 22 recoveries were below lower QC limits, which is acceptable. The MSD recoveries in reports 696 and 714 were marginally higher than allowable but MS were within QC limits; therefore, BNA data of both sets were acceptable. In report 702, the amount of one of the spiking compounds added was less than the initial concentration present in the samples; therefore, calculations were difficult but data were accepted based on acceptable surrogate recoveries and the remaining 20 out of 22 acceptable recoveries. The internal standard recoveries of dioxin/furans in ARDL report 717 were within QC limits and are acceptable. The internal standard results of the sludge samples in report 714 were below lower QC limits; therefore, data of dioxin/furans in this report are questionable. For details, see addendum of Chemwest Analytical Laboratories.

3) Metals: Metals data are given in ARDL report 728. The MS recoveries of cadmium, chromium, copper, lead, silver, thallium and zinc were below lower QC limits; data of these metals are questionable.

4) Anions: Anion results are given in ARDL report 719. Spike recoveries of ammonia-nitrogen and nitrate are within QC limits and acceptable. Total phosphorous recovery was above upper QC limits; therefore, data should be considered a high estimate.

c. Laboratory Controls: Laboratory controls of metals and anions were within QC limits and acceptable.

d. Laboratory Duplicates: Relative percent differences (RPD) of anions and metals were within QC limits except cadmium and zinc, where RPD of 84 and 57-percent were found, respectively.

e. Detection Limits: All detection limits used were within method requirements and acceptable.

f. Holding Times: Holding times were met for all parameters except for one set of BNA samples, where extraction holding times expired by three days.

g. Method Blanks: Methylene chloride and chloroform were detected in the VOC blanks and bis(2-Ethylhexyl)phthalate was found in the BNA blanks.

h. Trip and Rinsate Blanks: The trip blanks are given in Table I and rinsates in Tables II-a through II-c. Methylene chloride and chloroform were detected in trip blanks. Methylene chloride is due to laboratory contamination and chloroform to contaminated deionized water used for the preparation of this blank. No analytes of interest were found in any rinsate except bis(2-Ethylhexyl)phthalate in the BNA rinsate, which is due to laboratory contamination.

i. Blind Duplicates: Blind duplicates are shown in Tables IV through XXXVII. All data agree except for Tables XIX, XX, XXX and XXXVII-3. Data disagreements in the first three tables are due to non-homogeneous and non-identical samples. Metal discrepancies in Table XXXVII-3 are reflected by unacceptable internal QC; all metals data agree except silver data, which is questionable due to low MS recovery.

j. Overall Evaluation of the Project Data: The quantitation of dioxin/furans in soil/sludge samples and some metal data are questionable due to low recoveries of internal standards, matrix interferences and MS recoveries, respectively. The remaining project data are acceptable.

7. EVALUATION OF THE QA LABORATORIES' DATA: No surrogates were used for PCB analysis. Surrogates in one set of VOC and three sets of BNA analyses were within QC limits and are acceptable. MS and MSD of all parameters were within QC limits except for four out of ten recoveries of VOC's and two out of twenty-two recoveries in one BNA set, which are acceptable based on acceptable surrogate recoveries. Methylene chloride and acetone were found in the VOC laboratory blank and bis(2-Ethylhexyl)phthalate in the BNA blank. Detection limits used were within method requirements and are acceptable. Overall, all QA data are acceptable.

8. QA/QC COMPARISONS: Comparisons are given in Tables III through XXXVII. All data agree except for data of Tables XV, XXVI, XXX and XXXVII-2. The data disagreements in all of these tables are due, in part, to non-homogeneous/non-identical samples submitted as duplicates. The dioxin data disagreement in Table XXVI is due to the project laboratory's method of reporting and is reflected by the low internal standard recoveries. The project laboratory, Chemwest Analytical Laboratories, Inc. reported on a wet weight basis while the QA laboratory, Southwest Laboratory of Oklahoma, reported on a dry weight basis.

CENPD-EN-G-L (90-HM-107b)

COMPARISON OF PROJECT AND QA RESULTS

TRIP BLANKS

TABLE I

Project: ROOSEVELT ROAD TRANSMITTER SITE
Matrix: water Sample Prefix: 90RRTS
Project Laboratory: ARDL, Inc. QA Laboratory: SW Lab of Oklahoma

Method: Volatile Organics (EPA 624/8240) Units: ug/L (ppb)

Analytes Detected	Project Lab -418WA	Detection Limits	QA Lab -419WA	Detection Limits
Methylene chloride	18B	10	3JB	5
Chloroform	45	5	ND	5
Tentatively Identified Compounds				
	1 @ 4 ppb		ND	

B = Found in laboratory blank as well as sample
J = Estimated value, found at or below instrument detection limit
ND = None detected

SUMMARY: Methylene chloride is due to laboratory contamination. The presence of chloroform is due to contaminated deionized water used for trip blanks, as seen in numerous other projects. The absence of other targeted analytes indicates no cross-contamination occurred during sample transportation or storage.

CENPD-EN-G-L (90-HM-107b)

PROJECT RESULTS

RINSATE

TABLE II-a

Project: ROOSEVELT ROAD TRANSMITTER SITE
Matrix: water Sample Number: 90RRTS158WA
Project Laboratory: ARDL, Inc.

1. Method: Polychlorinated Biphenyls (EPA 608/8080) Units: ug/L (ppb)

Aroclors Detected	-158WA	Detection Limits
	ND	0.71-1.4

ND = None detected

SUMMARY: The absence of targeted analytes indicates thorough decontamination procedures were utilized during sampling.

2. Method: Semi-Volatile Organics (EPA 625/8270) Units: ug/L

Analytes Detected	-158WA	Detection Limits
bis(2-Ethylhexyl)phthalate	40B	14
Tentatively Identified Compounds*		
Unknown	2, from 4-8	

B = Found in laboratory blank as well as sample
* = Also detected in laboratory blank

SUMMARY: Bis(2-Ethylhexyl)phthalate is due to laboratory contamination. The absence of other targeted analytes indicates thorough decontamination procedures were utilized during sample.

CENPD-EN-G-L (90-HM-107b)

PROJECT RESULTS

RINSATE

TABLE II-b

Project: ROOSEVELT ROAD TRANSMITTER SITE
Matrix: hexane Sample Number: 90RRTS335MI
Project Laboratory: ARDL, Inc.

Method: Dioxin/Furans (EPA 8280) Units: ng/L (ppt)

335MI	Detection Limits
ND	1.3-11.7

ND = None detected

SUMMARY: The absence of targeted analytes indicates thorough decontamination procedures were utilized during sampling.

CENPD-EN-G-L (90-HM-107b)

COMPARISON OF PROJECT AND QA RESULTS

RINSATE

TABLE II-c

Project: ROOSEVELT ROAD TRANSMITTER SITE
Matrix: water Sample Prefix: 90RRTS
Project Laboratory: ARDL, Inc.

1. Method: Polychlorinated Biphenyls (EPA 608/8080) Units: ug/L (ppb)
QA Laboratory: CENPD-EN-G-L

Aroclors Detected	Project Lab -336WA	Project Lab -337WA	Detection Limits	QA Lab -338WA	Detection Limits
	ND	ND	0.5-1.4	ND	0.5-1.0

ND = None detected

SUMMARY: The project and QA data agree. The absence of targeted analytes indicates thorough decontamination procedures were utilized during sampling.

2. Method: Semi-Volatile Organics (EPA 625/8270) Units: ug/L
QA Laboratory: Southwest Laboratory of Oklahoma

Analytes Detected	Project Lab -336WA	Project Lab -337WA	Detection Limits	QA Lab -338WA	Detection Limits
bis(2-Ethylhexyl)phthalate	23B	24B	10-14	14B	30
Tentatively Identified Compounds:					
Unknown	2, from 7-8	5, from 1-7		ND	
hexanedioic acid ester	ND	53		ND	

SUMMARY: The project and QA data agree. Bis(2-Ethylhexyl)phthalate is due to laboratory contamination. The absence of additional targeted analytes indicates thorough decontamination procedures were utilized during sampling.

CENPD-EN-G-L (90-HM-107b)

COMPARISON OF PROJECT AND QA RESULTS

BLANK HEXANE WIPES

TABLE III

Project: ROOSEVELT ROAD TRANSMITTER SITE
Matrix: hexane wipes Sample Prefix: 90RRTS
Project Laboratory: ARDL, Inc. QA Laboratory: CENPD-EN-G-L

Method: Polychlorinated Biphenols (EPA 8080) Units: total ug

Aroclors Detected	Project Lab -18WS	Detection Limits	QA Lab -19WS	Detection Limits
	ND	0.5-1.0	ND	0.1

ND = None detected

SUMMARY: The project and QA data agree and are acceptable for seven targeted PCB's.

CENPD-EN-G-L (90-HM-107b)

COMPARISON OF PROJECT AND QA RESULTS

TABLE IV

Project: ROOSEVELT ROAD TRANSMITTER SITE
Matrix: hexane wipes   Sample Prefix: 90RRTS
Project Laboratory: ARDL, Inc.   QA Laboratory: CENPD-EN-G-L
Method: Polychlorinated Biphenyls (EPA 8080)   Units: Total ug

1. Aroclors Detected	Project Lab -03WS	Project Lab -08WS	Detection Limits	QA Lab -09WS	Detection Limits
1260	1.2	ND	1.0	ND	0.1

ND = None detected

SUMMARY: The project blind duplicate and the QA data agree for all seven targeted PCB's and are acceptable. Discrepancies at close to or below detection limits are not considered significant.

2. Aroclors Detected	Project Lab -11WS	Project Lab -12WS	Detection Limits	QA Lab -13WS	Detection Limits
1260	ND	ND	1.0	1.45	0.1

SUMMARY: The project blind duplicate and the QA data agree for all seven targeted PCB's and are acceptable. Discrepancies at close to or below detection limits are not considered significant.

3. Aroclors Detected	Project Lab -271WS	Project Lab -272WS	Detection Limits	QA Lab -273WS	Detection Limits
1260	8.1	8.4	1.0	25.10	0.1

SUMMARY: The project blind duplicate and the QA data agree within a factor of four, which is acceptable for wipe samples.

4. Aroclors Detected	Project Lab -291WS	Project Lab -292WS	Detection Limits	QA Lab -293WS	Detection Limits
1260	410	630	10.0	1062	10.0

SUMMARY: The project blind duplicate and the QA data agree within a factor of three, which is acceptable for wipe samples.

CENPD-EN-G-L (90-HM-107b)

COMPARISON OF PROJECT AND QA RESULTS

TABLE V

Project: ROOSEVELT ROAD TRANSMITTER SITE
Matrix: soil Sample Prefix: 90RRTS
Project Laboratory: ARDL, Inc. QA Laboratory: CENPD-EN-G-L

Method: Polychlorinated Biphenyls (EPA 8080) Units: ug/Kg (ppb)

Aroclors Detected	Project Lab -27SL	Project Lab -28SL	Detection Limits	QA Lab -29SL	Detection Limits
	ND	ND	910-1800	ND	80-160

ND = None detected

SUMMARY: The project blind duplicate and QA data agree and are acceptable for all seven targeted PCB's.

CENPD-EN-G-L (90-HM-107b)

COMPARISON OF PROJECT AND QA RESULTS

TABLE VI

Project: ROOSEVELT ROAD TRANSMITTER SITE
Matrix: soil   Sample Prefix: 90RRTS
Project Laboratory: ARDL, Inc.   QA Laboratory: CENPD-EN-G-L

Method: Polychlorinated Biphenyls (EPA 8080)   Units: ug/Kg (ppb)

Aroclors Detected	Project Lab -38SL	Project Lab -39SL	Detection Limits	QA Lab -40SL	Detection Limits
	ND	ND	82-170	ND	80-160

ND = None detected

SUMMARY: The project blind duplicate and QA data agree and are acceptable for all seven targeted PCB's.

CENPD-EN-G-L (90-HM-107b)

COMPARISON OF PROJECT AND QA RESULTS

TABLE VII

Project: ROOSEVELT ROAD TRANSMITTER SITE
Matrix: soil Sample Prefix: 90RRTS
Project Laboratory: ARDL, Inc. QA Laboratory: CENPD-EN-G-L

Method: Polychlorinated Biphenyls (EPA 8080) Units: ug/Kg (ppb)

Aroclors Detected	Project Lab -51SL	Project Lab -52SL	Detection Limits	QA Lab -53SL	Detection Limits
1254	3600	2000	170	ND	160
1260	3600	1800	170	5397	160

ND = None detected

SUMMARY: The project laboratory's blind duplicate data agree. The project and QA data also agree as total PCB's, but differ identification. The QA laboratory chose to quantitate as PCB-1260 due to overlapping of PCB-1254 and 1260.

CENPD-EN-G-L (90-HM-107b)

COMPARISON OF PROJECT AND QA RESULTS

TABLE VIII

Project: ROOSEVELT ROAD TRANSMITTER SITE
Matrix: soil Sample Prefix: 90RRTS
Project Laboratory: ARDL, Inc. QA Laboratory: CENPD-EN-G-L

Method: Polychlorinated Biphenyls (EPA 8080) Units: ug/Kg (ppb)

Aroclors Detected	Project Lab -57SL	Project Lab -58SL	Detection Limits	QA Lab -59SL	Detection Limits
1260	1100	1000	170	1425	160

SUMMARY: The project laboratory's blind duplicate and QA data agree and are acceptable for seven targeted PCB's.

CENPD-EN-G-L (90-HM-107b)

COMPARISON OF PROJECT AND QA RESULTS

TABLE IX

Project: ROOSEVELT ROAD TRANSMITTER SITE
Matrix: soil Sample Prefix: 90RRTS
Project Laboratory: ARDL, Inc. QA Laboratory: CENPD-EN-G-L

Method: Polychlorinated Biphenyls (EPA 8080) Units: ug/Kg (ppb)

Aroclors Detected	Project Lab -66SL	Project Lab -67SL	Detection Limits	QA Lab -68SL	Detection Limits
1260	150J	43J	170	199	160

J = Estimated value, found at less than instrument detection limit

SUMMARY: The project blind duplicate and QA data agree within a factor of five, which is acceptable for soil samples.

CENPD-EN-G-L (90-HM-107b)

COMPARISON OF PROJECT AND QA RESULTS

TABLE X

Project: ROOSEVELT ROAD TRANSMITTER SITE
Matrix: soil Sample Prefix: 90RRTS
Project Laboratory: ARDL, Inc. QA Laboratory: CENPD-EN-G-L

Method: Polychlorinated Biphenyls (EPA 8080) Units: ug/Kg (ppb)

Aroclors Detected	Project Lab -76SL	Project Lab -77SL	Detection Limits	QA Lab -78SL	Detection Limits
1260	ND	ND	170-200	46.4	30.0

ND = None detected

SUMMARY: The project blind duplicate and QA data agree. Aroclor 1260 was detected by the QA laboratory below the project laboratory's detection limits; discrepancies at this level are not significant.

CENPD-EN-G-L (90-HM-107b)

COMPARISON OF PROJECT AND QA RESULTS

TABLE XI

Project: ROOSEVELT ROAD TRANSMITTER SITE
Matrix: soil Sample Prefix: 90RRTS
Project Laboratory: ARDL, Inc. QA Laboratory: SW Lab of Oklahoma

Method: Semi-Volatile Organics (EPA 8270) Units: ug/Kg (ppb)

Analytes Detected	Project Lab 81SL	81SLDL	82SL	82SLDL	Detection Limits	QA Lab -83SL	Detection Limits
1,4-Dichlorobenzene	22J	ND	55J	54J	340-3500	ND	1980
1,2-Dichlorobenzene	ND	ND	110J	130J	340-3500	114J	1980
1,2,4-Trichlorobenzene	14000E	17000	5800E	32000	340-3500	22170	1980
Hexachlorobenzene	35J	ND	ND	ND	340-3500	ND	1980
bis(2-Ethylhexyl)phthalate	190JB	ND	220JB	210JB	340-3500	ND	1980
Tentatively Identified Compounds							
Unknown	13, from 240-7100	9, from 200-5500	11, from 430-5400	11, from 410-8400			
Naphthalene, decahydro-2-methyl	650	2, from 200-780	ND	1200		ND	
Benzene, trichloro	ND	ND	ND	ND		6500	
Benzene, tetrachloro-	2, from 980-6900	2, from 450-3400	2, from 1600-9500	1700		13000	
Benzene, pentachloro-	800	410	1100	1200		1500	
Hexachloro-biphenyl	3, from 1200-1400	3, from 440-470	3, from 1100 1300	3, from 1500 1700		12000*	
Heptachloro-biphenyl	ND	220	690	ND			
Aroclor-1260	ND	220	600	ND			
Aroclor-1254	ND	420	560	ND			

ND = None detected
J = Estimated value, found at less than detection limits
E = Compound exceeds instrument calibration level
* = Reported as total PCB's

SUMMARY: The project blind duplicate and QA data agree for all 65 targeted analytes and are acceptable. Discrepancies at or below detection limits are not significant.

CENPD-EN-G-L (90-HM-107b)

COMPARISON OF PROJECT AND QA RESULTS

TABLE XII

Project: ROOSEVELT ROAD TRANSMITTER SITE
Matrix: soil Sample Prefix: 90RRTS
Project Laboratory: ARDL, Inc. QA Laboratory: CENPD-EN-G-L

Method: Polychlorinated Biphenyls (EPA 8080) Units: ug/Kg (ppb)

Aroclors Detected	Project Lab -93SL	Project Lab -94SL	Detection Limits	QA Lab -95SL	Detection Limits
1260	140J	110J	170	213	160

J = Estimated value, found at less than instrument detection limits

SUMMARY: The project blind duplicate and QA data agree and are acceptable for all seven targeted PCB's.

CENPD-EN-G-L (90-HM-107b)

COMPARISON OF PROJECT AND QA RESULTS

TABLE XIII

Project: ROOSEVELT ROAD TRANSMITTER SITE
Matrix: soil Sample Prefix: 90RRTS
Project Laboratory: ARDL, Inc. QA Laboratory: CENPD-EN-G-L

Method: Polychlorinated Biphenyls (EPA 8080) Units: ug/Kg (ppb)

Aroclors Detected	Project Lab -111SL	Project Lab -112SL	Detection Limits	QA Lab -113SL	Detection Limits
1260	84J	140J	170	ND	160

J = Estimated value, found at less than instrument detection limits
ND = None detected

SUMMARY: The project blind duplicate and QA data agree. Discrepancies at less than detection limits are not significant.

CENPD-EN-G-L (90-HM-107b)

COMPARISON OF PROJECT AND QA RESULTS

TABLE XIV

Project: ROOSEVELT ROAD TRANSMITTER SITE
Matrix: soil Sample Prefix: 90RRTS
Project Laboratory: ARDL, Inc. QA Laboratory: CENPD-EN-G-L

Method: Polychlorinated Biphenyls (EPA 8080) Units: ug/Kg (ppb)

Aroclors Detected	Project Lab -125SL	Project Lab -126SL	Detection Limits	QA Lab -127SL	Detection Limits
1260	74J	220J	170-1800	ND	160

J = Estimated value, found at less than instrument detection limits
ND = None detected

SUMMARY: The project blind duplicate and QA data agree. Discrepancies at less than detection limits are not significant.

CENPD-EN-G-L (90-HM-107b)

COMPARISON OF PROJECT AND QA RESULTS

TABLE XV

Project: ROOSEVELT ROAD TRANSMITTER SITE
Matrix: soil Sample Prefix: 90RRTS
Project Laboratory: ARDL, Inc. QA Laboratory: CENPD-EN-G-L

Method: Polychlorinated Biphenyls (EPA 8080) Units: ug/Kg (ppb)

Aroclors Detected	Project Lab -129SL	Project Lab -130SL	Detection Limits	QA Lab -131SL	Detection Limits
1260	3200	4100	2000-2100	21870	1600
Percent Moisture	20	23		20	

SUMMARY: The project laboratory's blind duplicate data agree and are acceptable based on this agreement and acceptable internal QC. The project and QA data also agree for six out of seven PCB's. The higher PCB-1260 value reported by the QA laboratory is probably due either to non-identical samples or non-homogeneous aliquots used for the analysis.

CENPD-EN-G-L (90-HM-107b)

COMPARISON OF PROJECT AND QA RESULTS

TABLE XVI

Project: ROOSEVELT ROAD TRANSMITTER SITE
Matrix: soil Sample Prefix: 90RRTS
Project Laboratory: ARDL, Inc. QA Laboratory: CENPD-EN-G-L

Method: Polychlorinated Biphenyls (EPA 8080) Units: ug/Kg (ppb)

Aroclors Detected	Project Lab -149SL	Project Lab -150SL	Detection Limits	QA Lab -151SL	Detection Limits
	ND	ND	860-1700	ND	80-160

ND = None detected

SUMMARY: The project blind duplicate and QA data agree and are acceptable for all seven PCB's.

CENPD-EN-G-L (90-HM-107b)

COMPARISON OF PROJECT AND QA RESULTS

TABLE XVII

Project: ROOSEVELT ROAD TRANSMITTER SITE
Matrix: soil Sample Prefix: 90RRTS
Project Laboratory: ARDL, Inc. QA Laboratory: CENPD-EN-G-L

Method: Polychlorinated Biphenyls (EPA 8080) Units: ug/Kg (ppb)

Aroclors Detected	Project Lab -164SL	Project Lab -165SL	Detection Limits	QA Lab -166SL	Detection Limits
	ND	ND	930-2100	ND	80-160

ND = None detected

SUMMARY: The project blind duplicate and QA data agree and are acceptable for all seven PCB's.

CENPD-EN-G-L (90-HM-107b)

COMPARISON OF PROJECT AND QA RESULTS

TABLE XVIII

Project: ROOSEVELT ROAD TRANSMITTER SITE
Matrix: soil Sample Prefix: 90RRTS
Project Laboratory: ARDL, Inc. QA Laboratory: CENPD-EN-G-L

Method: Polychlorinated Biphenyls (EPA 8080) Units: ug/Kg (ppb)

Aroclors Detected	Project Lab -176SL	Project Lab -177SL	Detection Limits	QA Lab -178SL	Detection Limits
	ND	ND	1300-2600	ND	320

ND = None detected

SUMMARY: The project blind duplicate and QA data agree and are acceptable for all seven PCB's.

CENPD-EN-G-L (90-HM-107b)

COMPARISON OF PROJECT AND QA RESULTS

TABLE XIX

Project: ROOSEVELT ROAD TRANSMITTER SITE
Matrix: soil   Sample Prefix: 90RRTS
Project Laboratory: ARDL, Inc.   QA Laboratory: CENPD-EN-G-L

Method: Polychlorinated Biphenyls (EPA 8080)   Units: ug/Kg (ppb)

Aroclors Detected	Project Lab -187SL	Project Lab -188SL	Detection Limits	QA Lab -189SL	Detection Limits
1254	2500	ND	1800-2000	985	160
1260	1700J	ND	1800-2000	290	160
Percent Moisture	12	9		13.8	

ND = None detected

SUMMARY: The project laboratory's data of sample -187 agree with the QA data within a factor of three, which is acceptable for soil samples. The project blind duplicate data did not agree due to non-identical samples submitted as duplicates; see percent moisture above.

CENPD-EN-G-L (90-HM-107b)

COMPARISON OF PROJECT AND QA RESULTS

TABLE XX

Project: ROOSEVELT ROAD TRANSMITTER SITE
Matrix: soil Sample Prefix: 90RRTS
Project Laboratory: ARDL, Inc. QA Laboratory: CENPD-EN-G-L

Method: Polychlorinated Biphenyls (EPA 8080) Units: ug/Kg (ppb)

Aroclors Detected	Project Lab -210SL	Project Lab -211SL	Detection Limits	QA Lab -212SL	Detection Limits
1260	210	ND	170	517	160
Percent Moisture	4	7		8.5	

ND = None detected

SUMMARY: The project data of sample -210SL agree within a factor of two to the detection limits and agree within a factor of three to the QA data, which are considered comparable at these levels.

CENPD-EN-G-L (90-HM-107b)

COMPARISON OF PROJECT AND QA RESULTS

TABLE XXI

Project: ROOSEVELT ROAD TRANSMITTER SITE
Matrix: soil Sample Prefix: 90RRTS
Project Laboratory: ARDL, Inc. QA Laboratory: CENPD-EN-G-L

Method: Polychlorinated Biphenyls (EPA 8080) Units: ug/Kg (ppb)

Aroclors Detected	Project Lab -216SL	Project Lab -217SL	Detection Limits	QA Lab -218SL	Detection Limits
1260	280	130J	170	ND	160
Percent Moisture	5	6		6.1	

J = Estimated value, found at less than instrument detection limits
ND = None detected

SUMMARY: The project laboratory's blind duplicate data agree and are acceptable. The project data is within a factor of two to the QA laboratory's detection limits, which is considered comparable at these levels of detection.

CENPD-EN-G-L (90-HM-107b)

COMPARISON OF PROJECT AND QA RESULTS

TABLE XXII

Project: ROOSEVELT ROAD TRANSMITTER SITE
Matrix: soil   Sample Prefix: 90RRTS
Project Laboratory: ARDL, Inc.   QA Laboratory: CENPD-EN-G-L

Method: Polychlorinated Biphenyls (EPA 8080)   Units: ug/Kg (ppb)

Aroclors Detected	Project Lab -219SL	Project Lab -220SL	Detection Limits	QA Lab -221SL	Detection Limits
	ND	ND	90-180	ND	80-160

ND = None detected

SUMMARY: The project blind duplicate data agree and are acceptable for all seven targeted PCB's.

CENPD-EN-G-L (90-HM-107b)

COMPARISON OF PROJECT AND QA RESULTS

TABLE XXIII

Project: ROOSEVELT ROAD TRANSMITTER SITE
Matrix: soil Sample Prefix: 90RRTS
Project Laboratory: ARDL, Inc. QA Laboratory: CENPD-EN-G-L

Method: Polychlorinated Biphenyls (EPA 8080) Units: ug/Kg (ppb)

Aroclors Detected	Project Lab -245SL	Project Lab -246SL	Detection Limits	QA Lab -247SL	Detection Limits
1260	1100J	2600	1600-1700	3658	160
Percent Moisture	3	3		4.6	

ND = None detected

SUMMARY: The project blind duplicate and QA data agree within a factor of four, which is acceptable for soil samples.

CENPD-EN-G-L (90-HM-107b)

COMPARISON OF PROJECT AND QA RESULTS

TABLE XXIV

Project: ROOSEVELT ROAD TRANSMITTER SITE
Matrix: soil Sample Prefix: 90RRTS
Project Laboratory: ARDL, Inc. QA Laboratory: CENPD-EN-G-L

Method: Polychlorinated Biphenyls (EPA 8080) Units: ug/Kg (ppb)

Aroclors Detected	Project Lab -258SL	Project Lab -259SL	Detection Limits	QA Lab -260SL	Detection Limits
1260	1400J	770	170-1700	894	160
Percent Moisture	6	7		6.5	

J = Estimated value, found at less than instrument detection limits

SUMMARY: The project blind duplicate and QA data agree and are acceptable for all targeted PCB's.

CENPD-EN-G-L (90-HM-107b)

COMPARISON OF PROJECT AND QA RESULTS

TABLE XXV

Project: ROOSEVELT ROAD TRANSMITTER SITE
Matrix: insulation Sample Prefix: 90RRTS
Project Laboratory: ARDL, Inc. QA Laboratory: SW Lab of Oklahoma

Method: Bulk Asbestos Units: Percent by volume

Asbestos Detected	Project Lab -263MI	Project Lab -264MI	QA Lab -265MI
Chrysotile	<1%	5%	2%

SUMMARY: Bulk asbestos data agree. Both laboratories found chrysotile, which confirms the presence of asbestos.

CENPD-EN-G-L (90-HM-107b)

COMPARISON OF PROJECT AND QA RESULTS

TABLE XXVI

Project: ROOSEVELT ROAD TRANSMITTER SITE
Matrix: tar/soil Sample Prefix: 90RRTS
Project Laboratory: Chemwest QA Laboratory: SW Lab of Oklahoma

Method: Dioxin/Furan Units: ug/Kg (ppb)

	Project Lab -274SW	Project Lab -275SW	Detection Limits	QA Lab -276SW	Detection Limits
PECDD	85.5	ND	19.7	ND	2.22
HxCDD	389	352	--	33.92	--
HpCDD	209	170	--	106.5	--
OCDD	62.2	55.8	--	66.67	--
TCDF	13.0	7.0	--	--	--
TCDF	201	206	--	380.9	--
PeCDF	963	638	--	374.1	--
HxCDF	2970S	3300	--	252.6	--
HpCDF	3700S	3090	--	840.9	--
OCDF	4600S	54305	--	4545	--
Percent Solids				81	

N = None detected
S = Saturated

SUMMARY: The project laboratory's blind duplicate data agree. The PECDD was not quantitated in sample -275 due to distorted chlorine cluster ratio and low counts of targeted ions. The PECDD data of sample -274 agree within a factor of five to its detection limits, which is acceptable for non-homogeneous samples. The QA laboratory confirmed the findings of the project laboratory but comparisons in quantitation were not made due to non-identical samples submitted as duplicates. In addition, the project laboratory reported data on a wet weight basis, while the QA laboratory data were reported on a dry weight basis.

CENPD-EN-G-L (90-HM-107b)

COMPARISON OF PROJECT AND QA RESULTS

TABLE XXVII

Project: ROOSEVELT ROAD TRANSMITTER SITE
Matrix: tar Sample Prefix: 90RRTS
Project Laboratory: ARDL, Inc. QA Laboratory: CENPD-EN-G-L

Method: Polychlorinated Biphenols (EPA 8080) Units: mg/Kg (ppm)

Aroclors Detected	Project Lab -280SW	Project Lab -281SW	Detection Limits	QA Lab -282SW	Detection Limits
1260	880,000	410,000	76000-81000	1,000,000	4000

SUMMARY: The project blind duplicate and QA data agree and are acceptable for all seven targeted PCB's.

CENPD-EN-G-L (90-HM-107b)

COMPARISON OF PROJECT AND QA RESULTS

TABLE XXVIII

Project: ROOSEVELT ROAD TRANSMITTER SITE
Matrix: soil Sample Prefix: 90RRTS
Project Laboratory: ARDL, Inc. QA Laboratory: CENPD-EN-G-L

Method: Polychlorinated Biphenols (EPA 8080) Units: ug/Kg (ppb)

Aroclors Detected	Project Lab -322SL	Project Lab -323SL	Detection Limits	QA Lab -324SL	Detection Limits
1260	110J	74J	170	88.7	30

SUMMARY: The project blind duplicate and QA data agree and are acceptable for all seven targeted PCB's.

CENPD-EN-G-L (90-HM-107b)

COMPARISON OF PROJECT AND QA RESULTS

TABLE XXIX

Project: ROOSEVELT ROAD TRANSMITTER SITE
Matrix: soil Sample Prefix: 90RRTS
Project Laboratory: ARDL, Inc. QA Laboratory: CENPD-EN-G-L

Method: Polychlorinated Biphenols (EPA 8080) Units: ug/Kg (ppb)

Aroclors Detected	Project Lab -326SL	Project Lab -327SL	Detection Limits	QA Lab -328SL	Detection Limits
1260	730	200J	230	2536	160.0
Percent Moisture	30	30		28.5	

J = Estimated value, found at less than instrument detection limit

SUMMARY: The project laboratory's data of sample -326SL agree within a factor of four to the QA data, which is acceptable for soil samples. The project laboratory found PCB-1260 below detection limits in sample -327 due either to incomplete extraction or non-homogeneous aliquots used for the analysis.

CENPD-EN-G-L (90-HM-107b)

COMPARISON OF PROJECT AND QA RESULTS

TABLE XXX

Project: ROOSEVELT ROAD TRANSMITTER SITE
Matrix: soil Sample Prefix: 90RRTS
Project Laboratory: ARDL, Inc. QA Laboratory: CENPD-EN-G-L

Method: Polychlorinated Biphenols (EPA 8080) Units: ug/Kg (ppb)

Aroclors Detected	Project Lab -340SL	Project Lab -341SL	Detection Limits	QA Lab -342SL	Detection Limits
1260	ND	340J	400-2300	922	160
Percent Moisture	19	26		28.5	

J = Estimated value, found at less than instrument detection limit
ND = None detected

SUMMARY: The project laboratory's blind duplicate and QA data did not agree. The data disagreement is due to non-identical samples submitted as duplicates (see percent moisture). The project data of sample -341SL agree within a factor of three to the QA data and are acceptable. The moisture content of project sample -341SL and the QA sample are similar; therefore, comparable data was produced.

CENPD-EN-G-L (90-HM-107b)

COMPARISON OF PROJECT AND QA RESULTS

TABLE XXXI

Project: ROOSEVELT ROAD TRANSMITTER SITE
Matrix: soil   Sample Prefix: 90RRTS
Project Laboratory: ARDL, Inc.   QA Laboratory: CENPD-EN-G-L

Method: Polychlorinated Biphenols (EPA 8080)   Units: ug/Kg (ppb)

Aroclors Detected	Project Lab -354SL	Project Lab -355SL	Detection Limits	QA Lab -356SL	Detection Limits
1260	3700	4100	180-360	19220	1600
Percent Moisture	11	12		11.3	

SUMMARY: The project laboratory's blind duplicate data agree and are acceptable. The project and QA data agree close to a factor of five, which is marginally acceptable.

CENPD-EN-G-L (90-HM-107b)

COMPARISON OF PROJECT AND QA RESULTS

TABLE XXXII

Project: ROOSEVELT ROAD TRANSMITTER SITE
Matrix: soil Sample Prefix: 90RRTS
Project Laboratory: ARDL, Inc. QA Laboratory: CENPD-EN-G-L

Method: Polychlorinated Biphenols (EPA 8080) Units: ug/Kg (ppb)

Aroclors Detected	Project Lab -359SL	Project Lab -360SL	Detection Limits	QA Lab -361SL	Detection Limits
1260	850J	820	180-1900	3520	160.0

SUMMARY: The project blind duplicate and QA data agree within a factor of five, which is acceptable for soil samples.

CENPD-EN-G-L (90-HM-107b)

COMPARISON OF PROJECT AND QA RESULTS

TABLE XXXIII

Project: ROOSEVELT ROAD TRANSMITTER SITE
Matrix: soil Sample Prefix: 90RRTS
Project Laboratory: ARDL, Inc. QA Laboratory: SW Lab of Oklahoma

Method: Semi-Volatile Organics (EPA 8270) Units: ug/Kg (ppb)

Analytes Detected	Project Lab -375SL	Project Lab -376SL	Detection Limits	QA Lab -377SL	Detection Limits
bis(2-Ethylhexyl)phthalate	420B	430B	350	ND	660
Tentatively Identified Compounds					
Unknown	17, from 45-6100	17, from 91-6000		ND	
1,1,2,2-Tetrachloroethane	39	ND		ND	
1,1-hexachlorobiphenyl	200	2, from 110-120		ND	
mitotane	250	ND		ND	
Chlorinated benzene	ND	240		100	

B = Found in laboratory blank as well as sample

SUMMARY: The project blind duplicate and QA data agree and are acceptable for all 65 targeted analytes. Bis(2-Ethylhexyl)phthalate is due to laboratory contamination.

CENPD-EN-G-L (90-HM-107b)

COMPARISON OF PROJECT AND QA RESULTS

TABLE XXXIV

Project: ROOSEVELT ROAD TRANSMITTER SITE
Matrix: soil Sample Prefix: 90RRTS
Project Laboratory: ARDL, Inc. QA Laboratory: CENPD-EN-G-L

Method: Polychlorinated Biphenols (EPA 8080) Units: ug/Kg (ppb)

Aroclors Detected	Project Lab -380SL	Project Lab -381SL	Detection Limits	QA Lab -382SL	Detection Limits
1260	1200J	350J	1700	1241	160

SUMMARY: The project blind duplicate and QA data agree and are acceptable for all seven targeted PCB's.

CENPD-EN-G-L (90-HM-107b)

COMPARISON OF PROJECT AND QA RESULTS

TABLE XXXV

Project: ROOSEVELT ROAD TRANSMITTER SITE
Matrix: soil Sample Prefix: 90RRTS
Project Laboratory: ARDL, Inc. QA Laboratory: CENPD-EN-G-L

Method: Polychlorinated Biphenols (EPA 8080) Units: ug/Kg (ppb)

Aroclors Detected	Project Lab -391SL	Project Lab -392SL	Detection Limits	QA Lab -393SL	Detection Limits
1260	540J	1100	190-1900	1898	160

SUMMARY: The project blind duplicate and QA data agree within a factor of four, which is acceptable for soil samples.

CENPD-EN-G-L (90-HM-107b)

COMPARISON OF PROJECT AND QA RESULTS

TABLE XXXVI

Project: ROOSEVELT ROAD TRANSMITTER SITE
Matrix: soil Sample Prefix: 90RRTS
Project Laboratory: ARDL, Inc. QA Laboratory: CENPD-EN-G-L

Method: Polychlorinated Biphenols (EPA 8080) Units: ug/Kg (ppb)

Aroclors Detected	Project Lab -402SL	Project Lab -403SL	Detection Limits	QA Lab -404SL	Detection Limits
	ND	ND	820-1600	ND	80-160

SUMMARY: The project blind duplicate and QA data agree and are acceptable for all seven targeted PCB's.

CENPD-EN-G-L (90-HM-107b)

COMPARISON OF PROJECT AND QA RESULTS

TABLE XXXVII

Project: ROOSEVELT ROAD TRANSMITTER SITE
Matrix: sludge Sample Prefix: 90RRTS
Project Laboratory: ARDL, Inc.

1. Method: Polychlorinated Biphenols (EPA 8080) Units: ug/Kg (ppb)
QA Laboratory: CENPD-EN-G-L

Aroclors Detected	Project Lab -414SG	Project Lab -415SG	Detection Limits	QA Lab -416SG	Detection Limits
1260	5600	4600	3100	4183	160

SUMMARY: The project blind duplicate and QA data agree and are acceptable for all seven targeted PCB's.

:ENPD-EN-G-L (90-HM-107b)
Table XXXVII

2. Method: Volatile Organics (EPA 624/8240) Units: ug/Kg
QA Laboratory: Southwest Laboratory of Oklahoma

Analytes Detected	414SG	Project Laboratory 414SGDL	415SG	415SGDL	Detection Limits	QA Lab 416SG	Detection Limits
lethylene chloride	7100B	100,000BD	9400B	63000BD	1900-19000	9000B	6250
.,1-Dichloroethane	10000	11000JD	20000	16000D	960-9600	19400	6250
:hloroform	62000E	69000D	89000E	89000D	960-9600	ND	6250
.,2-Dichloroethane	2700	ND	ND	ND	960-9600	ND	6250
.,2-Dichloroethene (total)	ND	ND	2100	ND	960-9600	—	—
,1,1-Trichloroethane	32000	32000D	42000	45000	960-9600	35800	6250
richloroethene	250,000E	280,000D	280,000E	340,000D	960-9600	388,800	6250
etrachloroethene	2200	ND	2800	ND	960-9600	ND	6250
oluene	9500	12000JD	10000	8800	960-9600	9800J	6250
:thylbenzene	1500	ND	ND	ND	960-9600	ND	6250
r-xylene	6300	ND	5500	ND	960-9600	—	—
+p-xylene	5500	ND	5000	ND	960-9600	10600*	6250
.1-Dichloroethene	ND	ND	ND	ND	960-9600	19320	6250

...ively Identified Compounds

nknown	2, from 810-32000	2, from 7000-42000	4, from 1200-34000	2, from 16000-120,000		1 @ 152,000	
lkyl benzenes	ND	ND	ND	ND		78000	
-Carene	51000	ND	ND	ND		ND	

ID = None detected
: = Amount exceeds instrument calibration level
) = Results after dilution
: = Found in laboratory blank as well as sample
· = Reported as "total xylenes".

UMMARY: The project laboratory's blind duplicate data agree for 33 out of 35 analytes. The 1,2-ichloroethane and ethene disagreement are at or below detection limits and are not significant at hese levels for sludge samples. The project and QA data agree for 31 out of 35 analytes. Of hese four disagreements, two of the project data were below the QA laboratory's detection limits; iscrepancies at these levels are not significant. The remaining two analyte disagreements were ot resolved and could be due to non-identical, non-homogeneous aliquots used during analysis.

CENPD-EN-G-L (90-HM-107b)
Table XXXVII

3. Method: Metals Units: mg/Kg (ppm)
QA Laboratory: CENPD-EN-G-L

Targeted Analytes	Project Lab -414SG	-415SG	Detection Limits	QA Lab -416SG	Detection Limits
Antimony	ND	3.8	2.5	ND	12
Arsenic	4.2	3.8	--	8.2	2.0
Barium	320	240	--	490	40
Beryllium	1.8	ND	12.8	ND	1.0
Cadmium	7.5	6.6	--	4.7	1.0
Chromium	46	34	--	45	2.0
Copper	340	340	--	194	5.0
Lead	800	820	--	739	1.0
Mercury	5.9	8.4	0.1	6.9	0.1
Nickel	36	32	1.7-1.8	44	8.0
Selenium	ND	ND		ND	1.0
Silver	11	ND	3.5	3.3	2.0
Thallium	ND	ND	1.7-1.8	ND	2.0
Zinc	630	760	--	555	4.0
Percent moisture	48	48		63.3	

SUMMARY: The project laboratory's blind duplicate data agree within a factor of three to each other or to detection limits except for silver. The silver data reported in sample -414SG are questionable due to unacceptable internal QA submitted. The project and QA data agree for all of the above analytes and are acceptable. Data discrepancies at or below detection limits are not significant.

APPENDIX E

COST ESTIMATE SUMMARY

ALTERNATIVE #2

Roosevelt Road Transmitter Site
Cost Estimate
Off-Site Landfill PCB Soils

Mobilization/Demobilization:

1. 2 days to mobilize, 2 days to demobilize.
2. Standby equipment at 25% of daily rate.

Labor:

	Rate	Hours	Total
Project Manager	$57.75	32	$1,848.00
HWT Eq Operator	$41.50	32	$1,328.00
HWT	$39.25	32	$1,256.00
			$4,432.00

Equipment:

	Rate	Days	Total
Cat 235 Excavator	$162.50	4	$650.00
Ex-100 Excavator	$137.50	4	$550.00
Forklift	$43.13	4	$172.50
Cat 966 Loader	$112.50	4	$450.00
12-yd Dump Truck	$76.00	4	$304.00
	$31.25	4	$125.00
Lowboy	$800.00	4	$3,200.00
Scale	$18.75	4	$75.00
Pressure Washer	$18.75	4	$75.00
Miscellaneous	$50.00	4	$200.00
			$5,801.50

Total: $10,233.50

Roosevelt Road Transmitter Site
Cost Estimate
E-Site Landfill PCB Soils

Excavation/Backfill:

1. Based on cleanup level of 10 ppm.
2. Total excavation yardage estimate = 2400 cy.
3. Total PCB-contaminated yardage estimate = 400 cy.
4. Daily production estimate = 125 cy.

		Number	Reg Rate	O.T. Rate	Reg Hours	O.T. Hours	Total
Labor:	Project Coordinator	1	$65.00	$85.00	160	0	$10,400.00
	Project Manager	1	$57.75	$75.00	160	80	$15,240.00
	Project Engineer	1	$57.75	$75.00	160	80	$15,240.00
	H&S Specialist	1	$65.00	$85.00	160	80	$17,200.00
	HWT Eq Operator	2	$41.50	$63.75	160	80	$23,480.00
	Haz Waste Tech	6	$39.25	$51.00	160	80	$62,160.00
							$143,720.00

		Number	Rate	Days	Total
Equip:	Cat 235 Excavator	1	$650.00	20	$13,000.00
	Ex-100 Excavator	1	$550.00	20	$11,000.00
	Forklift	2	$172.50	20	$6,900.00
	Cat 966 Loader	1	$450.00	20	$9,000.00
	12-yd Dump	2	$304.00	20	$12,160.00
	Truck	1	$125.00	20	$2,500.00
	Lowboy	0	$800.00	20	$0.00
	Scale	1	$75.00	20	$1,500.00
	Pressure Washer	1	$75.00	20	$1,500.00
	Miscellaneous	1	$200.00	20	$4,000.00
					$61,560.00

		Est. Quantity	Units	Unit Price	Total
Materials:					
	Supersacks	533	Each	$30.26	$16,138.67
	Fabric Roll	4	Each	$428.65	$1,714.60
	Liner	3	Each	$466.00	$1,398.00
	Haz Waste Labels	2	Roll	$310.00	$620.00
	Pallets	533	Each	$12.65	$6,742.45
	Diesel	3000	gal	$1.50	$4,500.00
	Gasoline	500	gal	$1.40	$700.00
	Duct Tape	24	case	$8.05	$193.20
	Spray Paint	2	case	$51.75	$103.50
	Poly Rope	1000	feet	$1.15	$1,150.00
	Nails & Screws	2	case	$36.50	$73.00
	Sorbent	4	roll	$103.50	$414.00
	Sorbent	4	pad	$74.75	$299.00
	Haz Tape	4	roll	$34.50	$138.00
	55-gal Drum Poly	20	each	$30.00	$600.00
	Prot. Clothing	200	m-d	$25.00	$5,000.00
	Unclassified Fill	400	cy	$10.00	$4,000.00
					$43,784.42

Total: $249,064.42

Roosevelt Road Transmitter Site
Cost Estimate
Off-Site Landfill PCB Soils

Transportation:

1. Transportation from site to Arlington, Oregon quoted by ChemPro.
2. Cubic yard of soil estimated to weigh 3200 lbs.

	Est. Quantity	Units	Unit Price	Total
Transportation	640	Tons	$350.00	$224,000.00

Disposal:

1. Landfill disposal cost quoted by ChemWaste Management.

	Est. Quantity	Units	Unit Price	Total
Disposal	640	Tons	$150.00	$96,000.00

PCB Analysis:

1. Confirmation sample numbers based on EPA guidelines.
2. Assume 10 samples per shipping cooler.
3. Rush analysis cost = 2 x standard cost.
4. Assume all sampling during excavation is rush.

	Est. Quantity	Units	Unit Price	Total
Standard Analysis	70	each	$250.00	$17,500.00
Rush Analysis	110	each	$500.00	$55,000.00
Packing Materials	18	cooler	$10.00	$180.00
Shipping	18	cooler	$140.00	$2,520.00
				$75,200.00

ALTERNATIVE #3

Roosevelt Road Transmitter Site
Cost Estimate
Off-Site Incineration PCB Soils

Mobilization/Demobilization:

1. 2 days to mobilize, 2 days to demobilize.
2. Standby equipment at 25% of daily rate.

Labor:

	Rate	Hours	Total
Project Manager	$57.75	32	$1,848.00
HWT Eq Operator	$41.50	32	$1,328.00
HWT	$39.25	32	$1,256.00
			$4,432.00

Equipment:

	Rate	Days	Total
Cat 235 Excavator	$162.50	4	$650.00
Ex-100 Excavator	$137.50	4	$550.00
Forklift	$43.13	4	$172.50
Cat 966 Loader	$112.50	4	$450.00
12-yd Dump	$76.00	4	$304.00
Truck	$31.25	4	$125.00
Lowboy	$800.00	4	$3,200.00
Scale	$18.75	4	$75.00
Pressure Washer	$18.75	4	$75.00
Miscellaneous	$50.00	4	$200.00
			$5,801.50

Total: $10,233.50

Roosevelt Road Transmitter Site
Cost Estimate
Off-Site Incineration PCB Soils

Excavation/Backfill:

1. Based on cleanup level of 10 ppm.
2. Total excavation yardage estimate = 2400 cy.
3. Total PCB-contaminated yardage estimate = 400 cy.
4. Daily production estimate = 125 cy.

		Number	Reg Rate	O.T. Rate	Reg Hours	O.T. Hours	Total
Labor:	Project Coordinator	1	$65.00	$85.00	160	0	$10,400.00
	Project Manager	1	$57.75	$75.00	160	80	$15,240.00
	Project Engineer	1	$57.75	$75.00	160	80	$15,240.00
	H&S Specialist	1	$65.00	$85.00	160	80	$17,200.00
	HWT Eq Operator	2	$41.50	$63.75	160	80	$23,480.00
	Haz Waste Tech	6	$39.25	$51.00	160	80	$62,160.00
							$143,720.00

		Number	Rate	Days	Total
Equip:	Cat 235 Excavator	1	$650.00	20	$13,000.00
	Ex-100 Excavator	1	$550.00	20	$11,000.00
	Forklift	2	$172.50	20	$6,900.00
	Cat 966 Loader	1	$450.00	20	$9,000.00
	12-yd Dump	2	$304.00	20	$12,160.00
	Truck	1	$125.00	20	$2,500.00
	Lowboy	0	$800.00	20	$0.00
	Scale	1	$75.00	20	$1,500.00
	Pressure Washer	1	$75.00	20	$1,500.00
	Miscellaneous	1	$200.00	20	$4,000.00
					$61,560.00

		Est. Quantity	Units	Unit Price	Total	
Materials:						
	Supersacks	533	Each	$30.26	$16,138.67	
	Fabric Roll	4	Each	$428.65	$1,714.60	
	Liner	3	Each	$466.00	$1,398.00	
	Haz Waste Labels	2	Roll	$310.00	$620.00	
	Pallets	533	Each	$12.65	$6,746.67	6742.45
	Diesel	3000	gal	$1.50	$4,500.00	
	Gasoline	500	gal	$1.40	$700.00	
	Duct Tape	24	case	$8.05	$193.20	
	Spray Paint	2	case	$51.75	$103.50	
	Poly Rope	1000	feet	$1.15	$1,150.00	
	Nails & Screws	2	case	$36.50	$73.00	
	Sorbent	4	roll	$103.50	$414.00	
	Sorbent	4	pad	$74.75	$299.00	
	Haz Tape	4	roll	$34.50	$138.00	
	55-gal Drum Poly	20	each	$30.00	$600.00	
	Prot. Clothing	200	m-d	$25.00	$5,000.00	
	Unclassified Fill	400	cy	$10.00	$4,000.00	
					$43,788.63	43784.41

Total: $249,068.63

Roosevelt Road Transmitter Site
Cost Estimate
Off-Site Incineration PCB Soils

Transportation:

1. Transportation from site to Seattle, Wa quoted by Chemwaste
2. Cubic yard of soil estimated to weigh 3200 lbs.

	Est. Quantity	Units	Unit Price	Total
Transportation	640	Tons	$350.00	$224,000.00

Disposal:

1. Landfill disposal cost quoted by ChemWaste Management.
2. Incineration cost includes shipping from Seattle to Port Arthur, Texas, Chicago, or St. Louis

	Est. Quantity	Units	Unit Price	Total
Disposal	1280000	lbs	$1.75	$2,240,000.00

PCB Analysis:

1. Confirmation sample numbers based on EPA guidelines.
2. Assume 10 samples per shipping cooler.
3. Rush analysis cost = 2 x standard cost.
4. Assume all sampling during excavation is rush.

	Est. Quantity	Units	Unit Price	Total
Standard Analysis	70	each	$250.00	$17,500.00
Rush Analysis	110	each	$500.00	$55,000.00
Packing Materials	18	cooler	$10.00	$180.00
Shipping	18	cooler	$140.00	$2,520.00
				$75,200.00

ALTERNATIVE #4

Roosevelt Road Transmitter Site
Cost Estimate
On-Site Incineration PCB Soils

Mobilization/Demobilization:

1. 2 days to mobilize, 2 days to demobilize.
2. Standby equipment at 25% of daily rate.
3. Costs for mobilization of TDU (Thermal Destruction Unit) based on previous experience.

Labor:	Rate	Hours	Total
Project Manager	$57.75	32	$1,848.00
HWT Eq Operator	$41.50	32	$1,328.00
HWT	$39.25	32	$1,256.00
	Subtotal:		$4,432.00

Equipment:	Rate	Days	Total
Cat 235 Excavator	$162.50	4	$650.00
Ex-100 Excavator	$137.50	4	$550.00
Forklift	$43.13	0	$0.00
Cat 966 Loader	$112.50	4	$450.00
12-yd Dump	$76.00	4	$304.00
Truck	$31.25	4	$125.00
Lowboy	$800.00	4	$3,200.00
Scale	$18.75	4	$75.00
Pressure Washer	$18.75	4	$75.00
Miscellaneous	$50.00	4	$200.00
Thermal Destruct. U	LS		$1,700,000.00
	Subtotal:		$1,705,629.00
	Total:		$1,710,061.00

Roosevelt Road Transmitter Site
Cost Estimate
On-Site Incineration PCB Soils

Excavation/Backfill:

1. Based on cleanup level of 10 ppm.
2. Total excavation yardage estimate = 2400 cy.
3. Total PCB-contaminated yardage estimate = 400 cy.
4. Daily production estimate = 125 cy.

		Number	Reg Rate	O.T. Rate	Reg Hours	O.T. Hours	Total
Labor:	Project Coordinator	1	$65.00	$85.00	160	0	$10,400.00
	Project Manager	1	$57.75	$75.00	160	80	$15,240.00
	Project Engineer	1	$57.75	$75.00	160	80	$15,240.00
	H&S Specialist	1	$65.00	$85.00	160	80	$17,200.00
	HWT Eq Operator	2	$41.50	$63.75	160	80	$23,480.00
	Haz Waste Tech	6	$39.25	$51.00	160	80	$62,160.00
							$143,720.00

		Number	Rate	Days	Total
Equip:	Cat 235 Excavator	1	$650.00	20	$13,000.00
	Ex-100 Excavator	1	$550.00	20	$11,000.00
	Forklift	0	$172.50	20	$0.00
	Cat 966 Loader	1	$450.00	20	$9,000.00
	12-yd Dump	2	$304.00	20	$12,160.00
	Truck	1	$125.00	20	$2,500.00
	Lowboy	0	$800.00	20	$0.00
	Scale	1	$75.00	20	$1,500.00
	Pressure Washer	1	$75.00	20	$1,500.00
	Miscellaneous	1	$200.00	20	$4,000.00
					$54,660.00

		Est. Quantity	Units	Unit Price	Total
Materials:					
	Supersacks	0	Each	$30.26	$0.00
	Fabric Roll	4	Each	$428.65	$1,714.60
	Liner	3	Each	$466.00	$1,398.00
	Haz Waste Labels	0	Roll	$310.00	$0.00
	Pallets	0	Each	$12.65	$0.00
	Diesel	3000	gal	$1.50	$4,500.00
	Gasoline	500	gal	$1.40	$700.00
	Duct Tape	24	case	$8.05	$193.20
	Spray Paint	2	case	$51.75	$103.50
	Poly Rope	1000	feet	$1.15	$1,150.00
	Nails & Screws	2	case	$36.50	$73.00
	Sorbent	4	roll	$103.50	$414.00
	Sorbent	4	pad	$74.75	$299.00
	Haz Tape	4	roll	$34.50	$138.00
	55-gal Drum Poly	20	each	$30.00	$600.00
	Prot. Clothing	200	m-d	$25.00	$5,000.00
	Unclassified Fill	20	cy	$10.00	$200.00
					$16,483.30

Total: $214,863.30

Roosevelt Road Transmitter Site
Cost Estimate
On-Site Incineration PCB Soils

Test Burn

1. Estimate is based on previous experience.

	Est. Quantity	Units	Unit Price	Total
Testburn	50	Tons	LS	$625,000.00

Incineration

1. Estimate is based on previous experience.

	Est. Quantity	Units	Unit Price	Total
Incineration	590	Tons	$200.00	$118,000.00

PCB Analysis:

1. Confirmation sample numbers based on EPA guidelines.
2. Assume 10 samples per shipping cooler.
3. Rush analysis cost = 2 x standard cost.
4. Assume all sampling during excavation is rush.

	Est. Quantity	Units	Unit Price	Total
Standard Analysis	70	each	$250.00	$17,500.00
Rush Analysis	110	each	$500.00	$55,000.00
Packing Materials	18	cooler	$10.00	$180.00
Shipping	18	cooler	$140.00	$2,520.00
				$75,200.00

NO ACTION ALTERNATIVE FOR BUNKER REMEDIATION

"oosevelt Road Transmitter Site
ost Estimate
On-Site Landfilling

Monitoring Well Installation

1. Est. for required footage based on depth to water at 95.0 feet.
2. Assuming 5 total wells at 105 feet per well.

	Est. Quantity	Units	Unit Price	Total
Monitor Well Installion	5	ft	$100.00	$52,500.00

RCRA Permitting

1. Estimate for completing RCRA facility permit based on previous experience

	Est. Quantity	Units	Unit Price	Total
RCRA Permitting	Job	LS		$150,000.00

Annual Operating Cost

1. Present worth value of annual operating cost

	Est. Quantity	Units	Unit Price	Total
RCRA Permitting	Job	LS		$150,000.00

PCB Analysis:

1. Confirmation sample numbers based on EPA guidelines.
2. Assume 10 samples per shipping cooler.
3. Rush analysis cost = 2 x standard cost.
4. Assume all sampling during excavation is rush.

	Est. Quantity	Units	Unit Price	Total
Standard Analysis	70	each	$250.00	$17,500.00
Rush Analysis	110	each	$500.00	$55,000.00
Packing Materials	18	cooler	$10.00	$180.00
Shipping	18	cooler	$140.00	$2,520.00
				$75,200.00

Roosevelt Road Transmitter Site
Cost Estimate
Bunker Remediation

Demolition, Removal, Disposal of Miscellaneous Debris Inside Bunker

Assumptions:
1. Asbestos estimate based on 4000 lbs (wet) on 1000 feet of pipes.
2. Pipes will be cleaned and disposed of in a local sanitary landfill.

		Number	Reg Rate	Unit O.T. Rate	Reg Hours	O.T. Hours	Total
Labor:	Project Coordinator	1	$65.00		42	0	$2,730.00
	Project Manager	1	$57.75	$75.00	168	42	$12,852.00
	Project Engineer	1	$57.75	$75.00	168	42	$12,852.00
	H&S Specialist	1	$65.00	$85.00	168	42	$14,490.00
	HWT Eq Operator	1	$41.50	$63.75	168	42	$9,649.50
	Haz Waste Tech	4	$39.25	$51.00	168	42	$34,944.00
							$87,517.50

Materials and Equipment	Est. Quantity	Units	Unit Price	Total
55 Gal. Drums	40	Each	$30.26	$1,210.40
Tools	21	Day	$300.00	$6,300.00
Air Line Equip	21	Day	$300.00	$6,300.00
Haz Waste Labels	1	Roll	$310.00	$310.00
Pallets	20	Each	$12.65	$253.00
Duct Tape	24	case	$8.05	$193.20
Spray Paint	2	case	$51.75	$103.50
Sorbent	4	roll	$103.50	$414.00
Sorbent	4	pad	$74.75	$299.00
Haz Tape	4	roll	$34.50	$138.00
Prot. Clothing	112	m-d	$80.00	$8,960.00
Misc. Equip.	21	Day	$300.00	$6,300.00
				$30,781.10

Landfill Debris:

	Est. Quantity	Units	Unit Price	Total
Trans & Disposal	1	L.S.	$5,000.00	$5,000.00

Landfill Asbestos:

	Est. Quantity	Units	Unit Price	Total
Shipping	2	Tons	$350.00	$700.00
Disposal	2	Tons	$150.00	$300.00
				$1,000.00

PCB Disposal:
1. Disposal in TOSCA Permitted Landfill.

	Est. Quantity	Units	Unit Price	Total
Shipping	10000	Lb.	$0.25	$2,500.00
Disposal	10000	Lb.	$1.75	$17,500.00
				$20,000.00

Sampling:

	Est. Quantity	Units	Unit Price	Total
PCB	30	Each	$250.00	$7,500.00
				$7,500.00

Grand Total: $151,798.60

Roosevelt Road Transmitter Site
Cost Estimate
Bunker Remediation

Remove and Dispose PCB Sludge

Assumption: 1. Solvent (ZEP) wash used to remove sludge.

		Number	Reg Rate	O.T. Rate	Reg Hours	O.T. Hours	Total
Labor:	Project Coordinator	1	$65.00		28	0	$1,820.00
	Project Manager	1	$57.75	$75.00	112	28	$8,568.00
	Project Engineer	1	$57.75	$75.00	112	28	$8,568.00
	H&S Specialist	1	$65.00	$85.00	112	28	$9,660.00
	HWT Eq Operator	1	$41.50	$63.75	112	28	$6,433.00
	Haz Waste Tech	4	$39.25	$51.00	112	28	$23,296.00
							$58,345.00

Materials and Equipment	Est. Quantity	Units	Unit Price	Total
55 Gal. Drums	50	Each	$30.26	$1,513.00
Tools	14	Day	$300.00	$4,200.00
Air Line Equip	14	Day	$300.00	$4,200.00
Haz Waste Labels	1	Roll	$310.00	$310.00
Pallets	12	Each	$12.65	$151.80
Duct Tape	24	case	$8.05	$193.20
Misc. Materials	1	L.S.	$1,000.00	$1,000.00
Sorbent	4	roll	$103.50	$414.00
Sorbent	4	pad	$74.75	$299.00
Solvent (ZEP)	1	L.S.	$5,000.00	$5,000.00
Prot. Clothing	112	m-d	$80.00	$8,960.00
Misc. Equip.	14	Day	$300.00	$4,200.00
				$30,441.00

PCB Disposal:

	Est. Quantity	Units	Unit Price	Total
Shipping	20000	Lb.	$0.25	$5,000.00
Disposal	20000	Lb.	$1.75	$35,000.00
				$40,000.00

Sampling:

	Est. Quantity	Units	Unit Price	Total
PCB	30	Each	$250.00	$7,500.00
				$7,500.00

Grand Total: $136,286.00

Roosevelt Road Transmitter Site
Cost Estimate
Bunker Remediation

Demolition, Removal, and Disposal of Contaminated Concrete

Assumptions:

1. Depth of PCB contamination is 3" maximum.
2. No reinforcing steel will be encountered to depth of contamination.
3. Contaminated concrete area estimated at 10,000 SF.

Concrete Demolition:

	Est. Quantity	Units	Unit Price	Total
Scarify	2500	ft^3	$12.50	$31,250.00
Level B	1	L.S.	$7,812.50	$7,812.50
				$39,062.50

PCB Disposal:

	Est. Quantity	Units	Unit Price	Total
Shipping	190	Tons	$350.00	$66,500.00
Landfill	190	Tons	$150.00	$28,500.00
				$95,000.00

Sampling:

	Est. Quantity	Units	Unit Price	Total
PCB	220	Each	$250.00	$55,000.00
				$55,000.00

Grand Total: $189,062.50